

SURVEY MEASURES OF FAMILY DECISION PROCESSES  
FOR ECONOMETRIC ANALYSIS OF SCHOOLING DECISIONS

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**Abstract**

In this article, we consider the collection of novel subjective data on family processes of schooling decisions. In particular, we review recent progress on survey measurement of expectations, information, and locus of decision of American families within the context of secondary schooling, and we discuss possible future developments by providing concrete examples from recent exploratory efforts. We argue that collection of data on adolescents' and parents' perceptions of the available school options and the application-and-admission rules, their subjective expectations about short- and long-term consequences of alternative choices, and their assessments of the locus of decision making within families could greatly enhance economic modeling and contribute to effective econometric analysis of schooling decisions.

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## 1. Introduction

‘School choice’ has evolved dramatically over the past couple of decades, in (at least) two major dimensions: the increased variety and number of schooling alternatives that have become available to American families, and the increasingly complex process by which students are sorted into schools and programs.

The widespread entry of charter and magnet schools and the burgeoning of new ‘small schools’ (inside city neighborhoods) have expanded the public sector while partly supplanting traditional neighborhood schools. Private schools, in turn, have been supplying a richer set of distinctive alternatives to public options, which are often funded under common public voucher programs (e.g., Manski (1992), Schneider et al. (2000), the contributors to Hoxby (2003), Bast and Walberg (2004), Abdulkadiroglu et al. (2013), and Butler et al. (2013)). On the other hand, the traditionally tight connection between residential choice and school choice—although unlikely to vanish (see, e.g., Lankford and Wyckoff (2006), Rothstein (2006), Nechyba (2011), Abdulkadiroglu et al. (2014, 2015), and Pathak and Shi (2015))—has partly given way to the introduction of open-enrollment programs within and across districts, and to a widening implementation of universal-choice systems.

In such systems students are matched to schools on the basis of students’ self-reported preferences over schools and of schools’ capacity and other constraints, via algorithms developed from mechanism design and matching theory (e.g., Abdulkadiroglu and Sonmez (2003), Pathak (2011), Toch and Aldeman (2009), Agarwal and Somaini (2014), and references

therein). A stark urban example of these developments is New York City, featuring the largest public school system in the country as well as perhaps the most complex secondary school application and admission process (e.g., Abdulkadiroglu et al. (2005, 2009, 2015), Hoxby and Murarka (2009), Dobbie and Fryer (2013a), Kemple (2013), Nathanson et al. (2013), and Corcoran and Baker-Smith (2015)).

The recent evolution of school choice has stimulated a great deal of interest and effort among social scientists and policy makers in developing student-school matching algorithms with desirable properties and analyzing them via simulations or experiments (e.g., Pathak and Sonmez (2008), Abdulkadiroglu et al. (2009), Calsamiglia et al. (2010), Dur et al. (2013), Klijn et al. (2013), Guillen and Hing (2013), and Ding and Schotter (2014a,b)); in documenting descriptive patterns of families' choice or subsequent students' outcomes in specific localities (e.g., Schneider et al. (2000), Hoxby and Murarka (2009), Chakrabarti and Roy (2010), Butler et al. (2013), Dobbie and Fryer (2013b), Kemple (2013), Nathanson et al. (2013), Coca (2014), and Corcoran and Baker-Smith (2015)); in quantifying the causal effects of specific features of the new choice architecture on observed choices or following outcomes by exploiting random variation in implementation (e.g., Peterson et al. (2003), Hastings and Weinstein (2008), Hoxby and Murarka (2009), Angrist et al. (2010), Abdulkadiroglu et al. (2013), Angrist et al. (2013), Cohodes et al. (2013), Dobbie and Fryer (2013a), and Deming et al. (2014)); and in building structural econometric models of school demand and/or supply in order to forecast the effects of policy changes (e.g., Hastings et al. (2009), Metha (2012), Walters (2014), Agarwal and Somaini

(2014), Abdulkadiroglu et al. (2015), Ferreyra and Kosenok (2015), and Pathak and Shi (2013, 2015)).

Notable policies of interest include the introduction of new schooling alternatives, revisions to current matching algorithms, and modifications of existing curricula. The credibility of a forecast, however, depends on the realism of the model used to represent decision making. The model, in turn, should be informed as much as possible by data that shed light on actual decision processes (e.g., Manski (2000, 2004) or Ben-Akiva et al. (2012)).<sup>3</sup>

A careful reading of the recent literature of school choice reveals that—as often before—its novel empirical findings and modeling innovations have been closely associated with the emergence of new data. Most impressive has been the ever-growing availability and linkability of multiple sources of administrative data and other records, especially from the Department of Education (DOE). Such data span directories of local schools and programs, characterization of individual students' application-and-admission process (e.g., students' preference ranking and their priority at each school, or lottery files for specific schools/zones), students' schooling records (e.g., grade progression, school grades and attendance, graduation exam scores, college enrollment), and geocoded information about households' and schools' locations, neighborhoods' characteristics, etc.<sup>4</sup>

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<sup>3</sup> Butler et al. (2013) and Murnane (2013) offer critical surveys of existing national data sets for analysis of high school choice and high school outcomes, with an emphasis on their weaknesses and missing elements.

<sup>4</sup> Examples of analyses combining and using such data are Hoxby and Avery (2012), Deming et al. (2014), Walters (2014), among others.

We consider here the collection of novel subjective data on family processes of schooling decisions, with a focus on secondary schooling, as a complement to the above data. In particular, we think it important to collect new data on adolescents' and parents' perceptions of the available school options and the application-and-admission rules, their subjective expectations about short- and long-term consequences of alternative choices, and their assessments of the locus of decision making within families. Such data could greatly enhance our modeling capacity and contribute to effective econometric analysis of secondary schooling decisions. We explain below, discussing relevant literature.

## **2. Using Surveys to Learn How Children and Parents Perceive School Alternatives and Make School Choices**

Econometric analysis of discrete choice, pioneered by McFadden (1974), seeks to predict the distribution of choices that would be made by a population in specified choice scenarios. Suppose that a researcher observes the decisions made by a population of decision makers, each of whom faces a choice problem. McFadden (1974) showed that these data, combined with assumptions on the population distribution of preferences, enable estimation of parametric probabilistic choice models. He then showed how probabilistic choice models may be used to predict population choice behavior in other settings (see Manski (1995, Chapter 5) and Manski (2007, Chapter 13) for expositions).

The rational choice assumed in econometric analysis of discrete choice is a subjective concept. Decision makers are assumed to choose the most preferred alternative, given their perceptions of the options available. There is no requirement that these perceptions be ‘correct’ or ‘objective’ in any sense. A standard practice in discrete choice analysis has been to assume that researchers know how decision makers perceive their choice sets. It has also been standard practice to assume that researchers know who the decision makers are, for example a single family member or multiple ones.

Unless surveys directly ask respondents who makes or participates in decisions, and how decision makers perceive their choice sets, researchers performing choice analysis must make unverified assumptions about the locus of decisions and about decision makers’ perceptions. Existing surveys rarely query respondents about either the locus of decision or their choice-set perceptions. Data collection would enable more realistic choice analysis.

When discussing perceptions of choice sets, it is useful to distinguish between respondent information and expectations. By information, we mean respondent knowledge of objectively verifiable facts that may be relevant to decision making. When considering high school application or choice, these facts may include the current admission policies, curriculum content, student-body compositions, and graduation rates of various institutions. Some youths and their families might not even be aware of the existence of high schools that may potentially be good

matches. When aware of their existence, they may not know or may misperceive the objective attributes of these institutions.<sup>5</sup>

In the absence of survey data on the information that respondents possess, researchers usually assume that youth and their families know the facts of their choice situations. When these assumptions are incorrect, choice analysis may misinterpret preferences. For example, a researcher who observes that students with specified characteristics rarely enroll in a given type of high school might infer that such students dislike this type of high school. The actual reason for non-enrollment may be misperception or lack of knowledge of the attributes of the schools, or complete unawareness of existence of those schools.<sup>6</sup>

Whereas information refers to knowledge of facts, expectations means respondent beliefs about the outcomes that may occur if they make alternative choices. Expectations are fundamental to schooling decisions, as persons evaluate their options by the outcomes they believe will result from them. Expectations differ from information because they are inherently subjective. There are no facts with which they can be compared.

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<sup>5</sup> Schneider et al. (2000) and Neild (2005) offer some evidence about families' knowledge about high schools and the application process. Dawes and Brown (2002) and Hoxby and Avery (2012) focus on prospective students' awareness of choice alternatives and their knowledge of the admission process to college respectively.

<sup>6</sup> Manski (1977), Adamowicz et al. (2008), Sovinsky-Goeree (2008), Draganska and Klapper (2011), and Masatlioglu et al. (2012), among others, discuss this identification problem and its manifestation and consequences in structural modeling of discrete choice.

Schooling decisions may depend on a student's joint expectations of many events.<sup>7</sup> Consider, for example, the decision to enroll in a particular type of high school. A student's high school choice may depend on his beliefs about the likelihood of successful completion of the required curriculum. It may additionally depend on his beliefs about his chances of continuing onto college and/or about his chances of finding a job after graduating from high school. Looking further into the future, choice of high school may depend on expectations of the entire life course that will follow.

A student's high school choice may as well depend on the beliefs and/or preferences the student's parents hold for those same outcomes. Parental socialization of children begins at birth and continues through adolescence.<sup>8</sup> Moreover, parental beliefs and preferences may affect school choice directly as parents participate in decision making.

Existing surveys of youth and their parents do not directly ask respondents to state who makes schooling decisions in their families. It could be the youth alone, the parents alone, or some family decision process.<sup>9</sup> In the absence of data, the standard econometric practice has

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<sup>7</sup> Hartog and Diaz-Serrano (2014) provide a survey of the 'risks' associated to schooling, conceptualized as a risky investment in human capital, and of the existing empirical evidence about those risks.

<sup>8</sup> Saez-Marti and Zilibotti (2008) survey economic models of intergenerational transmission. Karniol (2010) and Lareau (2003) provide stimulating qualitative evidence about parental socialization through child-parent interactions and decision making during childhood.

<sup>9</sup> Within the context of high school track choice in Italy, Giustinelli (2015) finds evidence of multiple forms of child-parent interactive decision making, as well as of processes where the child chooses unilaterally with respect to his parents, but likely interactively with other individuals such as his teachers and/or friends. Attanasio and



been to assume that observed decisions result from optimizations by a single decision maker, sometimes thought of as the student and sometimes as the parents or the whole family, depending on the specific school grade or the child's age.<sup>10</sup>

This practice may be flawed. Some decisions, particularly those made during late middle school and early high school years, might better be conceptualized as the result of an intense interaction between students and their parents, who may have different preferences and beliefs. Later on, at the time of high school completion, parents may play a less comprehensive role in decision making but may still have a major say when comparing postsecondary schooling alternatives that differ in cost.<sup>11</sup>

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Kaufmann (2014) find that subjective expectations of Mexican children and their mothers have independent predictive power on schooling decisions in high school. More generally, Lundberg et al. (2009), Romich et al (2009), and Dauphin et al. (2011) provide evidence that both in the U.S. and in the U.K. adolescent children participate in various decisions concerning themselves or their households.

<sup>10</sup> E.g., Hastings et al. (2009) take parents in Charlotte to be the decision makers in schooling decisions of students in grades 4<sup>th</sup> to 8<sup>th</sup>. Walters (2014) takes 5<sup>th</sup> and 6<sup>th</sup> graders in Boston to be the relevant decision makers in his model of demand for charter schools. Butler et al. (2013) take households to be the relevant decision-making units and abstract from issues of intra-family decision making.

<sup>11</sup> Attanasio and Kaufmann (2014) find that while both children's and parents' expectations predict schooling choices of high school students in Mexico, only children's expectations predict college choices; on the other hand, Zafar (2012) finds indirect evidence that parental preferences do play a role in college major's choices of U.S. undergraduates (see also Kalenkoski (2008) for an analysis of child-parent bargaining over post-secondary schooling decisions, which lays out the main potential forces at play).

There is a need for surveys to collect data that shed light on how schooling decisions are actually made in households. This done, the participants in the decision process should be questioned about their perceptions of choice sets and their expectations for the consequences of alternative choices they may make. The remainder of this section deals with measurement of the locus of decision, choice set perceptions, and subjective expectations in schooling decisions, working backward from the last to the first.

### ***2.1. Assumptions vs. Measurement of Subjective Expectations in Discrete Choice Analysis***

Economists analyzing schooling decisions assume that youth compare the expected outcomes from schooling and other activities—or from alternative schooling options—and choose the best available option. Viewing education as an investment in human capital, economists use the term *returns to schooling* to refer to the outcomes from schooling relative to non-schooling choices—or from a specific schooling option relative to alternative ones. Although this term can encompass both the monetary and non-monetary returns to schooling, economists have usually focused on earnings, schooling costs, and related monetary outcomes (see Hartog and Diaz-Serrano (2014) for a comprehensive review).

Given the centrality of the expected returns to schooling in economic thinking on schooling behavior, it might be anticipated that economists would make substantial efforts to learn how youth and their families perceive the returns to schooling. However, hardly any data had been collected until recently. In the absence of data, the norm in analysis of schooling decisions has

been to assume that expectations of the returns to schooling are formed in specific ways. For instance, researchers have generally supposed that all decision makers condition their beliefs on the same variables and process information in the same way. The majority of studies have assumed that youth have rational expectations. A common practice has been to use longitudinal survey data on earnings to infer the objective returns to schooling and to assume that subjective expectations are the same as the objective returns.<sup>12</sup>

One way that expectations assumptions differ across studies concerns whether and how youth use ability information to form expectations.<sup>13</sup> Unfortunately, there is no evidence supporting any specific assumption among those economists have made about expectations of the returns to schooling, although such assumptions are consequential for choice analysis. Using a simple human capital model, Manski (1993) demonstrates that interpretation of data on schooling

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<sup>12</sup> These studies, mostly focusing on post-secondary education and work decisions, include Arcidiacono (2004), Cameron and Heckman (2001), Eckstein and Wolpin (2001), Keane and Wolpin (1997), Manski (1987), and Willis and Rosen (1979). On the other hand, Freeman (1971) and Manski and Wise (1983) posited different expectations processes. Freeman (1971) assumed myopic expectations whereby each male college student believes that, should he select a given college major, he would obtain the mean income realized by the members of a specified earlier cohort who did make that choice. Manski and Wise (1983) assumed that youth believe that the benefits of enrollment in a given college depend on their own SAT score and on the average score of students enrolled at the college.

<sup>13</sup> Whereas Freeman (1971) assumed that youth do not condition their expectations on ability, Willis and Rosen (1979) assumed that they do and that they have rational expectations. Manski and Wise (1983) assumed that they use SAT score, which may be associated with ability, to form expectations that may or may not be rational.

choices can depend critically on how youth actually use ability information to form expectations of the returns to schooling. In particular, if youth do not actually condition their expectations on ability, a researcher who assumes they do so may mistakenly conclude from observed choices that youth are unconcerned with the returns to schooling.

Knowledge of how students and their parents perceive the returns to schooling is essential to informed analysis of schooling decisions. However, only the barest empirical evidence has been available for a long time. Well into the 1990s, only a few studies had asked youth to report point beliefs about earnings unconditional on their future schooling.<sup>14</sup> Such studies did not ask respondents for their expectations of the returns to schooling, which requires comparing alternative schooling choices. Nor did they permit respondents to express uncertainty in their beliefs. Similarly, questions on student plans and expectations asked in surveys of the National Center for Education Statistics (NCES), such as the NELS88 or the ECLS-K (1998-1999), have not permitted respondents to express uncertainty about their future schooling and work behaviors. Uncertainty can be very important to schooling decisions. Students may be uncertain how well they would perform if enrolled in alternative institutions or study programs. Also, they

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<sup>14</sup> E.g., Freeman (1971) and Betts (1996) asked college undergraduates about the average earnings of persons in various occupations or major fields. Smith and Powell (1990) asked a sample of college seniors for point predictions of their “anticipated annual income in 10 years” and their “expected earnings” in the first year of their first job. Blau and Ferber (1991) asked a sample of college seniors to forecast “how much they would expect to earn initially and after 10 and 20 years if they were to be *continuously* employed in their preferred occupation after leaving school.” A few contemporary studies in Europe are reviewed in Hartog and Diaz-Serrano (2014).

may be uncertain about the monetary and non-monetary outcomes that they would experience given different schooling choices. In fact, they may be uncertain even about their own preferences (e.g., Altonji (1993)).

Following the exploratory effort of Dominitz and Manski (1996), a small but growing body of studies has elicited subjective expectations about youth's returns to schooling and other outcomes of schooling decisions, while enabling respondents to express uncertainty about their expectations.<sup>15</sup>

#### *The Dominitz-Manski Study*

Dominitz and Manski (1996) elicited probabilistic expectations of the returns to schooling from high school and university students in Madison, Wisconsin. They designed an interactive computer-assisted self-administered interview (CASI) survey, eliciting respondents' expectations of the income they would earn if they were to complete different levels of schooling as well as their beliefs about current earnings distributions.<sup>16</sup>

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<sup>15</sup> These include Zafar (2011, 2013), Stinebrickner and Stinebrickner (2012, 2014), Arcidiacono et al. (2012), Wiswall and Zafar (2015a,b), and Giustinelli (2015), some of which we describe further below.

<sup>16</sup> They found that students were willing and able to respond meaningfully to questions eliciting their earnings expectations in probabilistic form. The 110 respondents varied considerably in their earnings expectations but there was a common belief that the returns to a college education are positive and that earning rise between 30 and 40. There was a common belief that one's own future earnings are rather uncertain. Moreover, respondents tended to overestimate the current degree of earnings inequality in American society.

The CASI software enabled Dominitz and Manski to design a survey that appears straightforward to respondents but that actually incorporated an extensive question-branching algorithm. CASI also enabled the authors to incorporate several tools intended to aid respondents in expressing meaningful expectations. *Training screens* explained basic probabilistic ideas through examples before the respondent begins the actual survey. *Help screens* could be accessed by the respondent at any time. *Error checks* informed the respondent if a response to a probabilistic question was not a proper probability or if the response was logically inconsistent with earlier responses. *Review-and-revise* screens showed the respondents his or her responses to each completed sequence of questions and allowed the respondent to revise these responses if desired.

Following the introductory and training screens, the CASI software led the respondent through the various parts of the survey. Dominitz and Manski sequentially elicited

1. *Unconditional Earnings Expectations*: Each respondent was queried about his or her subjective probability distribution of real earnings at ages 30 and 40.
2. *Expected Earnings Under Alternative Schooling Scenarios*: Each respondent was asked about his or her expected earnings at ages 30 and 40 under the hypothetical scenario that the respondent continues in school at least through receipt of a bachelor's degree. The respondent was also asked about expected earnings at ages 30 and 40 under an alternative scenario assuming that less schooling is completed. In the version of the survey administered to high school students, the alternative scenario supposed that the respondent attains a high school diploma but no further schooling. In the version

administered to college undergraduates, the alternative supposed that the respondent completes the current semester and then leaves college permanently.

3. *Schooling Expectations:* Respondents were asked to state the probability that they will (a) attend college before age 21 (for high school students only); (b) receive a bachelor's degree before age 30; and (c) still be in school at age 30.
4. *Beliefs about Current Earnings Distributions:* Male (female) respondents were asked about the current distributions of earnings among American men (women) of age 30 who have attained at least a bachelor's degree and among those who have attained a high school diploma but no further schooling.

In terms of how these questions were actually asked, Dominitz and Manski first elicited the median of a subjective distribution and then the probability that earnings would exceed a sequence of thresholds, posed in increasing order. The thresholds about which a given respondent was queried were determined by the respondent's elicited median. We illustrate the procedure using the questions about unconditional earnings expectations. (The same approach was used for the other expectations and belief questions.)

*Eliciting median earnings:* First respondents were asked to state the median of their subjective distribution for future earnings,<sup>17</sup> as follows: "*Look ahead to when you will be  $X$  years*

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<sup>17</sup> Eliciting the median determines the probabilistic center of a respondent's expectations and provides a natural starting point for subsequent selection of threshold values in probability elicitation. At the beginning of the survey, respondents received this on-screen instruction defining the median of a distribution: "*The first question will ask you*

*old. Think about the kinds of jobs that will be available for you and that you will accept. What is the median amount of money that you think you will earn per year by the time you are X years old?”*

*Eliciting Probabilities that Earnings Exceed Thresholds:* Here is the format Dominitz and Manski used to elicit probabilities that earnings would exceed specified thresholds: *“When you are X years old, what do you think is the percent chance that you will earn more than Y thousand dollars per year? That is, what are the chances out of 100 that you will earn more than Y thousand dollars per year?”*<sup>18</sup>

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*about the median amount of money that you think will earn at some time in the future. The median is the amount of money for which there is 50 percent chance that you will earn more than it and a 50 percent chance that you will earn less than it. So, to answer this question and others like it, you should try to pick the amount of money that you think there is just as good a chance you will earn more than it as less than it.”*

<sup>18</sup> Each respondent answered this question with X taking the values 30 and 40 and Y taking three values that depend on the respondent’s elicited median. Elicitation of probabilities for three thresholds was the researchers’ resolution of the tension between their desire to collect as refined data as possible and their concern that too much attempt at refinement would sap respondents’ attention. Effective selection of the threshold values Y is a non-trivial matter. Asking questions about a range of thresholds spanning the support of a respondent’s subjective distribution should yield more information about the shape of the distribution than would the same number of questions asked about a narrower or wider range of thresholds. Morgan and Henrion (1990) warn that the specific thresholds chosen may influence respondents’ beliefs, a phenomenon called *anchoring* by psychologists. Hence, one of the reasons Dominitz and Manski first asked about median earnings was that the reported median provides a natural self-anchor for later selection thresholds.



Finally, we describe the questions eliciting earnings expectations under alternative schooling scenarios. We focus on the version administered to high school students. First, respondents were given this on-screen introduction: *“The next sets of questions ask you to put yourself in one of two hypothetical situations. In the first situation, you assume that you continue in school until you finish your senior year of high school and obtain your diploma, and you do not continue in school after that. In the second hypothetical situation, you assume that you continue in school at least until you finish your senior year of college and obtain your college diploma (a bachelor’s degree). When responding to these questions, please attempt to fully place yourself in the hypothetical situation as it is described.”*

After this, respondents receive these more detailed instructions concerning the first scenario: *“In the first hypothetical situation, assume that you continue in school until you complete your senior year of high school and obtain your high school diploma. Please respond under the assumption that you do not return to school at any time after high school. Remember, this is a hypothetical situation. Just think about the kinds of jobs that would be available for you and that you would accept. Think about the amount of money you would make on these jobs. Again, you should ignore the effects of price inflation on earnings.”* Following this, respondents were asked

to state their median earnings at age 30 and the probabilities that earnings would exceed three thresholds.<sup>19</sup>

*Measuring Probabilistic Expectations: Ideas and Applications*

The Dominitz-Manski study is an early example of the general idea of probabilistic measurement of expectations.<sup>20</sup> Attitudinal researchers have long used verbal questions to measure expectations. When asked to predict some outcome, respondents may be asked to report whether they ‘think’ or ‘expect’ that the event will occur. If the event is binary, the respondent may be asked to select an answer among ‘Yes,’ ‘No,’ or ‘Uncertain.’<sup>21</sup> If the event is discrete but not binary, as in the expectations question in the 2004 follow-up of the NCES Educational

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<sup>19</sup> The wording used to describe the two scenarios offered no reason why one or the other scenario might be realized. This was intentionally done in an attempt to avoid having respondents draw from the scenario descriptions information that might influence their expectations.

<sup>20</sup> As the idea has many potential applications to schooling surveys, it deserves a fuller discussion and historical account than the summary we provide here. Manski (2004) describes some of the history of research on expectations, beginning with the verbal tradition of attitudinal research and then turning to elicitation of probabilistic expectations in cognitive psychology and economics. Various American household surveys have elicited probabilistic expectations on various topics, including the Health and Retirement Study (HRS), the Survey of Economic Expectations (SEE), the 1997 National Longitudinal Study of Youth (NLSY97), and the Survey of Consumer Expectations (SCE). Similar surveys have been fielded elsewhere in the world.

<sup>21</sup> The fertility question in the Current Population Survey, “*Looking ahead, do you expect to have any (more) children?*,” uses these response categories.

Longitudinal survey,<sup>22</sup> the respondent may be asked to indicate a level of educational attainment from a list of schooling degrees, which might include an ‘I don’t know’ option. Sometimes respondents are asked to report the strength of this belief by reporting whether it is ‘very likely,’ ‘fairly likely,’ ‘not too likely,’ or ‘not at all likely’ that the event will occur. One prominent issue with these designs is the (lack of) inter- and intra-personal comparability of responses.<sup>23</sup> Another is the limited information contained in the responses, due to the coarseness of the response options.

If persons can express their expectations in probabilistic form, elicitation of subjective probability distributions should have compelling advantages relative to verbal questioning. Perhaps the most basic attraction is that probability provides a well-defined absolute numerical scale for responses; hence, there is reason to think that responses may be interpersonally comparable. Another attraction is that empirical assessment of the internal consistency of respondents’ expectations is possible. A researcher can use the algebra of probability (Bayes Theorem, the Law of Total Probability, etc.) to examine the internal consistency of a respondent’s expectations about different events. Finally, when probability has a frequentist interpretation, a researcher can compare elicited subjective probabilities with known event

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<sup>22</sup> The question asks, “*As things stand now, how far in school do you think you will get?*” Jacob and Wilder (2011) analyze educational expectations using data from multiple NCES surveys.

<sup>23</sup> That is, different persons may interpret verbal expectations questions differently. Or the same person may interpret verbal phrases differently when asked about different events E.g., Lichtenstein and Newman (1967), Beyth-Marom (1982), Wallsten et al. (1986), among others.

frequencies and reach conclusions about the correspondence between subjective beliefs and frequentist realities.

Among economists, the idea that survey measurement of probabilistic expectations might improve on the verbal approaches of attitudinal research appears to have originated with Juster (1966). Considering the case in which the behavior of interest is a binary purchase decision (buy or not buy), Juster considered how responses to traditional yes/no buying intentions questions should properly be interpreted. He hypothesized that a consumer facing a yes/no intentions question responds as would a decision maker asked to make a best point prediction of a future random event.<sup>24</sup> Working from this hypothesis, Juster concluded that it would be more informative to ask consumers for their purchase probabilities than for their buying intentions. In particular, he proposed questions that associate verbal expressions of likelihood with numerical probabilities to elicit purchase expectations for automobiles and other household appliances.<sup>25</sup> He went on to collect data and concluded that elicited purchase probabilities are better predictors of subsequent individual purchase behavior than are yes/no intentions data.

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<sup>24</sup> He wrote (Juster, 1966, p. 664): “Consumers reporting that they ‘intend to buy A within X months’ can be thought of as saying that the probability of their purchasing A within X months is high enough so that some form of ‘yes’ answer is more accurate than a ‘no’ answer.”

<sup>25</sup> Such questions were worded as follows: “*Taking everything into account, what are the prospects that some member of your family will buy a \_\_\_ sometime during the next \_\_\_ months, between now and \_\_\_ ?*” The answer categories are: Certainly, Practically Certain (99 in 100); Almost Sure (9 in 10); Probably (7 in 10); Good Possibility (6 in 10); Fairly Good Possibility (5 in 10); Fair Possibility (4 in 10); Some Possibility (3 in 10); Slight Possibility (2 in 10); Very Slight Possibility (1 in 10); No Chance, Almost No Chance (1 in 100).

The idea that expectations might be elicited probabilistically from survey respondents did not, however, draw the immediate attention of economists. By the time Juster's article was published, economists were preaching that empirical research on decision making should be based on choice data alone. The conventional economic wisdom finally unraveled in the 1990s. Several large scale surveys now use probabilistic formats to elicit expectations, and a new field of empirical research on expectations has emerged. Expectations have been elicited for macroeconomic events (stock market returns, price changes), for risks that a person faces (job loss, crime victimization, mortality, debt delinquency), for future income (earnings and Social Security benefits), and for choices that persons make (durable purchases and voting choices).<sup>26</sup>

#### *Extrapolation and Knowledge of Expectations Formation*

Thus far, we have not described research that aims to understand how persons form expectations and revise them with receipt of new information. In fact, to estimate random utility models of decision making, researchers do not need to understand expectations formation. They

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<sup>26</sup> The major American platforms for methodological exploration and substantive research have included the Health and Retirement Study, the Survey of Economic Expectations, the NLSY97, the American Life Panel, and the Survey of Consumer Expectations. Manski (2004) and Hurd (2009) review the new literature on probabilistic measurement of expectations in surveys. These review articles describe what has been learned methodologically about effective question design, and substantively about a large variety of expectations relevant to household decision making. They also discuss still-open questions about the cognitive process at work when persons form expectations and respond to survey questions (for reviews of elicitation of subjective expectations in developing countries, see Attanasio (2009) and Delavande (2014)).

need only to measure the expectations that persons held when they made their observed choices.<sup>27</sup>

The situation may change when one wants to extrapolate from observed behavior, using an econometric decision model to predict choice behavior in a new scenario. Measurement of the expectations associated with observed choices suffices if it is plausible to assume that the new scenario does not affect expectations or that it changes them in some obvious way.<sup>28</sup> However, econometric decision models often are used to predict behavior following policy interventions or other events that may alter expectations in non-obvious ways. Then credible prediction requires an understanding of expectations formation.

Experimental psychologists and economists have studied how persons update objective probabilities following receipt of random sample data in highly structured settings similar to those presented in textbook statistics exercises.<sup>29</sup> However, it is difficult to draw lessons from this work for expectations formation in real life, where the information that persons receive rarely maps cleanly into a textbook exercise in probability updating. In real life persons assimilate information from government announcements and media reports (e.g., the 600 pages

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<sup>27</sup> van der Klaauw (2012) discusses current use and issues of subjective probabilistic expectations in (dynamic) structural choice models.

<sup>28</sup> Giustinelli (2015) performs a series of counterfactual predictions of high school track enrollment using this approach.

<sup>29</sup> A particular concern has been to test adherence to, and characterize departures from, application of Bayes Theorem (e.g., Tversky and Kahneman (1974), El-Gamal and Grether (1995)).

directory of NYC public high schools); communication from friends, family, and experts (e.g., school teachers or counseling staff); and personal experiences and observations of the experiences of others (including, once again, older relatives and friends). The sampling process generating these forms of information is obscure.

One can learn something about updating in real life by eliciting expectations longitudinally or from repeated cross sections of the population. Research that measures revisions to expectations and associates them with observed event realizations can be informative.<sup>30</sup>

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<sup>30</sup> Dominitz (1998) elicits earnings expectations at six-month intervals from a sample of respondents. He examines the association between revisions to expectations and the earnings that respondents realized between interviews. Dominitz and Manski (2011) combine expectations of returns to mutual-fund investments elicited at six-month intervals with data on realized stock market performance to study how persons form expectations of future market performance. Armantier *et al.* (2014) study updating of inflation expectations when persons are given new information about prices.

In studies concerned with schooling expectations, Stinebrickner and Stinebrickner (2012, 2014) collect a panel of beliefs about own grade performance and ability from Berea College undergraduates. Stinebrickner and Stinebrickner (2012) use the data to model and analyze college dropout behavior and find that learning about own academic ability and grade performance plays a prominent role in determining observed college dropout. Similarly, Stinebrickner and Stinebrickner (2014) find that learning about own academic ability and grade performance is an important determinant of students opting out from Science and choosing less academically challenging majors. Wiswall and Zafar (2015b) perform an experiment informing a sample of NYU undergraduates about realized earnings in relevant sub-populations of college graduates. They use the data to study whether and how study participants revise their baseline subjective expectations about own future earning and college major choice, as a function of the received information.

However, understanding expectations formation in real life will likely also require intensive probing of persons to learn how they perceive their environments and how they process new information they may receive. Large-scale population surveys are not amenable to investigations of this type—the time available to query respondents is too limited and the standardized question-response format of interviews is too confining. Researchers may need to engage small samples of respondents in lengthy, semi-structured ‘conversations’ (e.g., Morgan et al. (2002), Wooffitt and Holt (2011)) to learn how they form expectations and revise them in the light of new information.

*Recent Studies on Expectations for Schooling and Related Outcomes*

Following Dominitz and Manski (1996)’s study, several other small-scale surveys have undertaken probabilistic measurement and analysis of expectations of the returns to schooling and of other expectations relevant to schooling decisions, especially among college students and, to a lesser extent, among high school students. For instance, Wolter (2000) performs an exploratory study in Switzerland that is similar to the Dominitz-Manski work and compares the Swiss and American findings. Rouse (2004) elicits subjective median earnings expectations with and without a college degree from a sample of high school seniors in Baltimore. Zafar (2013, 2011) elicits probabilistic expectations regarding the monetary and nonmonetary returns to different college majors from a sample of Northwestern University undergraduates. He uses the data to study gender differences in observed college major choices and expectations formation by students. In a follow-up study with NYU students, Wiswall and Zafar (2015a, b) also analyze



college major choice and formation of students' expectations about their college major choice and future earnings. Similarly, Arcidiacono et al. (2012) elicit expectations for chosen and counterfactual majors from Duke undergraduates and use them to model students' choice of college major. Stinebrickner and Stinebrickner (2012, 2014) elicit probabilistic expectations of academic performance and ability repeatedly from a panel of undergraduates at Berea College, which they use to model and analyze college dropout behavior of students and their moves out of Science major into academically less challenging majors. Giustinelli (2015) uses subjective probabilistic expectations, stated choice preferences, and observed choices in a sample of Italian 9<sup>th</sup> graders and their parents to study family choice of the high school track within a high school system featuring curricular specialization.

Thus far, the only large-scale survey to provide probabilistic data on the expectations of youth is the NLSY97. The NLSY97 has not elicited expectations of the returns to schooling. However, the base year questionnaire (round 1), administered in 1997, asked about 3500 youth aged 14 to 16 a module of questions asking them to state the unconditional probabilities of various schooling, work, parenthood, crime, and mortality outcomes. Fischhoff et al. (2000), Dominitz et al. (2001), Reynolds and Pemberton (2001), and Walker (2001) report analysis of the responses. Similar questions were administered in the fourth and fifth annual survey (rounds 5 and 6). Notably, a sub-set of the expectations questions asked to children in round 1 were also

included in the parent questionnaire. Dominitz et al. (2001) jointly analyzed child and parent responses to the common set of expectations questions.<sup>31</sup>

## *2.2. Eliciting Choice Set Perceptions*

Having discussed the collection of expectations data at some length, consider now inquiring respondents about the information they possess; that is, their knowledge of objectively verifiable facts. Survey researchers routinely ask respondents to report facts. For example, respondents to NCES or DOL (Department of Labor) surveys are asked about their schooling and work histories. While this has not been systematically done to date, respondents could be asked about

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<sup>31</sup> A small number of expectations questions have been asked also in the Add Health, including adolescents' perceived chances of living to age 35 and of attending college. Response choices, however, were constrained to a limited number of categories, spanning 'almost no chance,' 'some chance, but probably not,' '50/50 chance,' 'a good chance,' and 'almost certain.' Analyses of Add Health expectations and their relation to outcomes are reported by Harris et al. (2002), Caldwell et al. (2006), Borowsky et al. (2009), McDade et al. (2011), Nguyen et al (2012a,b). Similarly, the student questionnaire of the NELS88 (2<sup>nd</sup> follow-up) inquires respondents about their expectations for several future behaviors and outcomes, including graduating from high school, going to college, having a job that pays well, having a job that the person enjoys doing, among several others. However, such questions elicit respondents' expectations using a verbal 5-point scale of chance (from very low to very high chances), or in terms of expected age bands at which each event might occur if at all. Also, the ECLS-K survey of NCES asks responding parents to indicate "how far in school" they expect their child to go (i.e., the highest educational degree he will attain). But, once again, such questions do not allow parents to express uncertainty about their children's future education.

various facts that are relevant to schooling decisions. For example, 8<sup>th</sup> graders facing high school application and their parents could be asked about key features of the application and admission procedures in their locality, major characteristics of different types of schools, and even what schools they are aware of in the first place.

In a recent survey of Italian 8<sup>th</sup> graders from the city of Vicenza and their parents, facing choice of the high school track for the following year, Giustinelli (2012) elicited respondents' awareness about the major high school tracks or curricula available in Vicenza and about the schools in Vicenza offering those programs. Specifically, in the first section of the survey instrument respondents were asked for all curricula available in town, "*What high school curricula do you know or have you heard the name of?*" The mutually exclusive response categories were 'I know it,' 'I have heard the name only,' and 'I have never heard of it,' where 'I have never heard of [track K]' aimed to measure complete unawareness by the respondent about existence of K. 'I have heard [track K]'s name only' aimed to identify respondents who are aware of K's existence but have limited knowledge about its characteristics. Finally, 'I know [track K]' aimed to identify respondents who are aware of K's existence and have fairly refined knowledge about its characteristics.

These awareness questions were followed by a sequence of questions eliciting respondents' expectations of choosing each track, as well as their expectations for a range of future outcomes or consequences following choice of each track. The elicited beliefs about choice consequences include shorter-term outcomes which they would realize during high school (e.g., enjoyment, grades, effort, graduation, etc.) and longer-term outcomes pertaining to opportunity sets, college

choice, and the labor market after high school.<sup>32</sup> Parents were asked to report their expectations for their children's outcomes.

Respondents' expectations were elicited probabilistically using the 0-100 percent chance scale introduced in the previous section. However, different from the studies of schooling and earnings expectations reviewed above, participants in the Vicenza study were probed more deeply about their beliefs about the future. Specifically, after providing a single number between 0 and 100 expressing, for instance, their subjective likelihood of graduating from the Math & Science track (were they to attend it), respondents were asked to indicate how sure they felt about their answer. If they reported feeling unsure about their initial point-belief, they were further allowed to provide a range of chances expressing their degree of uncertainty, or to say they had 'no idea about the chances' altogether. Permitting respondents to give an interval rather than point probability response enables them to express ambiguity, in the sense of having incomplete probabilistic beliefs. See Ellsberg (1961) for a pioneering discussion of ambiguity and Manski and Molinari (2010) for an earlier empirical study eliciting beliefs as probability intervals.

There may be a link between the (un)awareness measure and the expectations measure. Specifically, it will be interesting to see whether expressions of complete unawareness about

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<sup>32</sup> Selection of choice consequences for the survey instruments was informed by the literature on career choice (e.g., Hartog and Diaz-Serrano (2014)); by a previous survey Giustinelli (2015) carried out in Verona, a nearby city in Northern Italy; and by in-depth interviews Giustinelli (2012) fielded in Vicenza on 30 8<sup>th</sup> graders and their parents during the spring of 2011.

specific programs ('I have never heard of it'), tend to map into expressions of complete belief uncertainty or ambiguity ('No idea about the chances') for the corresponding programs—rather than uncertainty characterized by a subjective probability distribution (e.g., Ellsberg (1961), Camerer and Weber (1992), and others); and whether expressions of awareness accompanied by limited knowledge ('I have heard the name only'), tend to map into expression of partial belief uncertainty or ambiguity ('Unsure about the chances'), and *vice versa*.

Although it is useful to distinguish information from expectations when considering the verifiability of responses, the two concepts need not be distinct from the perspective of respondents. Respondents often have only partial knowledge about facts. For example, middle school students and their parents may have only an approximate idea of the workings of the algorithm matching high school applicants to schools, or of the fine-grain details of the curriculum offered by some schools.<sup>33</sup> Respondents who are uncertain about these or related

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<sup>33</sup> Consider the case of NYC, analyzed by Abdulkadiroglu et al. (2015). New York has recently transitioned from a matching mechanism that did not incentivize truth-telling to a new coordinated deferred acceptance mechanism. Families' knowledge of the rules of the game in the old mechanism and their behavioral responses to those are unclear, which in turn makes the relationship between submitted preference rankings for schools and true preferences ambiguous from the researcher's perspective. In reality, modeling of school demand in NYC is challenging even under the new mechanism. On the one hand, the task of evaluating several hundred programs may be overwhelming for families, which might be more uncertain about lower ranked options. On the other hand, the fact that the set of schools students can rank and apply to is capped at 12 might induce students to deviate from truth-telling (e.g., Calsamiglia et al. (2010)). The latter may also occur as, while the mechanism has changed, families might still use strategies or information learned under the previous regime.

matters may choose not to respond to conventional questions asking about facts, or they may give responses that are not much more than guesses.

Modifying traditional survey practices to permit respondents to express uncertainty about facts can potentially shed light on the information they possess. Constructive steps in this direction have been taken by the Health and Retirement Study (HRS), which has used *unfolding bracket* questions to enable respondents to flexibly provide interval data on their income and assets. Respondents who are willing to provide interval data can do so. Those who are unwilling to respond to questions eliciting point responses are asked whether the quantity of interest lies above or below a sequence of specified thresholds (see Juster and Suzman (1995) or Hurd (1999)).

Probabilistic elicitation of facts offers another route for improvement of survey research practice. When the fact is categorical, respondents can be asked to report a subjective probability. For example, consider a student's priority status at a specific school. A student (or a parent) who knows that he (the child) has priority can state that he (the child) has a one-hundred percent chance of priority while someone who is unsure can state a lower percent chance. When the fact of interest is real-valued, the method used by Dominitz and Manski (1996) to elicit expectations of the returns to schooling may be applied.

It is of interest to note that the idea has long had proponents in educational testing. Shuford et al. (1966) argued that requiring a student to choose one answer to a true-false, multiple-choice, or fill-in-the-blank question reveals (page 125) "only a very small fraction of the information

potentially available from each query.” They proposed that students instead be asked to state subjective probabilities for the correctness of alternative answers to a question.

### ***2.3. Eliciting the Locus of Schooling Decisions***

Human capital investment in the form of schooling decisions is consequential to youths’ future. School choice in modern America is complex and permeated by uncertainty. Some uncertainty may be *resolved* as information unfolds or is actively sought by decision makers. Some uncertainty is *unresolvable* as of the time of choice, because the consequences of schooling decisions—whether returns to the associated investment or costs of bad choices—are realized in the future, sometimes many years after the choice was made.

The long-term consequences of early schooling decisions are borne mainly by the youths.<sup>34</sup> However, the process and outcome of school choice take place within their family. If the family is the locus of youths’ schooling decisions, then researchers engaged in school choice analysis must confront a number of questions about how families make such decisions. What family members take part in the process? If multiple members participate, how do they interact with one another? What role does each member play? Do they decide as a group? The answers to these

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<sup>34</sup> Of course, intergenerational ties with one’s family of origin and other societal ties make an individual’s investment in human capital and school choices consequential beyond the individual himself, for example, through mechanisms of support and exchange. On the other hand, an individual’s family-to-be may itself be conceptualized as a by-product or outcome of the individual’s investment in human capital.

questions bear important consequences for how researchers should analyze school choice and for the policy implications of their analyses.

A largely undiscussed and universally unaddressed matter in the literature on school choice in the U.S. is the fact that in localities where prospective students are assigned to high schools through the recently introduced matching mechanisms, submitted preference rankings over high schools are likely the outcome of a family decision process involving both the child and his parents. Whether or not choice preferences and rule-of-the-game perceptions of American 8<sup>th</sup> graders and their parents are fully aligned to one another, and whether or not adolescent children and their parents interact over high school choice—and if so how—are empirical questions about which we as yet know nearly nothing.<sup>35</sup>

Thus far, economists have traded empirical evidence for assumptions. In the words of Lundberg et al. (2009, page 2), “Economic models of the family treat children either as ‘goods’ in the consumption vector of their parents or as agents with autonomous preferences who are capable of full economic independence.”<sup>36</sup> Similarly, micro-econometric models of school

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<sup>35</sup> Nathanson et al. (2013) suggest the existence of considerable heterogeneity in families’ knowledge and sophistication in navigating the NYC school system. They also speculate that participation of children and parents in the decision is likely to vary across families.

<sup>36</sup> And they continue, “Analytically, the absence of child agency is accommodated either by an assumption of direct parental control of the child’s behavior, or by the neutralizing effect of parental transfer.” They review the literature starting with Becker (1974, 1981)’s altruist model through the most recent modeling efforts, which have made use of the principal-agent framework. Within the latter, Cosconati (2011) and Bergman (2014) offer the most recent analyses using data from the U.S, and Bursztyrn and Coffman (2012) from Brazil.



choice have alternatively taken the family or the parent(s) as a unitary decision maker about their children's schooling, or the child as the relevant unit.<sup>37</sup> Collection of survey data on individual family members' choice preferences, and on their perceptions of the choice set and rules of the game they face, will be a key step toward overcoming these challenges.<sup>38</sup>

Research in developmental psychology, and more recently in experimental economics, has gathered ample evidence that children's decision-making skills and autonomy increase substantially during adolescence,<sup>39</sup> a time during which children also become increasingly involved in household decisions (see qualitative evidence by Butler et al. (2005) and quantitative evidence by Lundberg et al. (2009) and Dauphin et al (2011)). This notwithstanding, even developmental psychologists have traditionally conceptualized and analyzed child decision making through adult-centric frameworks of parenting, according to which acquisition of agency by children is the result of a controlled process of independence giving by parents.

This view of child-parent interactions and decision making appears to have influenced the way in which corresponding family processes have been measured in large-scale U.S. surveys. A number of national studies such as the NLSY79, the NLSY97, and Add Health feature questions

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<sup>37</sup> As mentioned above, Butler et al. (2013), Hastings et al. (2009), and Walters (2014), among others, cover this spectrum of possibilities.

<sup>38</sup> For instance, Budish and Cantillon (2012) compare and find significant differences between the preferences for courses at the Harvard Business School that students submit to the course matching mechanism and the preferences they report on a survey. The authors establish that most of the difference is due to—correct or mistaken—strategic behavior, rather than to unstable preferences.

<sup>39</sup> Lundberg et al. (2009), Romich et al (2009), and Giustinelli (2010) review and summarize the literature.

about parental monitoring or control of children's activities in a variety of spheres. For example, Lundberg et al. (2009) and Cosconati (2011) use similar questions, respectively from the Youth questionnaire of the NLSY79 and of the NLSY97, which were in turn modeled after the following question in the National Health Examination Survey (NHES) (Dornbusch et al., 1985): “*Who makes most of the decisions on the following?*”, asked separately of both parent and adolescent in each of four domains of decisions concerning the youth: (1) choosing his or her clothes, (2) how to spend his or her money, (3) which friends to go out with, and (4) how late he or she can stay out. The possible responses in each decision-making sphere are: (1) youth alone, (2) father, (3) mother, (4) both of parents, (5) father and youth, (6) mother and youth, (7) parents and youth, (8) other person(s), and (9) nobody.<sup>40</sup>

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<sup>40</sup> The question from NLSY79 analyzed by Lundberg et al. (2009) asks, “*Who usually makes the decision about...?*”, with regard to the following seven domains concerning the child: (1) buying clothes, (2) spending money, (3) friends to go out with, (4) how late can stay out at night, (5) how much allowance they get, (6) how much television they can watch, and (7) their religious training. The answers categories are: (1) you (i.e., the respondent), (2) mother, (3) father, (4) stepfather, (5) friends, and (6) someone else. The corresponding question in the NLSY97 used by Cosconati (2011) asks, “*Now we are going to name things parents often set limits about. Thinking only about the parent or parents in your house; tell us if they set limits about these things or if they think you are old enough to decide for yourself. Who sets limits on...?*”, with reference to three activities of the child: (1) how late they stay out at night, (2) what kind of TV shows and movies they watch, and (3) who they can hang out with. The answers categories are: (1) my parents and I decide jointly, (2) parent or parents set limits, (3) parents let me decide. Finally, a similar question from Add Health asks, “*Do your parents let you make your own decisions about...?*”, with regard to the following seven domains: (1) time the child must be home on weekend nights, (2)

Questions pertaining to the education domain have concentrated on eliciting parental knowledge of the child's grades and effort in school, or parental involvement in the child's homework and related activities, as perceived by either the parent or the child.<sup>41</sup> Nevertheless, some studies by the NCES have included a few questions eliciting information related to the locus of schooling decisions in American families.<sup>42</sup>

For instance, in the second follow-up to the NELS88 student questionnaire, youths were asked the following question (from the 'Family' section): *"In your family, who makes most of the decisions on each of the following topics? (circle one on each line [corresponding to a topic])"*, about nine topics. Two of them concern whether the child should go to college or vocational/technical school, and the courses he takes. The answer categories are: (1) Parent(s)/guardian(s) decide themselves, (2) Parent(s)/guardian(s) decide after discussing with child, (3) Parent(s)/guardian(s) and child decide together after discussing it, (4) Child decides after discussing with parent(s)/guardian(s), (5) Child decides by himself.

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people he hangs around with, (3) what he wears, (4) how much television he watches, (5) which television programs he watches, (6) what time he goes to bed on week nights, (7) what he eats.

<sup>41</sup> Notice that these questions can be valuably used to analyze how parents influence the development of human capital in children within structural models. For instance, in the principal-agent model developed by Cosconati (2011), the parent sets limits on the child's leisure (through curfews, restrictions on TV watching, etc.). Such limits affect the time and effort the child puts into studying and, eventually, his academic achievement. The conflict between parent and child arises from an assumption of differential time preferences/discount factors, whereby the parent places a higher value on human capital than the child does.

<sup>42</sup> We are unaware of any study analyzing these data.

In the parent questionnaire of the ECLS-K (round 7), respondents were asked the following question (from the ‘Home environment, activities, and cognitive stimulation’ section): *“In the past year, how often have you {or SPOUSE/PARTNER} discussed or shared information about the following with {CHILD}?”* Out of the four domains covered, two regard school choices and plans: selecting courses or programs at school, and plans for after high school. The answers categories are: (1) Never, (2) Rarely, (3) Sometimes, (4) Often.<sup>43</sup>

Clearly, an issue for discrete choice modeling of families’ schooling decisions is the simultaneous lack of data on the three aspects of school choice we have covered thus far: choice set perceptions by decision makers, their expectations for choice consequences, and the locus of decision. Thus far, Giustinelli (2015) is the only study we are aware of to have dealt with two of these aspects simultaneously (the second and the third).

#### The Verona Study

Giustinelli (2015) fielded a paper & pencil questionnaire to a sample of entering 9<sup>th</sup> graders and their parents in Verona, a city in Northern Italy. Children took the survey in class. Parents were mailed the survey and asked to respond without consulting with the child. As study

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<sup>43</sup> A subsequent question in the same section asks, *“How often would it be true for you to make each of the following statements about {CHILD}?”* The response statements are (1) You get along well with {CHILD}, (2) {CHILD} and you make decisions about his/her life together, (3) You just do not understand him/her, (4) You feel you can really trust him/her, (5) He/She interferes with your activities.

participants were surveyed during the first week of school, their choice of high school track for the child (among general, technical, and vocational options), was observed by design.

The Italian secondary system features early curricular specialization and open-enrollment. Curricular specialization or tracking at high school entry implies that this choice is both consequential to Italian youths and subject to substantial uncertainty.<sup>44</sup> Open-enrollment justifies focus on the demand side.

In the analysis, observed choices are interpreted as the outcome of a family process of decision, unobserved by the researcher. The aim of the survey was to measure specific elements of the family decision process, including individual choice preference of child and parent over high school tracks, their subjective expectations for consequences of alternative choices, and the locus of choice.

Preferences over tracks or curricula were elicited by asking respondents to rank the programs offered by schools in Verona, according to those factors or criteria they individually regarded as most important for making the best choice for the child. Respondents' expectations were elicited probabilistically using the 0-100 percent chance scale introduced earlier. Both children and parents were asked to report their expectations for a series of future child's outcomes, including

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<sup>44</sup> Italian tracking has both 'rigid' and 'flexible' features. On the one hand, different tracks or curricula are generally offered in separate schools, and track-switching occurs infrequently and can be costly time wise. On the other hand, graduation certificates from the majority of curricula (including vocational ones), enable students to continue onto college, albeit at the cost of training and, hence, skill mismatch. See Brunello et al. (2007), Betts (2011), and Hall (2012) for elaboration and evidence.

enjoyment of the curriculum, grades, and effort in high school, graduation from high school, and subsequent college and labor market outcomes.<sup>45</sup> A key feature of these questions, to which we will return below, is that they were asked for all choice alternatives available in Verona, not only for the high school program each family had chosen.

The locus of choice was measured using a question similar to those included in the NLSY and NELS surveys above. The question asked respondents to select the statement (from a given list) that best describes the way in which choice of high school track was made in their family. Answer options were,

(A) We realized pretty soon that in our family we had the same idea about the choice	<input type="radio"/>
(B) We discussed within our family until we reached a common decision based on compromise	<input type="radio"/>
A specific member of our family made the final decision after exchanging information and/or opinions with others. <u>Indicate who decided:</u>	
(C) Myself	<input type="radio"/>
(D) My father	<input type="radio"/>
(E) My mother	<input type="radio"/>
(F) Other person, specify: .....	<input type="radio"/>
A specific member of our family made the final decision without discussing with anyone else.	

<sup>45</sup> The choice of outcomes was informed by existing qualitative evidence on high school track choice in Italy (e.g., Istituto IARD (2001), Istituto CISEM-IARD (2009)).

<p><u>Indicate who decided:</u></p> <p>(G) Myself</p> <p>(H) My father</p> <p>(I) My mother</p> <p>(J) Other person, specify: .....</p>	<p><input type="radio"/></p> <p><input type="radio"/></p> <p><input type="radio"/></p> <p><input type="radio"/></p>
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About 27% of children reported making the decision without consulting with their parents (or family process ‘PR1’); 35% of children indicated making the decision themselves aided by their parents’ inputs (or family process ‘PR2’); finally, about 38% of children indicated that they made the choice jointly with their parents (or family process ‘PR3’).<sup>46</sup>

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<sup>46</sup> Answers to this question, and to a follow-up question eliciting identities of all persons the decision maker talked to, were used to classify the reported family decision processes. ‘Child chooses unilaterally’ (PR1) includes the case in which the child talked to any person different from his parents and, hence, it groups part of (C) and all of (G) answers. ‘Child chooses with parental input’ (PR2) covers part of (C) answers. ‘Child and parent make a joint decision’ (PR3) includes (A) and (B) answers. ‘Parent chooses with the child input’ and ‘Parent chooses Unilaterally’ were constructed symmetrically, but not used in the empirical analysis because few such cases were observed in the data. Finally, when either (A) or (B) were selected, respondents were asked a follow-up question eliciting the identity of the decision maker in the counterfactual situation in which no agreement or compromise would be reached. Answers to this question and additional survey information were used to define the ‘relevant’ or ‘representative’ parent.

A comparison of children's and parents' stated-preferred choice alternatives within families further reveals that in a large fraction of families (about 46%), children's and parents' most preferred school track for the child differ. Moreover, conditional on differing child-parent choice preferences, the track indicated by the child as his top alternative (rather than that of the parent) coincides with the observed family choice in the large majority of cases.

Giustinelli (2015) combines actual choices and the subjective information elicited in the survey to estimate a random utility model, but with two main innovations. First, perceived uncertainty about the consequences of high school choice is explicitly incorporated by assuming that decision makers maximize a subjective expected utility (SEU) function that depends both on their utilities and their expectations for future outcomes.<sup>47</sup> Second, families are allowed to choose according to one of the three decision processes described above. That is, in the first process, the locus of choice is an individual family member—either the child or the parent(s). In the second process, an individual family member—either the child or the parent(s)—makes the decision based on inputs from the other member. In the third process, the child and parent(s) make a joint decision.<sup>48</sup>

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<sup>47</sup> This approach is similar to that used by some of the contemporaneous papers on college major choice using subjective expectations data (e.g., Zafar (2013)).

<sup>48</sup> Families are assumed to be child-parent dyads in the model. Extension to triads or larger groups is straightforward, but would require collection of stated choices and subjective expectations from all members. In practice, three processes only were observed in the data: unilateral choice by the child, child's choice with parental input, and child-parent joint decision.



Existing models of Bayesian individual and group choice provide a formalization of the preference and corresponding utility structure for the group and its members, which are easily portable into the standard random utility framework for discrete choice. Giustinelli (2015) assumes that in families where track choice is unilaterally made by a specific family member identified in the survey answers, that member makes the choice by maximizing his/her SEU over alternative programs, on the basis of his/her own subjective expectations and the utilities he/she assigns to future choice outcomes.

For the second decision process, Giustinelli (2015) assumes that the decision maker maximizes a SEU formed by the utilities (s)he individually attaches to future choice outcomes, and by subjective expectations resulting from the linear aggregation of individual members' beliefs, according to a set of weights to be estimated. Finally, for the third process she assumes that family preferences can be represented by a group's SEU, where individual members' SEUs are linearly aggregated by a pair of weights to be estimated.

In the multilateral case, joint identification and estimation of both utility parameters and aggregation weights exploits the full richness of the collected information. For each family, three sets of utility inequalities are used: one for the family and one for each member participating in the decision. For concreteness, consider the case in which child and parent make a joint decision. Heterogeneity of subjective expectations across children—that explains heterogeneity in children's reported choice preferences—yields identification of the parameters characterizing the child SEU. A similar argument applies to identification of the parent SEU's parameters. Once the utility parameters in the child and parent SEUs have been identified, the aggregation weights

governing child-parent interaction are identified by within-family differences between child and parent expectations that explain observed differences among individual members' reported choice preferences and the family observed choice.

Giustinelli (2015) uses parameter estimates from the model to quantify the impacts of pre-specified changes in children's and/or parents' expectations on track enrollment, alternatively induced by sensitization campaigns about specific study areas, by institutional changes to curricular tracking or standards, or by publication of education statistics. These counterfactuals confirm the importance of introducing the beliefs and decision roles of individual members in models and policy analysis of family schooling decisions.

Giustinelli (2015)'s analysis is the first empirical application to discrete school choice that simultaneously departs from treating the family as a monolithic decision maker and from making strong rationality assumptions about the relevant expectations for intra-family decision making. Direct measurement of the family members' expectations and their roles in the decision is a main feature and strength of the analysis. The latter, nevertheless, does still rely on substantial simplifications regarding both the theoretical framework and the data. Validity of the counterfactual forecasts, for example, requires that the family decision processes are correctly specified and remain unchanged following the hypothesized policies. The empirical analysis provides some evidence supporting the ability of the family process measure to discriminate among different models of family decision-making. However, neither alternative forms of family

interaction (e.g., strategic ones), nor selection into family decision processes are addressed.<sup>49</sup> Finally, both the theoretical framework and the data maintain the Bayesian agnosticism about how beliefs are formed and do not consider the potential role of ambiguity.

Substantial progress could be made by collecting a panel of beliefs from multiple family members, by allowing respondents to provide probability intervals as a way to express ambiguity, by measuring risk and ambiguity attitudes, by eliciting respondents' knowledge of the existing alternatives and of their characteristics. The Vicenza Study, whose design is described in Giustinelli (2012), makes a next step in this direction.

### 3. Conclusion

The absence of data on expectations, choice-set perceptions, and the locus of choice has seriously afflicted empirical analysis of schooling decisions from the earliest research through

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<sup>49</sup> For example, evidence from open-ended questions asked in the Verona survey, and from the in-depth interviews fielded during the development of the Vicenza surveys, provides both confirmation and qualifications to one of the basic findings of Giustinelli (2015)'s analysis—that children play a prominent role in their high school track decision. Specifically, the evidence suggests that while children do indeed have a strong and often final say in their high school choice, parents and teachers actively shape the set of options children may choose from. The latter is typically both smaller than the complete list of options available in their locality and heterogeneous across children/families. This finding emphasizes the importance of properly measuring and modeling choice set perceptions and heterogeneity, child-parent interactions, as well as the role of other agents such as teachers and counseling staff.

the present. A basic practical issue is the substantial interview time a comprehensive effort to inquire about these topics would require.

A way to make collection of rich data feasible is to place a relatively short module of questions in the core of a survey instrument and to pose a more comprehensive set of questions to a sub-sample of respondents. Moreover, subjective reports measured in the surveys may be linked to objective information available from school and other administrative records.

The Health and Retirement Study (HRS), funded by the National Institute of Aging (NIA), provides a good model that shows how such intensive interviewing and linkages may be accomplished in practice. From its inception in 1992 through the present, the HRS has combined its core questionnaire, which is administered to all respondents, with modules of additional questions that are administered to randomly drawn sub-samples of respondents. The HRS has also drawn dedicated sample of respondents, separate from the main sampling frame, for lengthy interviews on topics considered to be important to the NIA mission. Finally, individual- and household-level data from the HRS surveys has been linked to individual-level administrative data from Social Security and Medicare. In addition, the HRS has recently received funding to further link HRS survey data to economic, business, and employment data from the U.S. Census Bureau.

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