

Dissertation Proposal

**A CULTURAL SOCIOLOGY OF EDUCATIONAL OUTCOMES: RECIPROCAL
EFFECTS, SOCIAL STATUS, AND COMPLEXITY**

by

Francisco Olivos

Proposal Presented to the Department of Sociology at The Chinese University of Hong
Kong In Partial Fulfillment of Requirements For the Degree of Doctor in Philosophy

Under the supervision of Professor Tony Tam

April 22, 2020

Contents

| | |
|---|----|
| 1. Introduction | 3 |
| 2. Reciprocal effects of parental meritocratic beliefs and children's educational performance in china | 6 |
| 2.1. Research question | 6 |
| 2.2. Scientific contribution | 6 |
| 2.3. Method | 9 |
| 2.4. Results..... | 10 |
| 2.5. Career prospect | 10 |
| 3. "Brains gain and hearts drain": forms of selectivity into international migration expectations in China..... | 12 |
| 3.1. Research question | 12 |
| 3.2. Scientific contribution | 14 |
| 3.3. Data and Variables | 15 |
| 3.3.1. Dependent variables..... | 16 |
| 3.3.2. Independent variables | 16 |
| 3.3.3. Controls..... | 18 |
| 3.4. Results..... | 20 |
| 3.5. Career prospect | 24 |
| 4. An agent-based model of educational expectations adoption and adaptation | 26 |
| 4.1. Research question | 26 |
| 4.1.1. Adoption and adaptation..... | 27 |
| 4.1.2. Expectations and social comparison..... | 29 |
| 4.1.3. Educational segregation | 31 |
| 4.2. Scientific contribution | 32 |
| 4.3. Preliminary simulations | 33 |
| 4.4. Preliminary findings | 36 |
| 4.5. Career prospect | 40 |
| 5. References | 41 |

A cultural sociology of educational outcomes: Reciprocal effects, social status, and complexity

1. Introduction

This report presents the proposal of the dissertation entitled “Cultural sociology of educational outcomes: Reciprocal effects, social status, and complexity.” It is composed of three studies discussing cornerstone frameworks in cultural sociology and applying them to educational outcomes and students’ expectations. While culture is the object of study in the sociology of culture, in cultural sociology, the cultural analysis is at the service of other realms of sociology. In this case, I use cultural analysis to understand educational inequalities, educational outcomes, and students’ psycho-social dispositions with special emphasis in China.

Post-reform China has witnessed rapid economic development, educational expansion, and urbanization, which led sociologists to put aside culture as explanans or explanandum in Chinese Sociology. Thus, cultural sociology did not follow the pace of sociologists studying economic advantages or material dimensions of social stratification. Nowadays, cultural analysis has been monopolized by anthropologists and psychologists or, at the best, by qualitative sociologists¹. Therefore, this dissertation seeks to foster a research agenda in quantitative cultural sociology in Chinese societies.

The first study aims to understand how parents’ meritocratic beliefs and children’s educational performance are affected by each other in China. The reciprocal effect of cultural beliefs and educational outcomes is framed in a dual-process of culture, where culture motivates and makes sense of action and structures. Thus, I engage in a discussion with influential scholars in the field (Lizardo et al. 2016; Vaisey 2009) and classic works (Swidler 1986) that have initiated prolific research agendas in sociology. In addition, this paper contributes to the growing literature in meritocratic beliefs (Lamont 2019; Mijs 2016b) and tests two effects that have not measured simultaneously or are usually confounded.

¹ Only 5 studies with reference to China can be found in *Poetics*, the leading journal in cultural sociology, using the key work “China”. From this study, none of them is focused on China and quantitative.

Currently, this article is under review in *Social Science Research*. Previously it was submitted to Sociology of Education and was rejected after three auspicious reviews.

Methodologically, in this study, I use autoregressive cross-lagged structural equation models. A special type of structural model to disentangle reciprocal effects. Since my master's degree, I have been equipped with structural equation models (SEMs) in my toolkit of statistical methods. However, I have not had the opportunity to put them in practice. This article will be proof that I master SEMs and could teach them in a methodological course. In addition, I have conducted all the analyses in Mplus, specialized software for structural equation models.

The second study contributes to the understanding of the migration process by examining individual-level characteristics that determine expectations of international migration in a representative sample of Chinese middle-school students. Migration is not only determined by aggregated social influence or structural conditions without strategic reflection. It is also the result of cognizant agents who strategically act to achieve well-formulated objectives. Thus, objective conditions that make migration possible, and agents' subjectivity come together in a two-step process of migration (Carling 2002; Carling and Schewel 2018). First, individuals form thoughts and feelings that, in a second stage, will motivate and drive the migration outcomes (move or stay). These socio-psychological constructs include aspirations, intentions, considerations, willingness, necessity, and expectations to migrate. In this context, the selectivity not only takes place directly through outcomes but also indirectly through who wish or expect to migrate.

The most studied forms of selectivity are education and health (Feliciano 2020). In this study, skills and different indicators of health status are used to compare students who expect to migrate in the future with those who expect to stay. I argue that expectations of migration are a making-sense of the returns to these skills. In addition, I move forward the literature by examining the selectivity by cultural factors and untangling cognitive and non-cognitive skills². A mainstream approach in cultural sociology understands individual decisions as a dual-process where embedded culture motivates decision-making (Lizardo et al. 2016; Vaisey 2009). Thus, this study joins this framework discussing whether parental worldviews about meritocracy affect children's migration expectations.

² The literature in economics and sociology do not differentiate between skills and traits and tend to use them interchangeably. While skills refer to the ability to do something, trait is a feature of someone's character. To make a distinction between both constructs goes beyond the aims of this article, and I call them skills for the sake of simplicity.

Finally, the third study uses agent-based models to computationally simulate the formation of educational expectations. Different theoretical frameworks are combined to identify logical boundaries that make changes in educational expectations possible. Early findings suggest that students do not adapt their expectations unless unrealistic changes in performance (Andrew and Hauser 2011). Unless traditional theoretical frameworks, complexity science enables us to identify the possibility of social change, instead of the mere visualization of social reproduction. In this complexity framework, educational expectations are affected by social influence and, therefore, are cultural as defined by studies in cultural dissemination (Axelrod 1997; Flache and Macy 2011). In addition to this substantive contribution, this study is my initiation to computational sociology and complexity sciences, a growing field in sociology (Goldberg and Stein 2018; Page 2015). I do not have a background in mathematics or data science; therefore, I expect to take the first steps to the field of computational cultural sociology based on this study³. For this proposal, I present a theoretical discussion and a preliminary simulation to illustrate the feasibility of the study.

This report is structured in three section equivalents to each study. After the introduction, I summarized the main arguments and results of the study testing the reciprocal effects between parental meritocratic beliefs and children's educational performance. Second, I report the general discussion of the predictions of the cultural consumption article and preliminary results that support the univore-omnivore hypothesis in the Chinese case. Third, the computational simulation of educational expectations adaptation is presented. Finally, this proposal has associated additional files in a dissertation portfolio (LINK):

- Submission to Social Science Research pf study 1
- Codes for study 1 and study 2
- Preliminary computational simulation.

³ I attended a one-week course in Agent-based modeling at the University of Essex, the UK, in the summer of 2019. In this study, I applied the basis of the knowledge of that course. In addition, my second candidacy examination was directly related to complexity science.

Study 1

2. Reciprocal effects of parental meritocratic beliefs and children's educational performance in China

2.1. Research question

Meritocratic narratives, such as the American Dream, are losing effectiveness as collective myths (Lamont 2019). In modern societies, meritocracy is a guiding principle for reward allocation based on achievement rather than ascription (Mijs 2016b; Tsay et al. 2003; Young 1958). Defenders of meritocratic ideals (Herrnstein and Murray 1996; Saunders 1995) indicate that it serves two purposes: first, it enables scarce resources to be efficiently allocated and, second, it incentivizes effort. However, unequal and underserved starting positions lead to the understanding that meritocracy violates its own merit principle. It legitimizes societal inequalities as justly deserved, and misfortune becomes a personal failure (Mijs 2016b). However, the cross-national and comparative efforts of legitimization researchers have not produced longitudinal evidence to rule out bidirectional effects (Mijs 2016a, 2019). Either way, these competing perspectives could apply to different experiences of social mobility, professional career, educational achievement or any sort of success. Given this context, the aim of the present study is to test these two perspectives simultaneously in the case of the Chinese educational system: How are parents' meritocratic beliefs and children's educational performance affected by each other? By understanding the role of parental meritocratic beliefs in the educational system, I examine how meritocratic beliefs shape and are shaped by success in society. This is not an attempt to set aside the relevance of meritocratic beliefs in China but to better understand their relationships with children's educational performance. In addition, I examine how this dynamic varies between rural and urban China as an important cultural cleavage.

2.2. Scientific contribution

This article makes several contributions to the literature. First, I simultaneously test two competing hypotheses about the role of parental meritocratic beliefs in the educational system, using a theoretical rationale and rich longitudinal data. Sociologists tend to propose

that meritocratic narratives legitimize inequalities (e.g. Lamont 2019; Mijs 2019), distancing themselves from motivational arguments. However, this theory has not been accurately tested. In the present study, autoregressive cross-lagged structural models are implemented using data from the two waves of the China Educational Panel Survey with the aim of disentangling the theorized reciprocal effects. This theoretical argument and research design could be applied in different societies and to understand the role of meritocratic beliefs in a myriad of fields.

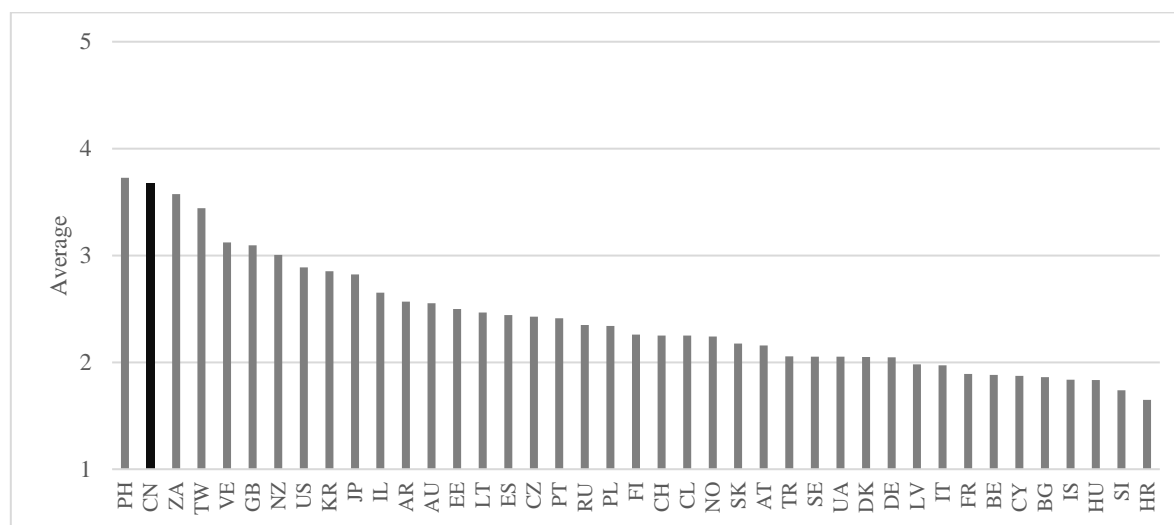
Second, the Chinese case is a unique setting for studying meritocratic beliefs. Paradoxically, there is no equivalent of the word meritocracy in Chinese. It is often translated as elitism (英才教育), which ignores its antecedents. However, Chinese culture has longstanding meritocratic norms, grounded in mainstream Chinese philosophies. First, it links educational institutions and exam-based qualifications for highly-valued civil service jobs (Hannum et al. 2019). The selection of public servants based on both moral character and talent has been attributed to the earliest period of Chinese history (Xiao and Li 2013). Second, administrative performance provides the basis of merit-based inequality (Xie 2016). It is widely considered the ruling class deserve their benefits as they work for the public good.

In addition, a recent study has shown that individuals from Western countries with higher levels of inequality tend to explain success in meritocratic terms (Mijs 2019). A similar conclusion has been drawn for Latin American countries (Bucca 2016), and experimental evidence in the United States (Molina, Bucca, and Macy 2019). In the case of China, a high level of inequality (Xie and Zhou 2014) and social fluidity (Zhou and Xie 2019), by international standards, bring the justificatory role of meritocratic narratives, alongside their hypothesized motivational effect, into sharper relief. I incorporate the Chinese case in the literature of meritocratic beliefs through a focus on the educational system. As shown in Figure 1, of the countries included in the 2009 International Social Survey Project, China is ranked second in tolerance of inequality in the educational system (3.68). Indeed, the difference between the Philippines, the most tolerant country in the sample, and China is not statistically significant.

By meritocratic beliefs, I refer to the perception of reward distribution in the educational system (as it is) in contrast to individual preferences for inequality (what ought to be), which is an important distinction made by previous studies in social justice beliefs (e.g. Castillo 2011). Although meritocratic ideals are important normative principles in Chinese tradition, it is not clear whether Chinese parents perceive educational systems as

such, and whether these beliefs have cultural efficacy in the explanation of children's performance. Throughout this article, I will use, for the sake of simplicity, meritocratic beliefs and perceived meritocracy as synonyms.

Figure 1. Is it *just* or *unjust* that people with higher incomes can buy better education for their children than people with lower incomes?



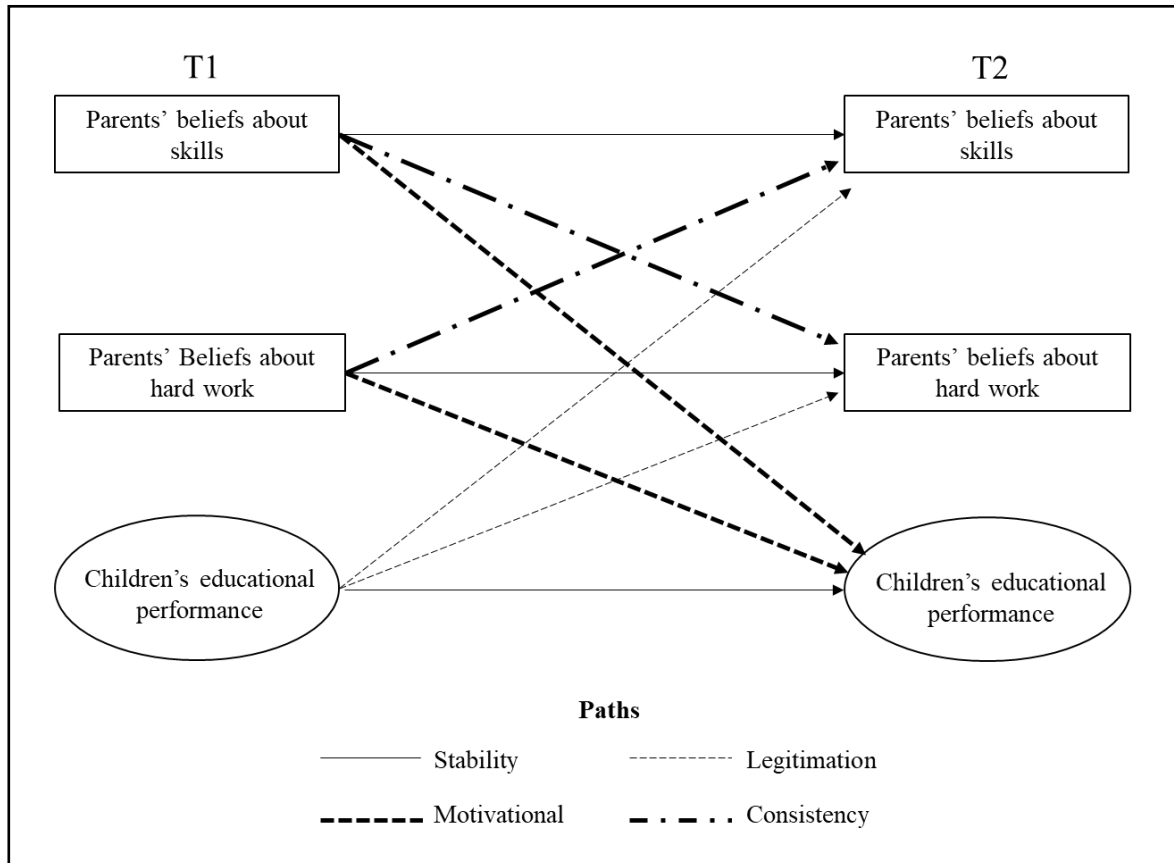
Note: Own elaboration from the 2009 International Social Survey Project. Weighted statistics. Values are reverse with 1 “Very unjust, definitely wrong” and 5 “Very just, definitely right”.

Finally, this study contributes to the literature by clarifying the debate about the cultural explanation of educational inequality. Values and beliefs are common explanations of racial gaps in the United States. Asian Americans outperform white Americans due to their cultural differences regarding the association between effort and success (Chen and Stevenson 1995; Hsin and Xie 2014; Liu and Xie 2016). Thus, parental beliefs have an effect on children's performance. However, Lee and Zhou (2015) have expressed their concerns about the misperception of culture and Asian American achievement. They are skeptical about findings showing that Confucian values of hard-working have explained Asian American's academic achievement because some migrant groups, such as Chinese and Koreans, are hyper-selected. Asian American children begin their studies from more advantaged positions than other groups, and the host society attributes their academic success to their culture. Thus, Asian American students benefit from positive racial stereotypes at school. The findings reported in this study are particularly insightful for reevaluating the cultural explanation under different social contexts and without the self-selection by cultural repertoire.

2.3. Method

From the theoretical arguments, I derive reciprocal effects between children's educational performance and parental perception of meritocracy in the educational system. Autoregressive cross-lagged panel models (ACLPM) are a specific type of structural equation model (SEM) that can be used if two or more variables have been measured longitudinally, and the interest is in their reciprocal effects. Like any SEM, ACLPM allows both latent and observed variables to be included. Moreover, the standardization of coefficients enables effects to be compared between paths. Figure 2 summarizes the empirical model.

Figure 2. Theoretical model.



Note: Control variables and residual covariances are not included in the figure. Latent variable (circles) formed by children's class rank in Math, Chinese and English. Observed variables represented by squares.

I analyze data from the first and second waves of the China Educational Panel Survey (CEPS). The sample comprises 10,279 seventh graders surveyed in 2013-2014 with a follow-up in

eighth grade. This survey is a longitudinal, large-scale, probabilistic and representative sample of seventh and ninth graders from 438 classes at 112 schools in 28 counties in mainland China. Of the 10,279 seventh graders in the baseline, 9,440 students were surveyed in the follow-up in eighth grade. Total attrition is about 8.16 percent of the original sample. The analyses in this work only consider parent questionnaire answered either by the biological father or the biological mother. Therefore, the final analytic sample includes 9,163 observations.

2.4. Results

The findings indicate that parental narratives of meritocratic success do not have an effect on the educational performance of children. Instead, meritocratic beliefs are affected by academic results, suggesting they have a justificatory role. This pattern is much clearer in rural China, where traditional Chinese culture is preserved. In addition, this study sought to explore the consistency of two narratives of meritocratic principles: hard work and skills. The results indicate that in China they are moderately related, and beliefs about hard work are used to make sense of better children's educational performance in a more salient manner.

2.5. Career prospect

This study is relevant to my career prospect in four aspects. First, this paper connects with a growing literature in meritocratic beliefs recently published in influential journals such as *Sociology of Education* (Mijs 2016b), *Socio-Economic Review* (Mijs 2019), and *Science* (Molina et al. 2019). With this paper, I expect to engage in this mainstream literature. Indeed, the first draft of this paper was commented by Jonathan Mijs, a Harvard scholar who has influential papers in the field and currently working on a book about it with the University of California Press.

Second, although broad research in social justice beliefs has grown in the last years in China (Xian and Reynolds 2017; Xie 2016), this literature acknowledges the lack of research in non-western societies (Bucca 2016; Mijs 2019). With this study, I aspire to fulfill

this gap and expand the research to other fields such as meritocratic beliefs in the labor market or higher education. It could be a natural extension in a GRF if I continue my career in Hong Kong.

Third, with this study, I seek to link previous publications and my prospective career. I have been working on social justice research as a Research Assistant before and after my master program at Utrecht University. I successfully published as a coauthor two papers in the field using Chilean (Castillo, Olivos, and Azar 2019) and cross-national data (Maldonado et al. 2019). In this article, I use relevant studies in social justice and complemented with cultural sociology and sociology of education in the Chinese context. Therefore, the successful publication will tell a more coherent story. In addition, my research in this area will sustain my research networks along time, which will make me more attractive in the labor market. Juan Carlos Castillo, one of my coauthors and mentors, commented on the first draft of this paper and planned a visit to our department in February but it was cancelled due to coronavirus. In July, I expect to present this paper in a seminar in his department at Universidad de Chile.

Finally, I use structural equation models in this paper. I learned this methodology in my master program, and I have not had the opportunity to capitalize it in a publication. I have currently published as first and secondary author papers using linear regressions, multilevel models, factorial surveys, fixed-effects model, and even qualitative data. But not structural equations. Indeed, autoregressive cross-lagged models are neither trivial nor common in sociology. Thus, this solo paper will guarantee that I am equipped with this technical skill, and I could teach structural equation models in the future.

Study 2

3. “Brains gain and hearts drain”: forms of selectivity into international migration expectations in China

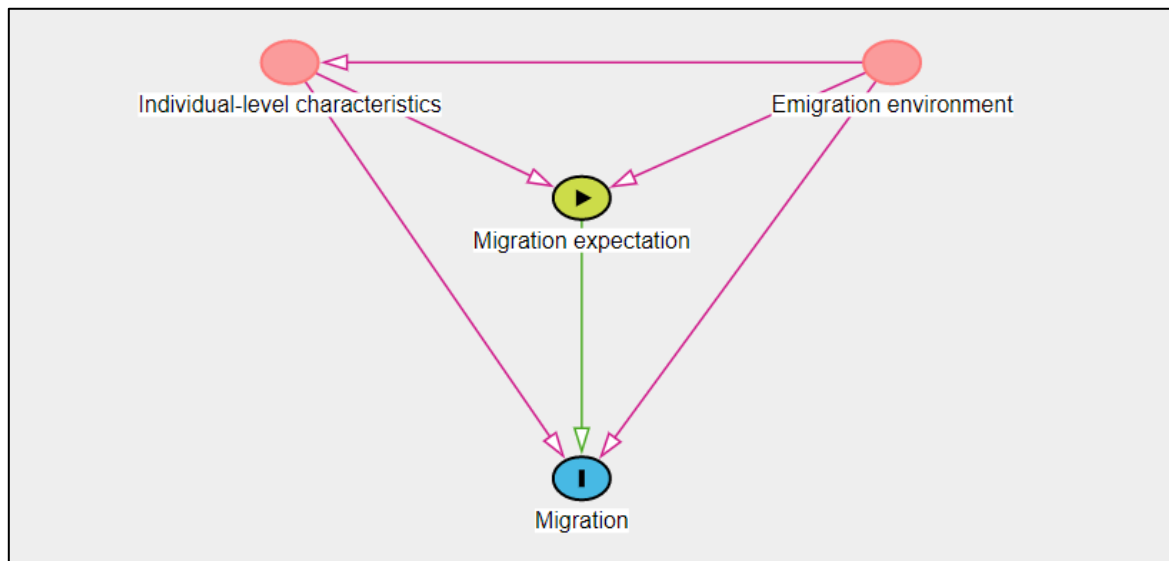
3.1. Research question

Migration is not at random. The migrating population is different from those co-nationals who stayed in the country of origin. That is what is termed as immigration selectivity (Borjas 1987; Feliciano 2020; Lee 1966; Portes and Rumbaut 1990). These differentials have important policy implications. For instance, when a highly skilled population migrates, countries encounter a “brain drain”. And when migrants are also positively self-selected by their non-cognitive skills, the economic costs go beyond “brain drain” and include the so-called “heart drain” (Polavieja, Fernández-Reino, and Ramos 2018). Thus, examining how certain characteristics influence the likelihood of migration provides critical information for understanding the migration process, its characteristics, and implications for both sending, and receiving countries.

In the last decades, researchers have produced a large body of evidence have supported immigrant selectivity hypotheses, mainly focusing on education and health (Feliciano 2020). However, migration is not only pushed by aggregated social influence or structural conditions without strategic reflection. It is also the result of cognizant agents who strategically act to achieve well-formulated objectives. Thus, objective conditions that make migration possible, and agents’ subjectivity come together in a two-step process of migration (Carling 2002; Carling and Schewel 2018). First, individuals form thoughts and feelings that, in a second stage, will motivate and drive the migration outcomes (move or stay). These socio-psychological constructs include aspirations, intentions, considerations, willingness, necessity, and expectations to migrate. In this context, the selectivity not only takes place directly through outcomes but also indirectly through who wish or expect to migrate. The direct acyclic graph in Figure 1 represents this selection. Individual characteristics and the emigration environment could influence both the migration outcome and the expectation of migration. Not only is migration not at random, but also who aspires, wishes, or expects to migrate. A full understanding of the migration process requires not only understanding selectivity of the migration outcome, but also the selectivity on the subjective components of the two-stages process. This study contributes to this full understanding of the migration

process by examining individual-level characteristics that determine expectations of international migration in a representative sample of Chinese middle-school students.

Figure 1. A direct acyclic graph of the causal effect of expectation to migrate on migration and potential selectivity.



While aspirations refer to students’ desire to migrate, expectations consider students’ subjective assessment of the likelihood of migrating. For a resource-constraint theory, they are a more realistic self-assessment of a child’s future (Bohon, Johnson, and Gorman 2006; Kurlaender and Hibel 2018; Morgan 1996). Therefore, I evaluate in which extend the constraints and opportunities of migration suggested by the literature apply to the formation of migration expectations in the early stages of life. Although migration could be years ahead from adolescence, it is important to examine adolescent socio-psychological dispositions to migrate because they will belong to the next cohorts of migration (Becerra 2012). Understanding the determinants of expectations of migration provides insights to anticipate future waves of emigration in China. In addition, most of the studies in migration selectivity use adult samples, ignoring the “1.5 generation” or those who migrated at a young age (Zhou and Gonzales 2019). By studying adolescents, this study closely examines a cohort of potential young migrants.

The most studied forms of selectivity are education and health (Feliciano 2020). In this study, skills and different indicators of health status are used to compare students who expect to migrate in the future with those who expect to stay. However, I move forward the literature by examining the selectivity by cultural factors and untangling cognitive and non-

cognitive skills⁴. A mainstream approach in cultural sociology understands individual decisions as a dual-process where embedded culture motivates decision-making (Lizardo et al. 2016; Vaisey 2009). Thus, this study joins this framework discussing whether parental worldviews about meritocracy affect children's migration expectations.

In addition, scholars have stated that migrants outperform in their non-cognitive skills to their counterparts who stayed (Cebolla-Boado and Soysal 2018; Polavieja et al. 2018; Portes and Rumbaut 1990). For instance, migration requires motivation and openness. This study focuses on educational expectations, motivation, and openness as non-cognitive skills shaping migration expectations. In the last decades, the literature in economics has invigorated a discussion of the productive value of non-cognitive skills, as dimension of human capital. Heckman and colleagues (Heckman, Stixrud, and Urzua 2006) has shown that the role played by non-cognitive skills on the explanation of behavior or labor market outcome is comparable to or greater than cognitive skills, which contradicts traditional theories of human behaviors (Jensen 1998) that attributes cognitive skills a prominent role. Therefore, I introduce this discussion in the literature of selectivity into migration.

The analysis uses school-based representative and longitudinal data from China. After India and Mexico, China is the largest country of origin of international migrants (International Organization for Migration 2020). Therefore, the Chinese case is a relevant standing point to understand the role of individuals' subjectivity in the scenario of international migration. Previous studies have examined the relationship between educational expectations and migration expectations in China using cross-sectional data (Cebolla-Boado and Soysal 2018). My analysis considers this "optimism hypothesis", where immigrant optimism is related to migrant selectivity, and uses panel data to address potential bidirectionality of the effects. Additionally, longitudinal fixed-effect models address the endogeneity of expectations by ruling out time-invariant confounders.

3.2. Scientific contribution

This article makes several scientific contributions. First, I introduce the selectivity into migration at a different level than traditional studies in international migration. I suggest

⁴ The literature in economics and sociology do not differentiate between skills and traits and tend to use them interchangeably. While skills refer to the ability to do something, trait is a feature of someone's character. To make a distinction between both constructs goes beyond the aims of this article, and I call them skills for the sake of simplicity.

that selectivity not only happens at the actual migration outcome but also in the subjective decision of migration. It is highly relevant for migration studies considering the recent annual review about immigration selection published by Feliciano (2020). I combine two research traditions, and the article makes more than an empirical contribution. From my study, the two-stages migration (Carling 2002; Carling and Schewel 2018) is extended to a two-stages selectivity.

The second major contribution of the article is the distinction between cognitive and non-cognitive skills, and the striking results that support the opposite effects. Studies in migration focus on educational selectivity (e.g. Liang and Chunyu 2013), which confounds both constructs. In addition, scarce previous studies do not find consistent effects of non-cognitive skills (Polavieja et al. 2018). For the first time, strong evidence in support of the “heart drain” hypothesis is provided, which has relevant policy implications in China. Moreover, this finding is highly attractive to the human capital theory (Heckman et al. 2006) and the productive value of non-cognitive skills. Therefore, I expect to reach a broader audience with this paper.

Finally, this study is theoretically driven, and I strongly advocate against p-hacking. Therefore, the non-significant effects of parental beliefs are part of my findings. Nevertheless, there is a cultural interpretation of the effects of the skills. Students, as cognizant agents, make-sense of the structural opportunities at the school and labor market. Thus, they form expectations of migration based on the understanding of returns to their skills in the educational tournament and the labor market. Therefore, this study engages discussions in migration, cognitive, and formation of private culture in cultural sociology.

3.3. Data and Variables

I analyze data from the first and second waves of the China Educational Panel Survey (CEPS). The sample comprises 10,279 seventh graders surveyed in 2013-2014 with a follow-up in eighth grade. This survey is a longitudinal, large-scale, probabilistic, and representative sample of seventh and ninth graders from 438 classes at 112 schools in 28 counties in mainland China. Of the 10,279 seventh graders in the baseline, 9,440 students were surveyed in the follow-up in eighth grade. Total attrition is low (8.16 percent of the original sample) and, therefore, it is assumed at random. CEPS includes questionnaires to students, parents, teachers, and school principals. The former two are used in this analysis.

3.3.1. Dependent variables

Expectation of international migration. Students were asked “Where do you most expect to live and work when you grow up?⁵.” The questions are not completely comparable between waves, due to changes in their categories. In the first wave, five categories were provided: (1) in a rural area, (2) in medium or small cities, (3) in big cities, such as Beijing/Shanghai/Guangzhou, (4) abroad, (5) I do not care. In contrast, in the second measurement two categories were added: (1) in rural area, (2) in towns/counties, (3) in medium or small cities, (4) In capital cities, (5) Beijing/Shanghai/Guangzhou, (6) abroad, (7) I do not care. Therefore, binary variables were created where 1 represents “Migrate abroad” and 0 “Stay.” Initially, “I do not care” answers were treated as missing values. Further robustness checks provide alternative specifications of the dependent variable⁶.

3.3.2. Independent variables

Cognitive skills. CEPS includes a test assessing students’ aptitudes over 22 items on reasoning and problem-solving, which must be answered in up to 15 minutes (Zhao et al. 2017). The test is unrelated to the school curriculum. To facilitate the comparability across students, scores were estimated using an item response theory model and z-scores. Instruments measuring cognitive skills are scarce, which makes CEPS a unique resource to test the hypotheses.

Parental beliefs about hard work and talent. Classical definitions of meritocratic beliefs consider individual motivation and abilities as predictors of success (Young 1958). However, both components have different implications in the explanation of achievement. Paradoxically, talents are considered as the non-meritocratic component of meritocracy. They are highly dependent on family origin and genetic endowments. Thus, studies in meritocratic beliefs have a focus on individual motivation as the true meritocratic component of meritocracy (Bucca 2016; Mijs 2019). In this study, we consider both

⁵ Surveys face the challenge of avoiding measurement error. Asking about expecting “to live or work” enables us to avoid the bias of the specific connotation of the word “migration” (Carling and Schewel 2018). This bias is highly relevant in China, where migrants perceive and experience a high level of stigmatization (Li et al. 2007; Wang et al. 2010).

⁶ CEPS do not include the specific information of province or city where the survey was applied due to ethical considerations. Instead, unspecific variables of the location of the survey and location of the school according to the principal are reported. With that information, it is impossible to identify rural-to-urban migration accurately.

measurements independently as worldviews. For beliefs about payoffs of hard work, respondents were asked “*Do you think that hard work affects student’s academic achievement?*”, where 1 signified “yes” and 0 “No”. Similarly, the attributional belief of talent was measured asking “*Do you believe that talent and capability affect student’s academic achievement?*”.

Students’ educational expectations. Students were asked “What is the highest level of education you expect yourself to receive?”. Following other sociological studies in educational expectations (Andrew and Flashman 2017; Andrew and Hauser 2011; Karlson 2015), I transform this variable in a continuous indicator from 0 (drop out) to 13 (Doctor degree). Analyses were replicated considering a binary indicator as a robustness check.

Index of motivation. Motivation is measured based on the average of three items about motivation in the previous grade. Students declared their agreement with three statements in a scale from 1 to 4, where 1 represents strongly disagree and 4 strongly agree: (1) I would try my best to go to school even if I was not feeling very well or I had other reasons to stay at home, (2) I would try my best to finish even the homework I dislike, (3) I would try my best to finish my homework, even if it would take me quite a long time. Similar indicators have been used to measure non-cognitive skills in the adult population in China (Tam and Wu 2013). Internal consistency is supported for both wave 1 ($\alpha=.69$) and wave 2 ($\alpha=.81$). The higher the score, the higher the motivation of the student.

Openness. The indicator of openness comes from the parent’s questionnaire. It provides a strong test of the non-cognitive hypothesis because it combines both self-perceived indicators (educational expectations and motivation) and an indicator observed by parents, as in this case. Parents were asked whether the child fits the description of “*curious about new stuff.*” They answered on a scale ranging from 1 “not fit at all” to 4 “exactly fit.” The extent that their child fits the description is the level of openness to experience as perceived by parents.

Psychological well-being. Five self-reported psychological states were averaged. Students were asked “Do you have the feelings below in the last seven days?”. The items included were (1) feeling blue, (2) depressed, (3) unhappy, (4) not enjoying life, and (5) sad. In both waves, the indicators show a high level of internal consistency ($\alpha=.85$ and $\alpha=.91$, respectively). Each item was rated on a scale from 1 “never” to 5 “always.” Values were reversed for a more intuitive interpretation. The higher the score, the better students’ psychological well-being.

Self-perceived health status. Students report their perception of their own general health condition at present on a 5-categories scale, ranging from 1 “very poor” to “very good.”

Descriptive statistics of these variables are reported in Table 1.

Table 1. Descriptive statistics

| Variable | | Mean | Std. Dev. | Min | Max |
|--|---------|------|-----------|-----|-----|
| Expectation of international migration | Overall | 0.19 | 0.40 | 0 | 1 |
| | Between | | 0.34 | 0 | 1 |
| | Within | | 0.21 | 0 | 1 |
| Cognitive skills | Overall | 0.14 | 0.87 | -3 | 2 |
| | Between | | 0.77 | -2 | 2 |
| | Within | | 0.41 | -2 | 2 |
| Parental beliefs about hard work | Overall | 0.86 | 0.35 | 0 | 1 |
| | Between | | 0.29 | 0 | 1 |
| | Within | | 0.22 | 0 | 1 |
| Parental beliefs about talent | Overall | 0.38 | 0.48 | 0 | 1 |
| | Between | | 0.39 | 0 | 1 |
| | Within | | 0.29 | 0 | 1 |
| Index of motivation | Overall | 3.28 | 0.71 | 1 | 4 |
| | Between | | 0.57 | 1 | 4 |
| | Within | | 0.44 | 2 | 5 |
| Openness | Overall | 3.37 | .712 | 1 | 4 |
| | Between | | .598 | 1 | 5 |
| | Within | | .416 | 2 | 5 |
| Psychological well-being | Overall | 2.09 | 0.86 | 1 | 5 |
| | Between | | 0.74 | 1 | 5 |
| | Within | | 0.46 | 0 | 4 |
| Self-perceived health status | Overall | 3.98 | 0.93 | 1 | 5 |
| | Between | | 0.79 | 1 | 5 |
| | Within | | 0.51 | 2 | 6 |
| Educational expectations | Overall | 8.63 | 2.81 | 0 | 13 |
| | Between | | 2.51 | 0 | 13 |
| | Within | | 1.43 | 2 | 15 |

3.3.3. Controls

The statistical models are controlled for different potential time-variant confounders of the investigated relationships. All the controls are theoretically driven. First, a set of variables is aimed to control for different indicators of family and parent-child relationships. Studies in international migration suggest that family relationships could encourage or discourage

mobility (e.g. Cairns 2014; Liu and Olivos 2019; Mata-Codesal 2015). At the same time, family members are significant others that could also affect children's well-being (Holder and Coleman 2009; Huebner 1991), motivation (Dornbusch 1989), and educational expectations (Carolan and Wasserman 2015; Roth 2017a). Particularly, I included (1) parental educational expectations, (2) frequency of parents giving instruction on your homework, (3) a parental strictness index⁷, (4) mother-child communication, (5) father-child communication, (6) an index of family activities⁸, and (7) parents confidence in child's future.

Second, recent evidence suggests that students' educational expectations are negatively affected by family economic shocks (Renzulli and Barr 2017). At the same time, expectations of migration are also highly conditioned by their conditions of possibility (Carling and Schewel 2018). Thus, changes in family income also could impact future expectations of migration. Therefore, the logarithm of pocket money received by the children is used as a proxy. I argue that the money that parents give to children might capture an important part of the economic shocks of the family. CEPS does not include a measurement of household income.

Third, different variables are aimed to capture educational achievement. The academic performance of students could be related to both educational expectations and expectations of migration. Bayesian Learning Theory (Morgan 2005) suggests that students could update their expectations based on the information provided by their educational performance. Although small, the evidence supports the effect of grades on educational expectations (Andrew and Hauser 2011; Carolan 2017). I include the percentile rank in mathematics at the class-level based on mid-term exams, declared current difficulty in Mathematics, Chinese and English, and parental subjective assessment of student's performance. Finally, students' school integration and school environment are controlled, considering its effect on individual-level characteristics and migration expectations, as suggested by Figure 1. The agreement with each of the following three statements was included: (1) I feel close to people in this school, (2) I feel bored in this school, and (3) I hope that I could transfer to another school.

⁷ Average of six items. For different actions, students were asked "Do your parents care and are they strict with you about the following." They included: (1) your homework and examination; (2) your behavior at school; (3) whom you make friends with; (4) your dress style; (5) time you spend on the internet; (6) and time you spend on watching TV.

⁸ Average of the frequency in which family members did the following activities with this child over the last year: (1) having dinner; (2) visiting museums, zoos, science museums; and (3) going out to watch movies, shows, sports games. Categories range from 1 "never" to 6 "more than once a week."

3.4. Results

A Hausman test was conducted to decide whether to use random- or fixed-effects models (Table 1S in the supplementary material). This test indicates whether the between-relationships are different from the within-relationships. In this case, the difference is significant ($X^2(25) = 164.19$; $p < .001$). Therefore, and since the hypotheses refer to within relationships, I report conditional logistic fixed-effect models to control for time-invariant confounders. Table 5S, in the supplementary material, reports the results using fixed-effect models, which are consistent with the findings from conditional logistic fixed-effect models⁹.

Table 2 reports the main results of the study. Model 1 shows the effects of the variables of interest without time-variant controls. They are only controlled by time-invariant characteristics due to fixed-effects. Model 2 incorporates the control variables describe in the previous section. Both cognitive skills and students' educational expectations have significant effects on the expectations of international migration. Coefficients and standard errors changed slightly these observed confounders in Model 2, suggesting the robustness of the effects. An increase of cognitive skills in one unit between wave 1 and wave 2 decreases the probability of expecting to migrate abroad by a factor of 0.73 ($p < 0.01$), as suggested by odds ratios in Model 3. In contrast, an increase in student educational expectations positively affects the likelihood of hold expectations of migration. An increase of one year of expected education, increase the chances of holding expectations by a factor of 1.11 ($p < 0.01$). Changes in students' openness ($OR = 1.22$, $p < 0.05$) and in the index of motivation ($OR = 1.23$, $p < 0.05$) also have positive effects on migration expectation.

Predicted probabilities cannot be used with fixed-effect models. However, average (semi) elasticities have been proposed as an alternative (Kitazawa 2012)¹⁰. Thus, an increase of one unit in the cognitive skills scale, on average, the probability of expecting to migrated increases 13 percent. Contrariwise, when students' educational expectation increases one year, the probability of holding expectations of international migration goes up by five percent. In model 2, the index of motivation shows statistical significance after controlling

⁹ Unlike logistic regressions, dependent variable errors only cause imprecision but not bias in linear regressions (Hausman 2001). Thus, consistent results between both models suggest robustness of the results produced by biases, such as misclassification in the binary outcome.

¹⁰ The user-written Stata module *aextlogit* (Santos Silva 2020) was used to compute average elasticities for fixed-effect logit models.

by time-variant confounders. It suggests that the increase of one unit in the index increases the probability of expecting to migrate abroad by five percent. In addition, the effect of openness is statistically significant and consistent with the effect of educational expectations. The higher students' openness according to their parents, the higher is the probability of expecting to migrate. One unit in the scale increases the probabilities of migration expectation by 10 percent. Similarly, the exploratory interactions between cognitive and non-cognitive skills do not show statistical significance (models available under request). Noteworthy, the effect of educational expectations on migration expectations is net of openness. As Cebolla-Boado and Nuhoğlu (2018) pointed out, both kinds of expectations are confounded by an adventurous individual trait. Therefore, it might be captured by the indicator of openness to experience. Overall, the results support hypothesis 1B of a negative effect of cognitive skills and hypothesis 2A of a positive effect of non-cognitive skills: "brain gain" and "hearts drain".

In order to compare the effect between cognitive and non-cognitive skills, I used the within-wave decile rank of the cognitive and non-cognitive indicators. This procedure standardized measurement scale and distributions of variables. Average elasticities for these variables are reported in Model 5. In increase of one decile on cognitive skills reduces the probability of expecting migration in 4 percent, while for non-cognitive skills it ranges from 3 to 6. Therefore, the effect of non-cognitive skills is at least comparable to the effect of cognitive skills.

Regarding cultural and health selection, there are no significant differences between those students who expect to migrate and those who do not. In addition, to evaluate potential multicollinearity between key predictors, a matrix of pairwise correlations is reported in Table 2S of the supplementary material. The correlations are relatively low.

The non-significance of the self-perceived health status could be explained by an error of measurement or subjective evaluations that do not reflect changes in students' objective health conditions. To evaluate this potential bias, Table 2S in the supplementary material reports the results for two alternative indicators. First, CEPS lists certain disorders and parents declare whether their children have some of those conditions (vision disorders, hearing disorders, extremity disabled, language disorders, mental disorders, attention deficit hyperactivity disorder, epilepsy, others). I used a binary indicator where 1 represents those parents that at least listed one condition. Second, parents described the general health condition of the child at present on a scale from 1 "very poor" to 5 "very good." For both

indicators, there is no significant effect on the migration expectation, which is consistent with the original finding.

Table 2. Conditional logistic models for expectation of migrating.

| VARIABLES | (1) B | (2) B | (3) OR | (4) E | (5) E |
|-----------------------------------|-------------------|-------------------|------------------|-------------------|-------------------|
| Cognitive skills | -0.29* (0.11) | -0.32** (0.11) | 0.73** (0.08) | -0.16** (0.06) | -0.04* (0.02) |
| Parental belief about hard work | -0.18 (0.26) | -0.23 (0.25) | 0.79 (0.20) | -0.12 (0.13) | -0.11 (0.13) |
| Parental beliefs about talents | 0.08 (0.15) | 0.11 (0.15) | 1.12 (0.17) | 0.06 (0.08) | 0.06 (0.08) |
| Students educational expectations | 0.12*** (0.03) | 0.10** (0.04) | 1.11** (0.04) | 0.05** (0.02) | 0.06*** (0.02) |
| Index of students' motivation | 0.2 (0.11) | 0.21* (0.11) | 1.23* (0.13) | 0.10* (0.05) | 0.03* (0.01) |
| Openness | 0.20* (0.09) | 0.20* (0.09) | 1.22* (0.11) | 0.10* (0.05) | 0.03* (0.01) |
| Psychological well-being | -0.07 (0.09) | -0.04 (0.10) | 0.96 (0.10) | -0.02 (0.05) | -0.02 (0.05) |
| Self-perceived health status | -0.03 (0.09) | -0.03 (0.09) | 0.97 (0.09) | -0.02 (0.05) | -0.02 (0.05) |
| Observations | 2002 | 2002 | 2002 | 2002 | 2002 |
| Students | 1001 | 1001 | 1001 | 1001 | 1001 |
| Pseudo-R2 | 0.047 | 0.078 | 0.078 | 0.078 | 0.078 |
| Controls | NO | YES | YES | YES | YES |

Note: *** p<0.001, ** p<0.01, * p<0.05. Clustered standard errors at school-level. Weighted statistics.

Explaining returns to cognitive and non-cognitive skills

The striking opposite effects of cognitive and non-cognitive skills were further explored. The theoretical rationale considers students as cognizant agents that make sense of the returns to their skills in their immediate social environment, shaping their imagined futures. However, we do not really know whether the returns to cognitive and non-cognitive skills are different. Therefore, I estimated pairwise correlations between skills indicators and class-rank in Mathematics and Chinese. The analysis assumes that students are aware of these associations and make-sense of them. A long tradition of cognitive sociology has

developed the idea that social environments influence individuals' understanding of how the world works (Cerulo 2010; DiMaggio 1993; Lizardo and Strand 2010; Zerubel 1997). Arguing that students are fully aware of the returns to skills in the labor market could be unrealistic. Instead, grades at school are the rewards in the educational tournament and could be conceptualized as returns in the closest social environment. As Table 3 shows, cognitive skills are positive and strongly associated with grades in Mathematics, Chinese, and English. It is consistent across waves. Nevertheless, the associations of non-cognitive skills are more inconsistent. In the first wave, grade ranks are not associated with students' motivation nor openness. The same is suggested in wave 2 for openness. Only educational expectations are consistently associated with performance in Mathematics and Chinese.

Table 3. Pairwise correlations between skills indicators and class-rank by wave (standardized variables).

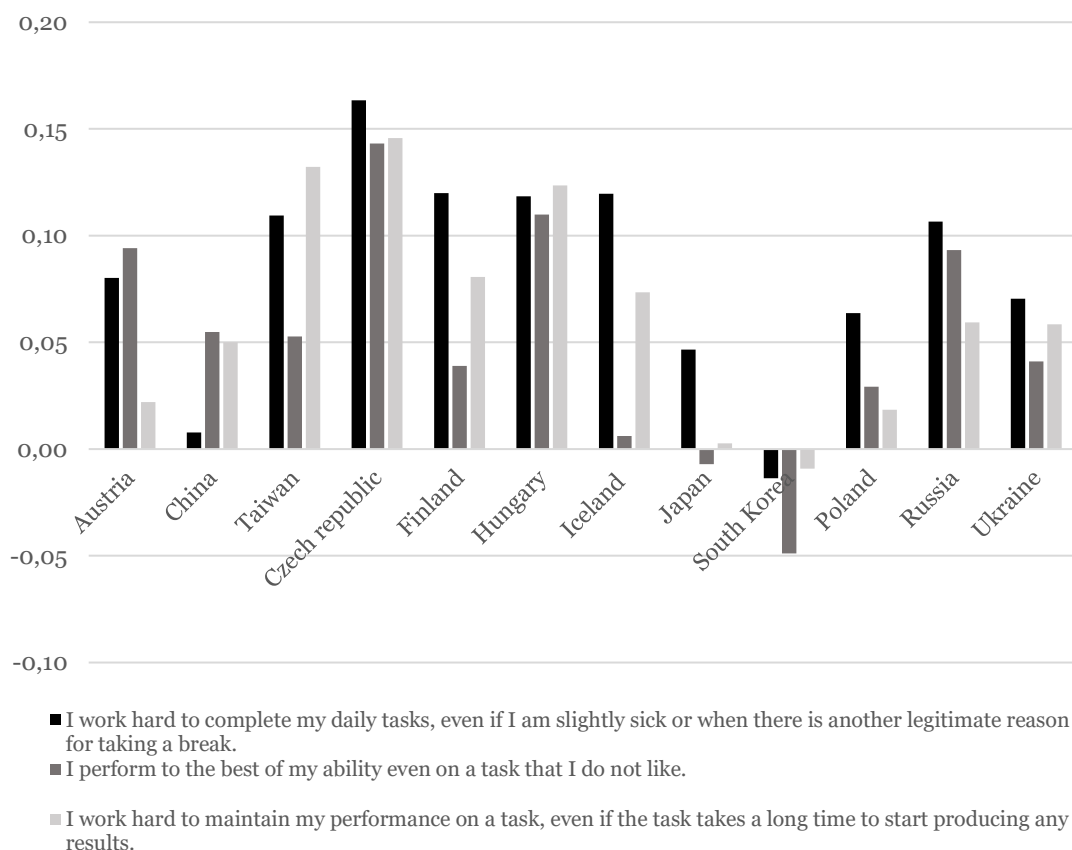
| | Subject | |
|-----------------------------------|-------------|---------|
| | Mathematics | Chinese |
| Wave 1 | | |
| Cognitive skills | 0.304* | 0.209* |
| Students educational expectations | 0.228* | 0.148* |
| Index of students' motivation | 0.100 | 0.104 |
| Openness | 0.031 | 0.038 |
| Wave 2 | | |
| Cognitive skills | 0.408* | 0.334* |
| Students educational expectations | 0.292* | 0.247* |
| Index of students' motivation | 0.205* | 0.184* |
| Openness | 0.041 | 0.025 |

Note: *** $p < 0.001$.

The assumption that students make-sense of their immediate environment could also be relaxed. If adolescents are also aware of how society rewards different skills, the returns to non-cognitive skills might be low in the Chinese labor market. I use data from the 2009 International Social Survey Project to evaluate returns to non-cognitive skills in a benchmark with 11 countries from different continents. The survey included three indicators that match the item of the Index of Motivation. The pairwise correlations between these indicators and the status attainment of respondents using ISEI (International Socio-Economic Index of occupational status) are reported in Figure 2 by countries with

measurements available. Overall, the association between non-cognitive skills and status attainment is lower in China in comparison to other countries, except for Japan and South Korea.

Figure 2. Pairwise correlations between ISEI and non-cognitive skills by country.



Note: Weighted statistics.

Therefore, if we consider returns at school and returns at the society, students with higher non-cognitive skills might likely form expectations of international migration as a strategy to overcome the low pay-offs.

3.5. Career prospect

This article makes important contributions to my career. First, I try to acquire expertise in cultural sociology, instead of the sociology of culture. The former is the application of a cultural framework to understand social phenomena. In contrast, the sociology of culture is

the study of culture as an object. Therefore, I adopt a much modern approach. The expectations of migration are a sense-making of structural opportunities. This argument is central to the contemporary framework in cultural sociology.

Until now, my articles have been published in subfield journals such as the *Journal of Happiness Studies* or *Poetics*. Thus, the impact of those papers is narrower compared to papers that appear in outlets for a broader audience. However, in this paper, I speak to migration studies, cultural-cognitive sociology, and human capital theory. Therefore, I have the opportunity to contribute with an article that could have an impact in different subfields and even in other disciplines.

Finally, the study makes an important policy contribution to the Chinese context. The supported “brain gain” and “heart drain” in a young cohort signal the need for anticipating future selection of Chinese with higher non-cognitive skills. Policies might aim to provide higher returns to non-cognitive skills to prevent it. Therefore, as a foreign scholar conducting research in and about China, a substantive contribution with social impact will provide stronger credentials and scholar legitimacy for my future career in Asia.

Study 3

4. An agent-based model of educational expectations adoption and adaptation

4.1. Research question

Educational expectations are a central social-psychological mechanism in the educational attainment process and models of educational decision-making. There is consistent evidence about the effects of students' educational expectations on educational outcomes (Andrew and Hauser 2011; Carolan and Wasserman 2015; Reyes, Marcela; Domina 2017; Rumberger 1995) and the consequences of unmatched, unrealistic and unfulfilled expectations on students' well-being (Cundiff 2017; Hao and Bonstead-Bruns 1998; Reynolds and Baird 2010). Since the Wisconsin Framework, educational expectations are “motor to behavior” (Bozick et al. 2010; Woelfel and Haller 1971). The difference between high and low achievers is explained by young's people plans and sense of future. Several explanations for this effect have been argued, such as effort, motivation, and perceived utilities of higher education (Bozick et al. 2010; Haller 1982; Hoover-Dempsey and Sandler 1997). Bodovski and Farkas (2008) use the concept of self-elimination proposed by Bourdieu and Passeron (1990) to explain the effect of expectation on these outcomes. Expectations are part of the “habitus” and students will adjust their aspirations to the place in the social structure and perceived odds of success. Therefore, these perceived chances are embedded in students' actions leading to higher achievement and attainment (Carolan and Wasserman 2015). To assess the explanatory contribution of peer influence and network structure on students' educational expectations, I conduct computational simulations using agent-based models. Thus, this study aims to understand the macro-level consequences of different mechanisms of educational expectations formation from a social influence perspective.

Although the recent interest on peer effects on educational expectations (e.g. Megan Andrew & Flashman, 2017; Carbonaro & Workman, 2016; Carolan, 2018a), the question of how the structure of social interaction between students affects the formation and adaptation of expectations remains open. Identity-based theories and social learning

theories suggest that adolescents align their expectations with the social environment due to their belongingness and need for affirmation. However, the evidence indicates that students ossify their educational expectations earlier in the socialization (Andrew and Hauser 2011; Johnson and Reynolds 2013). Through computational simulations, I integrate these frameworks and manipulate different conditions to understand how peer interaction could generate adaptation of educational expectations.

This is an important theoretical contribution because traditional models of adoption of educational expectations provide insights into social reproduction. Due to the early adoption of educational expectations, the sense of future seems immovable. The current literature shows a great deal of how social inequalities in education are made, but they say little about how they could be unmade. Using agent-based modeling as a tool to identify logical boundaries of different theoretical developments (Page 2018), this study explores the micro-foundations and structural conditions that could make social change possible. Furthermore, virtual experiments enable me to examine the global pattern of educational expectations when considering social influence and educational segregation.

4.1.1. Adoption and adaptation

The adoption theory proposes that educational expectations are a static mental state, and they persist over time. More fundamentally, this static mental state is structured in early socialization by several forces such as family, networks, and social background (Andrew and Hauser 2011; Haller 1982). Therefore, the agency of students on the formation of educational expectations is limited. Although Bayesian learning theory suggests that students will adapt their expectations based on their performance (Morgan 2005), students update their expectations only due to exceptionally large changes in the grade point average. Andrew and Hauser (2011) found that for every unit increase in grade point average, students will increase their expected education in 0.07 additional years. One year of educational expectation across eighth or 10th grade is equivalent to 0.90 to 0.97 in the following period, which suggests a slight change. The same unrealistic and large increase is suggested by Carolan (2017) with a more recent cohort¹¹.

¹¹ Andrew and Hauser (2011) used a sample from the National Education Longitudinal Study 1988 with three follow-ups until 2000 when students were 26-27 years of age. In contrast, Carolan (2017) used three waves of the High School Longitudinal Study starting in 2009.

Nonetheless, further attempts to explain the adaptation of educational expectations have considered a wider range of resources of information that goes beyond student's past performance. Those environmental forces will also provide newer information for forming and refining educational expectations. Following the terminology in structuration theory, structures are embedded in students' educational expectations in a dynamic process. New structural rules and resources are new information for students, which allows them to update their expectations until later in their schooling.

Another evidence of adaptation through institutional effects is presented by Andrew and Flashman (2017). The authors assessed the effect of school transitions on student's college attendance expectations. Their findings indicate that the transition from middle to high school decreases educational expectations. Independently of this transition, the authors found that a stable peer environment also decreases expectations. The change into an environment that mixes more equally old and new peers will update their expectations upward. Therefore, the authors introduce social influence as a new resource of information for the formation and refining of educational expectations. In another recent study, Carolan (2018b) shown that friends affect educational expectations through their own educational plan. However, possible mechanisms of this effect (e.g. social comparison) remain untested, and the network-based conditions under which peers influence educational expectations have not been explored.

Finally, if certain conditions could make the adaptation of expectation possible, what are the macro-consequences of that process? One of the aims of complexity sciences and computational sociology (Agar 1999; Macy and Willer 2002; Page 2015; Sawyer 2005; Urry 2005) is to understand the global patterns of self-organization that emerge from adaptive response to social influence. Schelling's model (1971) of segregation is a classic model for understanding the emergence of global patterns based on micro-level rules. His simulation shows that agents following basic rules could segregate in communities even with high levels of tolerance, as agents relocate to avoid being a minority in their neighbors. Following studies in cultural differentiation and convergence (e.g. Axelrod 1997; Flache and Macy 2011; Shaw 2015), this study asks whether students tend to become more alike when mechanism of adaptation, social interaction, and social comparison are brought in.

A commonsense idea could indicate that social influence will generate cultural homogenization, as culture defines as features susceptible to social influence (Axelrod 1997; Centola et al. 2007; Flache and Macy 2011). However, classical works in cultural dynamics

have shown that local convergence could generate global polarization (Axelrod 1997) in a phenomenon called “mimetic divergence” (Macy and Willer 2002; Shaw 2015). Instead of convergence toward a single educational expectation, a certain degree of heterogeneity might be sustained due to a propensity to sync up with agents around. To explain the persistence of this divergence, Axelrod (1997) relies on a selection mechanism that is considering in this model. Similar individuals are more likely to influence each other than dissimilar individuals. To operationalize selection, models of cultural dynamics weight the effect of links by the number of shared features (e.g. Axelrod 1997; Centola et al. 2007), such as taste, language, or music preference. This selection maintains heterogeneity despite the propensity to cultural convergence by social influence, even in the presence of cultural drift (Centola et al. 2007).

4.1.2. Expectations and social comparison

Through comparison, peers’ performance is also a source of information. Social comparison theories have long argued that comparison is a fundamental human condition (Jasso 1990). According to Levine (1983), students compare themselves with their peers in several stages. First, and after comparison is elicited, students choose their target of comparison. Since individuals compare with similar others (Festinger 1954), peers are key comparison targets. Second, students use the performance of their peers as a gauge to assess their own performance (superior, equal, inferior). Finally, students react interpersonally and intrapersonally. Thus, educational expectations might be affected by changes in peers’ performance to which students have ties. Although school, grade or class peers are also resources of information, I consider peers of the network based on the well-documented local dominance effect (Gerber, Wheeler, and Suls 2018; Zell and Alicke 2010), which suggests the preeminence of closer targets in social comparison processes when multiple resources are available, and subjects are aware of it.

Nevertheless, one of the most important refinements of social comparison theory is the asymmetric comparison (Shelley and Marci 1989; Wills 1981). Comparison with a better-off or worse-off group could either affect negatively or positively individuals’ self-image. The potential negative effect of social influence is often omitted in computational sociology (Macy and Willer 2002). Studies have shown that students attending schools with higher average achievement have lower academic self-evaluation, motivation, grades, achievement-

oriented behavior, and expectations than comparable students in schools with lower average achievement (e.g. Göllner et al. 2018; Marsh 1987; Marsh and Hau 2003; Thijs, Verkuyten, and Helmond 2010). Students in a low-ability environment are more likely to be the “big fish in the little pond”, which affects their self-image positively, increasing educational expectations. In contrast, contagion theories indicate that studying in school with high-performer peers promotes the adoption of achievement-oriented norms and fosters high academic expectations for all (Hanushek et al. 2003; Roth 2017b; Zimmer and Toma 2000). Students might benefit from attending schools with advantaged classmates (Coleman 1966). The opposite could be found when low-achievers study in low-ability environments. Therefore, modeling social influence mechanisms might consider the macro-level outcomes of these two conflicting hypotheses.¹²

However, recent studies recognize that not all peers exert the same influence under different network structures (e.g. Faris and Felmlee 2014; Frank et al. 2008; Haynie 2001; South, Haynie, and Bose 2007). By ignoring structure, previous studies have not provided a full account of networks as moderators of peer influence on the formation of educational expectations. The average expectation of classmates or close friends is not sufficient information to assess the dynamics of peer influence. Based on social influence theories, two network characteristics are considered:

Density: According to differential association and social control theories, peer behavior in dense networks exerts a stronger influence than in cases of a less dense network (Haynie 2001; West et al. 1999). It facilitates coordinated supervision and the formation of common identities between members. Therefore, the influence of peer’s performance on students’ educational expectations might be stronger in more cohesive networks. Density is defined as the extent in which ties that could possibly exist among peers do in fact exist (Mitchell 1969). In educational settings, and based on the direct observation of networks, studies have shown that more connected cohorts within schools are positively associated with educational attainment and adult wages (Babcock 2008; Galeotti and Mueller 2005). Thus, a social network framework indicates that the connectivity of actors will increase the predictive power of social influence, and individuals are more likely to use their network as a reference group (Bienenstock, Bonacich, and Oliver 1990). In addition, as shown by

¹² With these hypotheses, I seek to make a link with my recent publication in the Journal of Happiness Studies (Olivos, Olivos-Jara, and Browne 2020). It is my first corresponding author in a Q1 SSCI paper. Although certain methodological limitations, in that article, I estimated the effect of downward and upward social comparison on life satisfaction. At the theoretical level, I can develop a narrative through my publications.

Buskens, Corten, and Weesie (2008), a higher degree of density will lead to more homogenous networks

Clustering: In most real-world networks, ties tend to be clustered in closely-knit local networks (Davis 1970; Friedkin 1984), and it could co-exist with high levels of density (Watts and Strogatz 1998). These local clusters have been shown constraining how fast and widely social objects spread throughout social networks (Centola and Macy 2007; Flache and Macy 2011; Grow, Flache, and Wittek 2017). Social network theory predicts that local clusters of relations will generate homogeneity within groups due to social reinforcement of adoption (Centola 2010; Grow et al. 2017; Moody 2001). The high local density facilitates the diffusion of information and creates common beliefs among individuals. Regarding behavioral change, Centola's experiments (2010) show that 54 percent of individuals in clustered networks adopt the behaviors, while 38 percent do it in random networks. The rate of diffusion is also four times faster in clustered networks. Thus, when simulating peer influence processes, and defining initial educational expectations as random, students will adapt their expectations in a higher proportion and more rapidly in clustered networks than in less clustered networks and, thus, tend to homogeneity within the local cluster. Initial conditions are defined as random to avoid conflicting processes of social selection and social influence.

4.1.3. Educational segregation

Studies in interpersonal influence cast doubt on whether peers affect educational expectations in highly stratified educational systems (Buchmann and Dalton 2002; Buchmann and Park 2009; Roth 2017a). The influence of significant others, such as peers, should be attenuated in educational systems in which students are tracked into different types of secondary schools.

Students in undifferentiated educational systems are open to receive the influence of their peers. In these systems, schools do little in constraining educational expectations. In contrast, in systems where students are tracked in different trajectories, schools provide strong signals about students' abilities. Karlson (2015) argued that one of those signals is educational tracking. Students will have good reasons for updating their expectations conditional on their track placement, even if the effect of ability-grouping on grades and educational attainment is controversial (Bygren 2016; Shavit 1990). Using the same data as Andrew and Hauser (2011), Karlson (2015) estimated the effect of ability track in the

transition from 8th grade to 10th grade by means of a difference-in-difference method. In their transition, students could move to a high-ability, low-ability track or mixed. The findings indicate that, on average, students who moved from a low-ability track to a high ability track increased their educational expectations in one year of schooling. In contrast, moving from a high ability track to a low ability track does not affect expectations. As expected, in-variant tracks imply in-variant expectations as well. This effect is interpreted by the author as an institutional signaling effect. Move from a low ability track to a high ability track is a signal of being a good student, and it encourages them to go further in their educational attainment.

Overall, I specifically evaluate five research questions:

- 1) Do students update their educational expectations to peer influence considering different adaptations rates?
- 2) What are the macro-level consequences of downward and upward social comparison?
- 3) How does the adaptation vary when considering different levels of density and clustering of peer networks?
- 4) How does tracking affect the adaptation of expectations to peer influence?
- 5) What are the characteristics of the emergent structure?

4.2. Scientific contribution

This article moves forward the literature on educational expectations. It combines different theories in a single computational simulation. First, it contrasts seminal studies stating Bayesian learning and status attainment predictions (Andrew and Hauser 2011; Morgan 2005). Second, educational outcomes of educational segregation (Buchmann and Dalton 2002; Buchmann and Park 2009; Karlson 2015). And social influence in a social networks framework (Babcock 2008; Centola and Macy 2007; Flache and Macy 2011; Galeotti and Mueller 2005; Grow et al. 2017). This combination of frameworks and building of a complex system is what characterizes the fertility of complexity science (Page 2018).

In addition, it is the first study adoption a complexity approach to understand the mechanisms enabling the adaptation of educational expectations. Traditional approaches, such as structuration or habitus theory (Bourdieu 1979; Bourdieu and Passeron 1990;

Giddens 1984), tend to emphasize social reproduction. In contrast, using complexity science, I model the conditions that make social change possible (Morrison 2005; Page 2015). I test different mechanisms that could enable the adaptation of educational expectations. Thus, this study provides a theoretical-driven discussion and computational simulation of how micro-level interactions and structural conditions could be combined to generate changes in students' educational expectations.

4.3. Preliminary simulations

I use agent-based modeling (ABM) to produce a parsimonious and empirically grounded model of educational expectations. Instead of interaction among variables, in this computer simulation, individual adaptive “agents” interact and lead to the emergence of global patterns (Macy and Willer 2002). In this study, students are agents that behave following a certain set of rules and interact locally with each other's. The proportion of students who adapt their educational expectations is understood as the global pattern and it emerges without top-down planning. ABMs enable to conduct experimental manipulations of structural factors and micro-level rules to test different educational expectations theories. In social science, it has been used to model diverse phenomena such as neighborhood segregation (Schelling 1971), dissemination of culture (Axelrod 1997), and state formation (Cederman 2003). Netlogo (Wilensky 1999) is the agent-based modeling software to perform the computational simulation.

A basic recommendation in computational simulations is starting (Macy and Willer 2002; Wilensky and Rand 2015) basic and incorporating complexity in a step-wise process. The following steps of complexity will be included:

1. *Basic model*: All the students update their educational expectations considering their new grades randomly drawn and following different adaptations rates.
2. *Path-dependence model*: Grades are not at random; they will depend on the grade obtained in the previous round. Different weights are considered.
3. *Social influence*: Students interact locally with a random subset of classmates and compare their performance. Negative or Positive effects of social comparison are allowed.
4. *Homophily*: Peer effect is weighted by the degree of student-peers similarity.

5. *Social structure*: Network characteristics are manipulated.
6. *Educational segregation*: Students are divided in different tracks considering their grades.

At this stage, I describe a preliminary simulation that will be developed and perfected in the following academic year.

Figure 1. Computational simulation

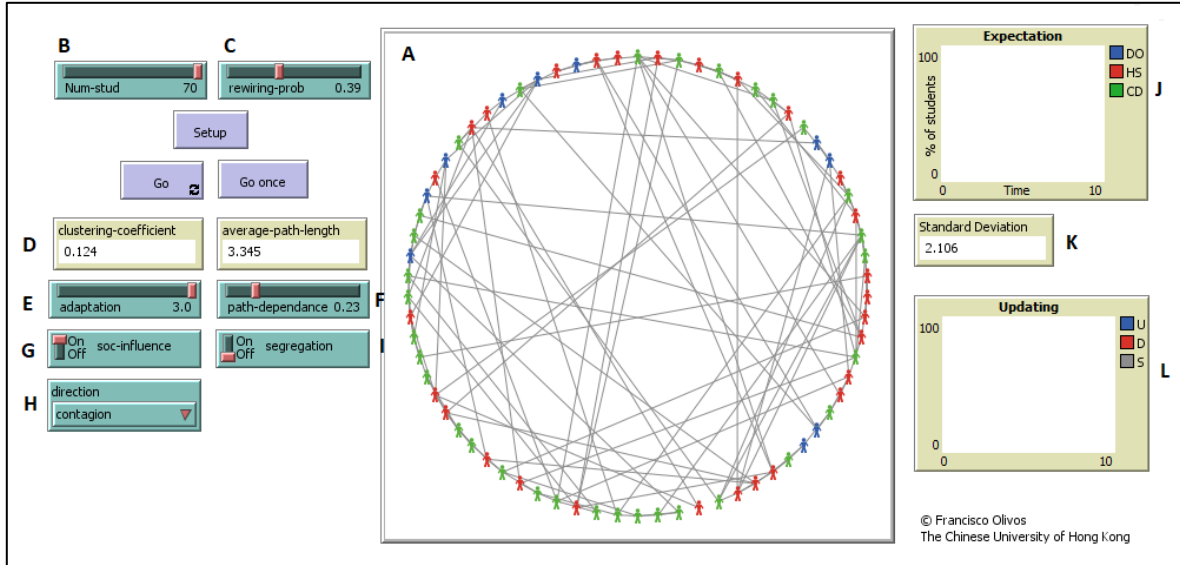


Figure 1 shows the visualization of the computational simulation available in the repository [LINK]. The frame A shows the students of the classroom and their relationships. I initialize each student with a random grade from 0 to 3, and a random educational expectation from 0 to 6. Blue represents those students who expect to study less than one additional year and, therefore, drop out (DO). Red indicates the expectation of completing 1 to 3 years more. They will present those students who expect to finish high school (HS). Finally, students who expect to complete 6 or less years, but more than 3, are assigned to the green color. These students represent those who access or complete college (CD). Further extension of the models could modify the grading scale using percentiles or the range of expected years of schooling.

Slider B enables to modify the class size from 10 to 70. It will provide the robustness of the estimations given different population size. Since, we expect to manipulate network characteristics, slider C defines different parameters of our network that are reported in

monitors D when the system is initialized. In this preliminary simulation, I use the algorithm of small-world networks (Watts and Strogatz 1998). At the beginning, each student is connected to their adjacent neighbors. The rewiring probability is the chance that a tie rewires. It means that one of the ends of the tie change to another peer. Slider E indicates the adaptation rate (α). Agents will adapt their educational expectations each round based on this parameter. At the stage, we use the same adaptation rate to the Bayesian updating based on past performance as well as the comparison with peers. The adaptation rate varies from 0 to 3.

Slider F sets the parameter of the grades path dependence (ω). When $\omega > 0$, students' performance follows a path-dependent process. It produces grades as outcomes at discrete time intervals, $t = 1, 2, \dots$. The grade at time t is denote by x_t . In a more general model, there might be other events or opportunities that take place in period t defined as environment at time t . Due to our focus on the adaptative process, the history consists of past outcomes. Therefore, the history at time T , h_t is the combination of all outcomes x_t up through time $T - 1$. Thus, outcome function G defines the dynamic process the incorporate the historical performance into the next outcome:

$$x_{t+1} = G_t(h_t) * \omega + \varepsilon * (1 - \omega) \quad (1)$$

G_t generates a probabilistic distribution over the outcome. It indicates a shift on the probabilities of obtaining certain grade as a function of the past performance. ω indicates the weight of the history in the outcome, and ε is a random component of the outcome with weight $1 - \omega$. When the slider is set to zero, the process is completely independent.

Dial G activate social small-world network in the class. When it is active, agents adapt their expectations considering the grades obtained by their neighbors following the same adaptation rate than Bayesian updating. Dial H select two possible mechanism of social comparison. In Figure 3, I have selected contagion. However, the option of the BFLP is also available. It will indicate whether better-off and worse-off peers will have a negative or positive effect.

$$Contagion(\Delta_{ij(t+1)}) = \begin{cases} x_j - x_{ij} & x_j > x_{ij} \\ (x_j - x_{ij}) * -1 & x_j < x_{ij} \\ 0 & x_j = x_{ij} \end{cases} \quad (2)$$

$$BFLP(\Delta_{ij(t+1)}) = \begin{cases} (x_j - x_{ij}) * -1 & x_j > x_{ij} \\ x_j - x_{ij} & x_j < x_{ij} \\ 0 & x_j = x_{ij} \end{cases} \quad (3)$$

Δ represent the comparison between grade x of student i , and the average grade in the network j . In the social contagion hypotheses, a better-off network will have a negative effect. While, in BFLP mechanism, the expected effect is the opposite. Therefore, the educational expectation is defined by the following equation:

$$Y_{ij(t+1)} = x_{ij(t+1)} * \alpha + \Delta_{ij(t+1)} * \alpha \quad (4)$$

Where Y indicates the expectation of student i in network j as a function of the path-dependent grades x , and the average grade of neighbors' in the network j . Both resources of information are weighted by a single adaptation rate, α .

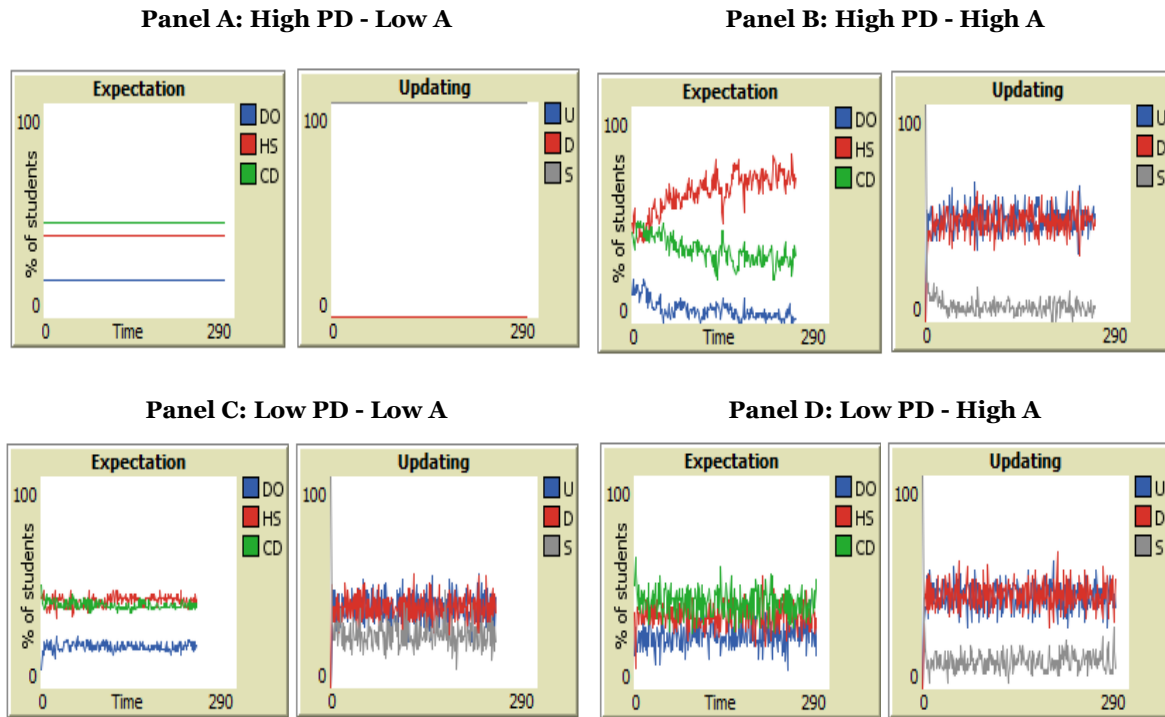
Finally, the Dial I is expected to segregate students by initial educational expectations. When inactive, educational expectations will be randomly assigned. This manipulation will be further programmed.

Three outcomes have been programmed so far that could provide insights of the expected measurements and visualizations: (J) percentage of students who expect to achieve the three educational levels, (K) standard deviation of the expected years of education as measurement of homogeneity, (L) percentage of student who have stable expectations, or update their expectations either upward or downward.

4.4. Preliminary findings

As preliminary findings, I report the visualization of a single simulation for different manipulation of central characteristics and parameters modeled so far. For the definitive ABM model, each condition should be simulation a large number of times to avoid the bias of the random initial conditions.

Figure 2. Educational expectations and changes by conditions without social influence.



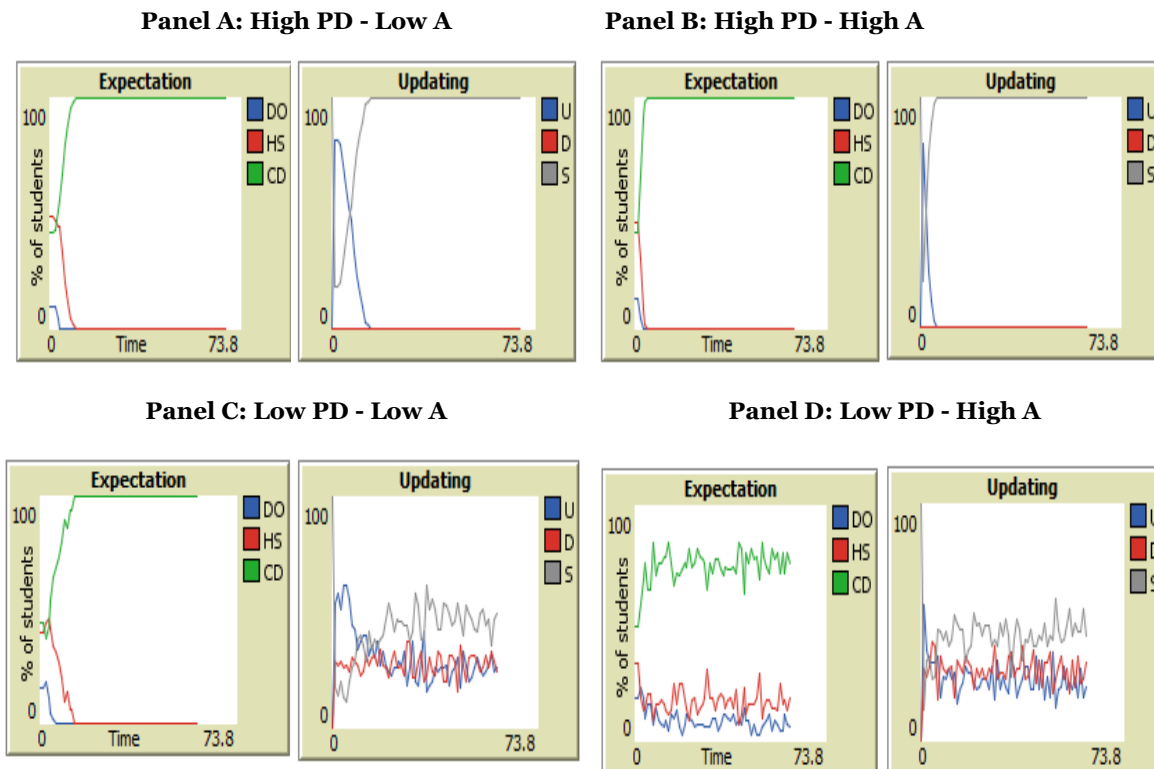
Note: PD = path dependence; A = adaptation; DO = drop out; HS = high school; CD = college degree; U = upward; D = downward; S = stable.

Figure 2 shows the effect of manipulating the two main parameters without the interdependence of the agents. In other words, students only follow rules of path dependence and adaptation of their educational expectations. Panel A represents a simulation where grades are highly dependent on the previous grade, and students adapt their expectations at a low rate. It is similar to what the literature has found for the United States, and the results are straightforward: students do not deviate from the initial conditions. As the grey line in the updating plot indicates, 100 percent of the students have a stable educational expectation.

In Panel B, students are allowed to adapt their expectations at a higher rate. For each additional grade unit, they adapt their expectations in 2 years. Expectations' plot suggests that the proportion of students who expect to drop out decreases, while the proportion of students expecting to finish high school increases. Thus, as the updating plot confirms, the proportion of students who maintain their expectations stable is much lower than the proportion of students who adapt their expectations either upward or downward. Therefore, even when the grade is highly dependent on historical performance, students will update their expectations if their expectations are sensible to that information.

The simulation of low path dependence and low adaptation rate is represented in Panel C. The patterns are similar to those described in Panel A but with higher instability. Although a low adaptation rate is defined, students update their expectations due to the randomness of their grades. However, at the aggregated level, there are not important variations in the proportions of each expected educational level. Panel D visualize the outcomes for low path dependence and high adaptation rate. Once again, there are changes in the educational expectations, as shown by the updating plot, but the proportions of each educational level are relatively stable. Therefore, even in scenarios of a high level of adaptation, the path dependence of grades is necessary to exhibit changes in the aggregated educational expectations.

Figure 3. Educational expectations and changes by conditions with social influence.



Note: PD = path dependence; A = adaptation; DO = drop out; HS = high school; CD = college degree; U = upward; D = downward; S = stable.

The next step of the simulation is to incorporate interdependence between students. Figure 3 reports these results for the four conditions before examined. In this case, I show only the outcomes under the contagion hypothesis. In the BFLP condition, the results are similar, but the proportion of categories drop out and college degree inverted. When

comparing the left-hand plot of each panel, students achieve homogeneity rapidly around the expectations of a college degree. It could be considered an aggregated effect of interdependence. However, only when path dependence is low, and adaptation high, a certain level of heterogeneity is maintained. Table 1 uses the standard deviation of years of educational expectations as a measurement of cultural homogeneity. It answers the question about whether path dependence and adaptation affect cultural dissemination. Clustering (0.144) and average path length (3.304) have been kept constant. In further experiments, they might be manipulated. On the one hand, a single simulation for each condition indicates that higher levels of grade path dependence produce cultural homogeneity in the system. When both path dependence and adaptation are at a higher level, the system rapidly achieves homogeneity. The result is similar to even a higher level of clustering (not reported here). This finding contradicts the common result of cultural heterogeneity in social networks, where the system maintains certain levels of heterogeneity due to the clustering of nodes. On the other hand, when students' grades exhibit a lower dependence on the previous performance, a certain level of heterogeneity arises that increases at higher levels of adaptation. Thus, the exploration of these outcomes will provide important insights into the discussion of the homogenization of educational expectations.

Moreover, updating plots in Panel C and Panel D indicate that under the condition of low path-dependence, students will adapt their educational expectations, independently of their level of adaptation. This finding is highly consequential for evidence-based decision-making. Educational expectations will be updated if grades are less path-dependent. If the educational system is only oriented toward rewarding educational performance, psychosocial motivations will remain stable, and social change will not be possible. Grades based on effort or in more diverse means of evaluation could foster the adaptation of educational expectations.

Table 1. Standard deviation of expected years of education by condition in social influence scenarios.

| Condition | 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 |
|------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| High PD - Low A | 1.798 | 1.411 | 0.935 | 0.501 | 0.298 | 0.275 | 0.227 | 0.143 | 0 |
| High PD - High A | 1.538 | 0.514 | 0.048 | 0 | 0 | 0 | 0 | 0 | 0 |
| Low PD - Low A | 1.894 | 1.796 | 1.338 | 1.015 | 0.763 | 0.552 | 0.374 | 0.265 | 0.224 |
| Low PD - High A | 2.185 | 2.076 | 1.613 | 2.166 | 2.134 | 1.929 | 2.077 | 2.022 | 1.938 |

Note: PD = path dependence; A = Adaptation.

4.5. Career prospect

This paper contributes to my career in three aspects. First, I try to engage with the growing trend in computational social science. It is new frontier in sociology that is expected to lead the discipline in the upcoming years. I have no background in computational science or mathematical sociology, therefore this study becomes my first approach to these tools. It is an important theoretical contribution, based in simple programming. I expect to develop this agenda after my graduation.

Second, this study crystallizes my substantive interests: cultural sociology and sociology of education. Educational expectations as a byproduct of social influence could be understood as culture, since culture is everything that social influence influences in a complexity framework (Axelrod 1997; Corsaro and Eder 1999). In addition, peers' educational expectations can be also understood as cultural resources (Carolan 2018a).

Third, the study has two strength that could make it publishable in a high impact journal. First, the integration of different theories makes it a substantive contribution. I discuss with different research traditions and with papers previously published in influential outlets in sociology, such as *Social Forces*, *Sociology of Education* and *American Sociological Review*. Second, the application of computational sociology to address the mechanism enabling adaptation of educational expectations is an innovative contribution considering the state-of-the-art. Both aspects could be of editors and reviewers' interest in major sociological journals.

5. References

- Agar, Michael. 1999. "Complexity Theory: An Exploration and Overview Based on John Holland's Work." *Field Methods* 11(2):99–120.
- Andrew, Megan and Jennifer Flashman. 2017. "School Transitions, Peer Influence, and Educational Expectation Formation: Girls and Boys." *Social Science Research* 61:218–33.
- Andrew, Megan and R. Hauser. 2011. "Adoption? Adaptation? Evaluating the Formation of Educational Expectations." *Social Forces* 90(2):497–520.
- Axelrod, Robert. 1997. "The Dissemination of Culture." *Journal of Conflict Resolution* 41(2):203–26.
- Babcock, Philip. 2008. "From Ties to Gains? Evidence on Connectedness and Human Capital Acquisition." *Journal of Human Capital* 2(4):379–409.
- Bauman, Zygmunt. 2001. *The Individualized Society*. Cambridge: Polity Press.
- Becerra, David. 2012. "The Impact of Anti-Immigration Policies and Perceived Discrimination in the United States on Migration Intentions among Mexican Adolescents." *International Migration* 50(4):20–32.
- Beck, Ulrich and Elisabeth Beck-Gernsheim. 2002. *Individualization: Institutionalized Individualism and Its Social and Political Consequences*. London: Sage.
- Bienenstock, Elisa Jayne, Phillip Bonacich, and Melvin Oliver. 1990. "The Effect of Network Density and Homogeneity on Attitude Polarization." *Social Networks* 12(2):153–72.
- Bodovski, Katerina and George Farkas. 2008. "'Concerted Cultivation' and Unequal Achievement in Elementary School." *Social Science Research* 37(3):903–19.
- Bohon, Stephanie, Monica Kirkpatrick Johnson, and Bridget Gorman. 2006. "College Aspirations and Expectations among Latino Adolescents in the United States." *Social Problems* 53(2):207–25.
- Borjas, George. 1987. *Self-Selection and the Earnings of Immigrants*. Cambridge, MA.
- Bourdieu, Pierre. 1979. *Distinction : A Social Critique of the Judgement of Taste*. Cambridge, MA: Harvard University Press.
- Bourdieu, Pierre and Jean Claude Passeron. 1990. *Reproduction in Education, Society and Culture*. 2nd ed. London: Sage.
- Bozick, R., K. Alexander, D. Entwisle, S. Dauber, and K. Kerr. 2010. "Framing the Future: Revisiting the Place of Educational Expectations in Status Attainment." *Social Forces* 88(5):2027–52.
- Bucca, Mauricio. 2016. "Merit and Blame in Unequal Societies: Explaining Latin Americans' Beliefs about Wealth and Poverty." *Research in Social Stratification and Mobility* 44:98–112.
- Buchmann, Claudia and Ben Dalton. 2002. "Interpersonal Influences and Educational Aspirations in 12 Countries: The Importance of Institutional Context." *Sociology of*

Education 75(2):99.

- Buchmann, Claudia and Hyunjoon Park. 2009. "Stratification and the Formation of Expectations in Highly Differentiated Educational Systems." *Research in Social Stratification and Mobility* 27(4):245–67.
- Buskens, Vincent, Rense Corten, and Jeroen Weesie. 2008. "Consent or Conflict: Coevolution of Coordination and Networks." *Journal of Peace Research* 45(2):205–22.
- Bygren, Magnus. 2016. "Ability Grouping's Effects on Grades and the Attainment of Higher Education." *Sociology of Education* 89(2):118–36.
- Cairns, David. 2014. "'I Wouldn't Stay Here': Economic Crisis and Youth Mobility in Ireland." *International Migration* 52(3):236–49.
- Carbonaro, William and Joseph Workman. 2016. "Intermediate Peer Contexts and Educational Outcomes: Do the Friends of Students' Friends Matter?" *Social Science Research* 58:184–97.
- Carling, J. 2002. "Migration in the Age of Involuntary Immobility: Theoretical Reflections and Cape Verdean Experiences." *Journal of Ethnic and Migration Studies* 28(1):5–42.
- Carling, Jørgen and Kerilyn Schewel. 2018. "Revisiting Aspiration and Ability in International Migration." *Journal of Ethnic and Migration Studies* 44(6):945–63.
- Carolan, Brian V. 2017. "Assessing the Adaptation of Adolescents' Educational Expectations: Variations by Gender." *Social Psychology of Education* 20(2):237–57.
- Carolan, Brian V. 2018a. "Friends' Plans for College and Adolescents' Educational Expectations: An Instrumental Variable Approach." *International Journal of Adolescence and Youth* 23(3):334–46.
- Carolan, Brian V. 2018b. "Friends' Plans for College and Adolescents' Educational Expectations: An Instrumental Variable Approach." *International Journal of Adolescence and Youth* 23(3):334–46.
- Carolan, Brian V. and Sara J. Wasserman. 2015. "Does Parenting Style Matter? Concerted Cultivation, Educational Expectations, and the Transmission of Educational Advantage." *Sociological Perspectives* 58(2):168–86.
- Castillo, Juan Carlos. 2011. "Legitimacy of Inequality in a Highly Unequal Context: Evidence from the Chilean Case." *Social Justice Research* 24(4):314–40.
- Castillo, Juan Carlos, Francisco Olivos, and Ariel Azar. 2019. "Deserving a Just Pension: A Factorial Survey Approach." *Social Science Quarterly* 100(1):359–78.
- Cebolla-Boado, Héctor and Yasemin Nuhoğlu Soysal. 2018. "Educational Optimism in China: Migrant Selectivity or Migration Experience?" *Journal of Ethnic and Migration Studies* 44(13):2107–26.
- Cederman, Lars Erik. 2003. "Modeling the Size of Wars: From Billiard Balls to Sandpiles." *American Political Science Review* 97(1):135–50.
- Centola, Damon. 2010. "The Spread of Behavior in an Online Social Network Experiment." *Science* 329(5996):1194–97.

- Centola, Damon, Juan Carlos González-Avella, Víctor M. Eguíluz, and Maxi San Miguel. 2007. "Homophily, Cultural Drift, and the Co-Evolution of Cultural Groups." *Journal of Conflict Resolution* 51(6):905–29.
- Centola, Damon and Michael Macy. 2007. "Complex Contagions and the Weakness of Long Ties." *American Journal of Sociology* 113(3):702–34.
- Cerulo, Karen. 2010. "Mining the Intersections of Cognitive Sociology and Neuroscience." *Poetics* 38(2):115–32.
- Chen, Chuansheng and Harold W. Stevenson. 1995. "Motivation and Mathematics Achievement: A Comparative Study of Asian-American, Caucasian-American, and East Asian High School Students." *Child Development* 66(4):1215–34.
- Coleman, James. 1966. *Equality of Educational Opportunity*. Washington.
- Corsaro, William and Donna Eder. 1999. "Children's Peer Cultures." *Annual Review of Sociology* 16:197–220.
- Cundiff, Patrick R. 2017. "Great Expectations Unmet: The Impact of Adolescent Educational Expectations on Deviant Coping During the Transition to Adulthood." *Sociological Inquiry* 87(3):449–71.
- Davis, James A. 1970. "Clustering and Hierarchy in Interpersonal Relations: Testing Two Graph Theoretical Models on 742 Sociomatrices." *American Sociological Review* 35(5):843.
- DiMaggio, Paul. 1993. "Nadeis Paradox Revisited: Relational and Cultural Aspects of Organizational." Pp. 118–42 in *Networks and Organizations*, edited by N. Nohria and R. Eccles. Massachusetts: Harvard Business School Press.
- Dornbusch, Sanford. 1989. "The Sociology of Adolescence." *Annual Review of Sociology* 15:233–59.
- Faris, Robert and Diane Felmlee. 2014. "Casualties of Social Combat: School Networks of Peer Victimization and Their Consequences." *American Sociological Review* 79(2):228–57.
- Feliciano, Cynthia. 2020. "Immigrant Selectivity Effects on Health, Labor Market, and Educational Outcomes." *Annual Review of Sociology* 46(1).
- Festinger, Leon. 1954. "A Theory of Social Comparison Processes." *Human Relations* 7(2):117–40.
- Flache, Andreas and Michael W. Macy. 2011. "Small Worlds and Cultural Polarization." *Journal of Mathematical Sociology* 35(1–3):146–76.
- Frank, Kenneth A., Chandra Muller, Kathryn S. Schiller, Catherine Riegle-Crumb, Anna Strassmann Mueller, Robert Crosnoe, and Jennifer Pearson. 2008. "The Social Dynamics of Mathematics Coursetaking in High School." *American Journal of Sociology* 113(6):1645–96.
- Friedkin, Noah. 1984. "Structural Cohesion and Equivalence Explanations of Social Homogeneity." *Sociological Methods & Research* 12(3):235–61.
- Galeotti, Andrea and Gerrit Mueller. 2005. *Friendship Relations in the School Class and Adult Economic Attainment* . 1682.

- Gerber, J. P., Ladd Wheeler, and Jerry Suls. 2018. "A Social Comparison Theory Meta-Analysis 60+ Years On." *Psychological Bulletin* 144(2):177–97.
- Giddens, Anthony. 1984. *The Constitution of Society - Outline of the Theory of Structuration*. Cambridge: Polity Press.
- Giddens, Anthony. 1991. *Self and Society in the Late Modern Age*. Cambridge: Polity Press.
- Goldberg, Amir and Sarah K. Stein. 2018. "Beyond Social Contagion: Associative Diffusion and the Emergence of Cultural Variation." *American Sociological Review* 83(5):897–932.
- Göllner, Richard, Rodica Ioana Damian, Benjamin Nagengast, Brent W. Roberts, and Ulrich Trautwein. 2018. "It's Not Only Who You Are but Who You Are With: High School Composition and Individuals' Attainment Over the Life Course." *Psychological Science* 29(11):1785–96.
- Grow, André, Andreas Flache, and Rafael P. M. Wittek. 2017. "Global Diversity and Local Consensus in Status Beliefs: The Role of Network Clustering and Resistance to Belief Change." *Sociological Science* 4:611–40.
- Haller, Archibald. 1982. "Reflections on the Social Psychology of Status Attainment." Pp. 3–28 in *Social Structure and Behavior: Essays in Honor of William Hamilton Sewel*, edited by R. M. Hauser, A. O. Haller, and T. S. Hauser. New York: Academic Press.
- Hannum, Emily, Hiroshi Ishida, Hyunjoon Park, and Tony Tam. 2019. "Education in East Asian Societies: Postwar Expansion and the Evolution of Inequality." *Annual Review of Sociology* 45(1):625–47.
- Hanushek, Eric A., John F. Kain, Jacob M. Markman, and Steven G. Rivkin. 2003. "Does Peer Ability Affect Student Achievement?" *Journal of Applied Econometrics* 18(5):527–44.
- Hao, Lingxin and Melissa Bonstead-Bruns. 1998. "Parent-Child Differences in Educational Expectations and the Academic Achievement of Immigrant and Native Students." *Sociology of Education* 71(3):175.
- Hausman, Jerry. 2001. "Mismeasured Variables in Econometric Analysis: Problems from the Right and Problems from the Left." *Journal of Economic Perspectives* 15(4):57–67.
- Haynie, Dana L. 2001. "Delinquent Peers Revisited: Does Network Structure Matter?" *American Journal of Sociology* 10(4):1013–57.
- Heckman, James J., Jora Stixrud, and Sergio Urzua. 2006. "The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior." *Journal of Labor Economics* 24(3):411–82.
- Herrnstein, Richard J. and Charles A. Murray. 1996. *The Bell Curve : Intelligence and Class Structure in American Life*. New York: Simon & Schuster.
- Holder, Mark D. and Ben Coleman. 2009. "The Contribution of Social Relationships to Children's Happiness." *Journal of Happiness Studies* 10(3):329–49.
- Hoover-Dempsey, Kathleen V. and Howard M. Sandler. 1997. "Why Do Parents Become Involved in Their Children's Education?" *Review of Educational Research* 67(1):3–

- Hsin, Amy and Yu Xie. 2014. "Explaining Asian Americans' Academic Advantage over Whites." *Proceedings of the National Academy of Sciences of the United States of America* 111(23):8416–21.
- Huebner, E. Scott. 1991. "Correlates of Life Satisfaction in Children." *School Psychology Quarterly* 6(2):103–11.
- International Organization for Migration. 2020. *World Migration Report 2020*. Geneva, Switzerland : International Organization for Migration.
- Jasso, Guillermina. 1990. "Methods for the Theoretical and Empirical Analysis of Comparison Processes." *Sociological Methodology* 20:369.
- Jensen, Arthur. 1998. *The g Factor : The Science of Mental Ability*. Westport: Praeger.
- Johnson, Monica Kirkpatrick and John R. Reynolds. 2013. "Educational Expectation Trajectories and Attainment in the Transition to Adulthood." *Social Science Research* 42(3):818–35.
- Karlson, Kristian Bernt. 2015. "Expectations on Track? High School Tracking and Adolescent Educational Expectations." *Social Forces* 94(1):115–41.
- Kitazawa, Yoshitsugu. 2012. "Hyperbolic Transformation and Average Elasticity in the Framework of the Fixed Effects Logit Model." *Theoretical Economics Letters* 02(02):192–99.
- Kurlaender, Michal and Jacob Hibel. 2018. "Students' Educational Pathways: Aspirations, Decisions, and Constrained Choices Along the Education Lifecourse." Pp. 361–84 in *Handbook of the Sociology of Education in the 21st Century*, edited by B. Schneider. Cham, Switzerland: Springer.
- Lamont, Michèle. 2019. "From 'Having' to 'Being': Self-worth and the Current Crisis of American Society." *The British Journal of Sociology* 70(3):660–707.
- Lee, Everett S. 1966. "A Theory of Migration." *Demography* 3(1):47–57.
- Lee, Jennifer and Min Zhou. 2015. *The Asian American Achievement Paradox*. New York: Russell Sage Foundation.
- Levine, John M. 1983. "Social Comparison and Education." Pp. 29–55 in *Teacher and student perceptions: Implications for learning*, edited by J. M. Levine and M. C. Wang. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Li, Xiaoming, Liying Zhang, Xiaoyi Fang, Xinguang Chen, Danhua Lin, Ambika Mathur, and Bonita Stanton. 2007. "Stigmatization Experienced by Rural-to-Urban Migrant Workers in China: Findings from a Qualitative Study." *World Health & Population* 9(4):29–43.
- Liang, Zai and Miao David Chunyu. 2013. "Migration within China and from China to the USA: The Effects of Migration Networks, Selectivity, and the Rural Political Economy in Fujian Province." *Population Studies* 67(2):209–23.
- Liu, Airan and Yu Xie. 2016. "Why Do Asian Americans Academically Outperform Whites? - The Cultural Explanation Revisited." *Social Science Research* 58:210–26.
- Liu, Minhui and Francisco Olivos. 2019. "Co-Ethnic Exploitation among Chinese within an

- Ethnic Economy.” *Asian and Pacific Migration Journal* 28(4).
- Lizardo, Omar. 2019. “Culture and Stratification.” Pp. 198–206 in *Routledge Handbook of Cultural Sociology*, edited by L. Grindstaff, M.-C. M. Lo, and J. R. Hall. New York: Routledge.
- Lizardo, Omar, Robert Mowry, Brandon Sepulvado, Dustin S. Stoltz, Marshall A. Taylor, Justin Van Ness, and Michael Wood. 2016. “What Are Dual Process Models? Implications for Cultural Analysis in Sociology.” *Sociological Theory* 34(4):287–310.
- Lizardo, Omar and Michael Strand. 2010. “Skills, Toolkits, Contexts and Institutions: Clarifying the Relationship between Different Approaches to Cognition in Cultural Sociology.” *Poetics* 38(2):205–28.
- Macy, Michael W. and Robert Willer. 2002. “From Factors to Actors: Computational Sociology and Agent-Based Modeling.” *Annual Review of Sociology* 28(1):143–66.
- Maldonado, Luis, Francisco Olivos, Juan Castillo, Jorge Atria, and Ariel Azar. 2019. “Risk Exposure, Humanitarianism and Willingness to Pay for Universal Healthcare: A Cross-National Analysis of 28 Countries.” *Social Justice Research* 32(3).
- Marsh, Herbert W. 1987. “The Big-Fish-Little-Pond Effect on Academic Self-Concept.” *Journal of Educational Psychology* 79(3):280–95.
- Marsh, Herbert W. and Kit Tai Hau. 2003. “Big-Fish-Little-Pond Effect on Academic Self-Concept: A Cross-Cultural (26-Country) Test of the Negative Effects of Academically Selective Schools.” *American Psychologist* 58(5):364–76.
- Mata-Codesal, Diana. 2015. “Ways of Staying Put in Ecuador: Social and Embodied Experiences of Mobility–Immobility Interactions.” *Journal of Ethnic and Migration Studies* 41(14):2274–90.
- Mijs, Jonathan. 2016a. “Stratified Failure: Educational Stratification and Students’ Attributions of Their Mathematics Performance in 24 Countries.” *Sociology of Education* 89(2):137–53.
- Mijs, Jonathan. 2016b. “The Unfulfillable Promise of Meritocracy: Three Lessons and Their Implications for Justice in Education.” *Social Justice Research* 29(1):14–34.
- Mijs, Jonathan. 2019. “The Paradox of Inequality: Income Inequality and Belief in Meritocracy Go Hand in Hand.” *Socio-Economic Review* 1–29.
- Mitchell, J. Clyde. 1969. “The Concept and Use of Social Networks.” Pp. 1–50 in *Social Networks in Urban Situations*, edited by J. C. Mitchell. Manchester: Manchester University Press.
- Molina, Mario, Mauricio Bucca, and Michael Macy. 2019. “It’s Not Just How the Game Is Played, It’s Whether You Win or Lose.” *Science Advances* 5(7):eaau1156.
- Moody, James. 2001. “Peer Influence Groups: Identifying Dense Clusters in Large Networks.” *Social Networks* 23(4):261–83.
- Morgan, Stephen L. 1996. “Trends in Black-White Differences in Educational Expectations: 1980–92.” *Sociology of Education* 69(4):308–19.
- Morgan, Stephen L. 2005. *On the Edge of Commitment : Educational Attainment and Race in the United States*. Stanford, California: Stanford University Press.

- Morrison, Keith. 2005. "Structuration Theory, Habitus and Complexity Theory: Elective Affinities or Old Wine in New Bottles?" *British Journal of Sociology of Education* 26(3):311–26.
- Olivos, Francisco, Pablo Olivos-Jara, and Magdalena Browne. 2020. "Asymmetric Social Comparison and Life Satisfaction in Social Networks." *Journal of Happiness Studies*.
- Page, Scott. 2018. *The Model Thinker: What You Need to Know to Make Data Work for You*. New York: Basic Books.
- Page, Scott E. 2015. "What Sociologists Should Know About Complexity." *Annual Review of Sociology* 41(1):21–41.
- Peterson, Richard. 2005. "Problems in Comparative Research: The Example of Omnivorousness." *Poetics* 33(5–6):257–82.
- Peterson, Richard and Albert Stimkus. 1992. "How Musical Tastes Mark Occupational Status Groups." Pp. 152–68 in *Cultivating Differences: Symbolic Boundaries and the Making of Inequality*, edited by M. Lamont and F. Michael. Chicago: University of Chicago Press.
- Polavieja, Javier G., Mariña Fernández-Reino, and María Ramos. 2018. "Are Migrants Selected on Motivational Orientations? Selectivity Patterns amongst International Migrants in Europe." *European Sociological Review* 34(5):570–88.
- Portes, Alejandro and Rubén G. Rumbaut. 1990. *Immigrant America : A Portrait*. Berkeley: University of California Press.
- Renzulli, Linda and Ashley B. Barr. 2017. "Adapting to Family Setbacks: Malleability of Students' and Parents' Educational Expectations." *Social Problems* 64(3):351–72.
- Reyes, Marcela; Domina, Thurston. 2017. "Track Placement and the Motivational Predictors of Math Course Enrollment." *Teachers College Record* 119(12).
- Reynolds, John R. and Chardie L. Baird. 2010. "Is There a Downside to Shooting for the Stars? Unrealized Educational Expectations and Symptoms of Depression." *American Sociological Review* 75(1):151–72.
- Roth, Tobias. 2017a. "Interpersonal Influences on Educational Expectations: New Evidence for Germany." *Research in Social Stratification and Mobility* 48:68–84.
- Roth, Tobias. 2017b. "Interpersonal Influences on Educational Expectations: New Evidence for Germany." *Research in Social Stratification and Mobility* 48:68–84.
- Rumberger, Russell W. 1995. "Dropping Out of Middle School: A Multilevel Analysis of Students and Schools." *American Educational Research Journal* 32(3):583–625.
- Santos Silva, Joao. 2020. "AEXTLOGIT: Stata Module to Compute Average Elasticities for Fixed Effects Logit." *Statistical Software Components*.
- Saunders, Peter. 1995. "Might Britain Be a Meritocracy?" *Sociology* 29(1):23–41.
- Sawyer, R. Keith (Robert Keith). 2005. *Social Emergence : Societies as Complex Systems*. Cambridge: Cambridge University Press.
- Schelling, Thomas C. 1971. "Dynamic Models of Segregation." *The Journal of Mathematical Sociology* 1(2):143–86.

- Shavit, Yossi. 1990. "Segregation, Tracking, and the Educational Attainment of Minorities: Arabs and Oriental Jews in Israel." *American Sociological Review* 55(1):115–26.
- Shaw, Lynette. 2015. "Mechanics and Dynamics of Social Construction: Modeling the Emergence of Culture from Individual Mental Representation." *Poetics* 52:75–90.
- Shelley, Taylor and Lobel Marci. 1989. "Social Comparison Activity under Threat: Downward Evaluation and Upward Contacts." *Psychological Review* 96(4):569–75.
- South, Scott J., Dana L. Haynie, and Sunita Bose. 2007. "Student Mobility and School Dropout." *Social Science Research* 36(1):68–94.
- Swidler, Ann. 1986. "Culture in Action: Symbols and Strategies." *American Sociological Review* 51(2):273.
- Tam, Tony and Hania Fei Wu. 2013. "Noncognitive Traits as Fundamental Causes of Health Inequality." *Chinese Sociological Review* 46(2):32–62.
- Thijs, Jochem, Maykel Verkuyten, and Petra Helmond. 2010. "A Further Examination of the Big-Fish–Little-Pond Effect." *Sociology of Education* 83(4):333–45.
- Tsay, Angela, Michèle Lamont, Andrew Abbott, and Joshua Guetzkow. 2003. "From Character to Intellect: Changing Conceptions of Merit in the Social Sciences and Humanities, 1951–1971." *Poetics* 31(1):23–49.
- Urry, John. 2005. "The Complexity Turn." *Theory, Culture & Society* 22(5):1–14.
- Vaisey, Stephen. 2009. "Motivation and Justification: A Dual-Process Model of Culture in Action." *American Journal of Sociology* 114(6):1675–1715.
- Wang, Bo, Xiaoming Li, Bonita Stanton, and Xiaoyi Fang. 2010. "The Influence of Social Stigma and Discriminatory Experience on Psychological Distress and Quality of Life among Rural-to-Urban Migrants in China." *Social Science and Medicine* 71(1):84–92.
- Watts, Duncan J. and Steven H. Strogatz. 1998. "Collective Dynamics of 'small-World' Networks." *Nature* 393:440–442.
- West, Elizabeth, David N. Barron, Juliet Dowsett, and John N. Newton. 1999. "Hierarchies and Cliques in the Social Networks of Health Care Professionals: Implications for the Design of Dissemination Strategies." *Social Science and Medicine* 48(5):633–46.
- Wilensky, U. 1999. "NetLogo."
- Wilensky, Uri and William Rand. 2015. *An Introduction to Agent-Based Modeling : Modeling Natural, Social, and Engineered Complex Systems with NetLogo*. Cambridge, MA: The MIT Press.
- Wills, Thomas A. 1981. "Downward Comparison Principles in Social Psychology." *Psychological Bulletin* 90(2):245–71.
- Woelfel, Joseph and Archibald O. Haller. 1971. "Significant Others, The Self-Reflexive Act and the Attitude Formation Process." *American Sociological Review* 36(1):74.
- Xian, He and Jeremy Reynolds. 2017. "Bootstraps, Buddies, and Bribes: Perceived Meritocracy in the United States and China." *The Sociological Quarterly* 58(4):622–47.
- Xiao, Hong and Chenyang Li. 2013. "China's Meritocratic Examinations and the Ideal of

- Virtuous Talents.” Pp. 340–62 in *The East Asian Challenge for Democracy: Political Meritocracy in Comparative Perspective*, edited by D. Bell and C. Li. Cambridge University Press.
- Xie, Yu. 2016. “Understanding Inequality in China.” *Chinese Journal of Sociology* 2(3):327–47.
- Xie, Yu and Xiang Zhou. 2014. “Income Inequality in Today’s China.” *Proceedings of the National Academy of Sciences of the United States of America* 111(19):6928–33.
- Young, Michael Dunlop. 1958. *The Rise of the Meritocracy*. New York: Transaction Publishers.
- Zell, Ethan and Mark D. Alicke. 2010. “The Local Dominance Effect in Self-Evaluation: Evidence and Explanations.” *Personality and Social Psychology Review : An Official Journal of the Society for Personality and Social Psychology, Inc* 14(4):368–84.
- Zerubel, Eviatar. 1997. *Social Mindscapes: An Invitation to Cognitive Sociology*. Cambridge, MA: Harvard University Press.
- Zhao, Guochang, Jingjing Ye, Zhengyang Li, and Sen Xue. 2017. “How and Why Do Chinese Urban Students Outperform Their Rural Counterparts?” *China Economic Review* 45:103–23.
- Zhou, Min and Roberto G. Gonzales. 2019. “Divergent Destinies: Children of Immigrants Growing Up in the United States.” *Annual Review of Sociology* 45(1):383–99.
- Zhou, Xiang and Yu Xie. 2019. “Market Transition, Industrialization, and Social Mobility Trends in Postrevolution China.” *American Journal of Sociology* 124(6):1810–47.
- Zimmer, Ron W. and Eugenia F. Toma. 2000. “Peer Effects in Private and Public Schools across Countries.” *Journal of Policy Analysis and Management* 19(1):75–92.