"Does risk aversion increase the willingness to become a teacher in Brazil? An investigation of risk preference and occupation choice among students of teacher training programs"

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Resumo

No Brasil, a maioria dos professores de escolas públicas trabalha dentro de sistemas educacionais que fazem uso de contratos de compensação defasados. Sob tais contratos de trabalho, os salários dos professores dependem essencialmente da experiência e do nível de qualificação. Propostas que objetivam reformar a remuneração, o recrutamento e a retenção de professores há muito tempo consideram o uso de sistemas de remuneração baseados no mérito. Os professores geralmente não apoiam tais propostas. Uma possível explicação para essas objeções é o fato de que mecanismos baseados no desempenho introduzem incerteza. Se professores são relativamente avessos ao risco, como sugere uma vasta literatura sobre este tópico, um mecanismo de compensação baseado em mérito poderia reduzir a atratividade da carreira docente a longo prazo e a satisfação dessa carreira a curto prazo. Este trabalho contribui para a literatura, investigando o papel das preferências de risco e escolha ocupacional entre os alunos de cursos de formação de professores. Os dados foram extraídos de uma pesquisa aplicada a uma amostra representativa de concluintes em cursos de formação docente no Brasil. Os primeiros resultados parecem sugerir que a profissão docente pode atrair indivíduos que possam ser, pelo menos, mais receptivos a modelos alternativos de remuneração. Para abordar a potencial preocupação com a endogeneidade, fez-se uso de modelo de variáveis instrumentais e identificou-se uma correlação negativa entre indivíduos que escolhem a carreira docente e a disposição para assumir riscos. Este resultado aplica-se apenas a medida qualitativa utilizada para mensurar riscos. Até agora, esses resultados devem chamar a atenção para a importância de considerar as preferências dos professores ao projetar novos sistemas de remuneração para professores.
Palavras-chaves: Escolha ocupacional, preferências de risco, remuneração docente, educação

Abstract

In Brazil, most public school teachers work within educational systems that make use of lagged compensation contracts. Under such employment contracts, teachers' salaries depend essentially on their years of experience and level of qualification. Proposals that aim to reform teacher compensation, recruitment and retention have long considered the use of merit-based compensation systems. Teachers have generally not embraced these policies. One possible explanation for their objections is the fact that these mechanisms introduce uncertainty into teachers' income. If teachers are relatively risk averse, as a vast literature on this topic suggests, a merit-based compensation mechanism could potentially reduce the attractiveness of a teaching career over the long term, and the satisfaction of this career in the short term. This paper contributes to the literature by investigating the role of risk preferences and occupational choice among students of teacher training courses. Data were drawn from a survey administered to a representative sample of recent teaching graduates in Brazil. First results seems to suggest that teaching profession may attract individuals that might be, at least, more receptive to alternative compensation models. To address potential concern about endogeneity, we use instrumental variable estimation and find a negative correlation between individuals who choose a teaching career and willingness to take risks. This result applies only to the general risk measure. So far, these results should call attention to the importance of considering teachers' preferences when designing new compensation systems for teachers.
Keywords: Occupational choice, risk preferences, teacher compensation, education

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1. Introduction[2]

In Brazil, most public school teachers work within educational systems that make use of lagged compensation contracts. Under such employment contracts, teachers' salaries depend not on the performance of their students, but essentially on their years of experience and level of qualification. Some authors believe compensating teachers based on the performance of their students would both incentivize teachers to work harder in the short term, and alter the composition of the teaching profession in the long term, attracting better teachers (Lazear, 2003; Biasi, 2018; Dohmen & Falk, 2010; (Goldhaber, Bignell, Farley, Walch, & Cowan, 2016). In line with this literature, a uniform compensation system, such as that which currently operates in Brazil, could be failing to extract maximum effort from teachers and to increase teacher productivity.

However, the use of merit-based compensation systems would introduce uncertainty into teachers' income, given that it would be subject to oscillation over time. Additionally, pay would depend on their students' performance, which means teachers would not perfectly control their incomes. If teachers are relatively risk averse, as a vast literature on this topic suggests (Goldhaber, Bignell, Farley, Walch, & Cowan, 2016); (Bowen, Buck, Deck, Mills, & Shuls, 2015); (Dohmen & Falk, 2010); (Hernani-Limarino, 2005); (Liang, 2000), a merit-based compensation mechanism could potentially reduce the attractiveness of a teaching career over the long term, and the satisfaction of this career in the short term, eventually increasing rates of exit from the teaching profession.

A key question related to this dynamic is how the effects of a merit-based compensation model may vary over teachers who already have years of experience, new entrants into the teaching profession, and individuals who are currently choosing a future career. Recent studies appear to document a preference for less-volatile compensation mechanisms, or at least for mixed models that retain an element of predictability (Goldhaber, Bignell, Farley, Walch, & Cowan, 2016) (Biasi, 2018). It appears that for school districts in the United States that adopted, either totally or partially merit-based compensation models, the results remain unclear. Nonetheless, there does appear to be an observable tendency in relation to new entrants into the teaching profession. If teachers are not in fact more risk averse, teachers' opposition to performance pay system could be less strong than we supposed, especially regarding new entrants.

Flexible compensation systems are still new to a majority of teachers, and in this case, teachers' choices may be affected not only by aversion to income risk, but also by information asymmetries. Teachers may require time to acquire the information necessary to evaluate new compensation models, whatever these may be. In this context, teachers still appear to exhibit relatively high levels of resistance to productivity-based compensation models, perhaps due to their complexity and ambiguity. As a result of the limited information available to them, many teachers may not be totally cognizant of the magnitude of the potential risks and rewards associated with these models (Goldhaber, Bignell, Farley, Walch, & Cowan, 2016).

To our knowledge, there are no studies in the Brazilian literature that specifically analyze the individual risk preferences of a specific occupational group – in Brazil, the relation between risk preferences and career choice has traditionally been examined in the context of wage differentials between public and private sector workers. In general, studies of this topic have demonstrated that public sector workers in Brazil are more risk averse than their private sector counterparts when considering total lifetime earnings, including bonuses and pension benefits along with basic pay

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(Barbosa, Barbosa-Filho, & Lima, 2013); (Becker & Kassouf, 2012); (Barbosa-Filho, Pessôa, & Afonso, 2009).

From a methodological point of view, the primary difficulty in analyzing heterogeneity in individual risk preferences lies in the fact that these preferences are not directly measurable. Most of the economic literature assumes not only that risk preferences are stable over time, but that they are homogenous across individuals. A growing, albeit exclusively international literature has made important progress in developing empirical measurement of individual risk preferences (Beauchamp, Cesarini, & Johannesson, 2017); (Dohmen, et al., 2011); (Dohmen, et al., 2005).

Further methodological limitations apply when considering the labor market for teachers. First, there is a lack of information gathered on risk preferences in standard questionnaires administered in Brazil. Second, of the data that do exist about teachers, most encompass information on teachers who have already entered the profession. Yet these experienced teachers' preferences may already have been shaped or influenced by their own experiences or by the opinions of their colleagues, and may not represent their original individual preferences (Perez, 2011). Collectively, these challenges make it difficult to foresee how teachers' preferences should be incorporated into the design of new incentives to attract future teaching professionals and retain those who are already involved in the profession.

In this article, we analyze the responses of undergraduate students in teacher training courses on how to identify themselves in relation to their risk behavior from open questions. Open questions were used, following the approach of Dohmen et al. (2011, 2005), whose objective was to compare the judgment of individuals on open questions versus questions traditionally used in the literature that measures risk preferences such as coefficients of risk aversion, measures based on hypothetical lotteries, or measures of variance in wages in different segments of the labor market. The hypothesis underlying these models is that riskier occupations may offer higher pay in order to incentivize workers to participate. By correlating results with specific occupations, within which the literature has traditionally assumed that risk preferences are homogenous, we hope to find a measure capable of reflecting specific individual traits and behaviors (Bowen et al., 2015).

The data used in our analyses come from a survey administered to a representative sample of nearly 2,000 undergraduate teaching majors, distributed over Brazil's five regions in 2015. By focusing on undergraduate students preparing to enter the teaching profession, it is possible to incorporate the problem of self-selection into low-risk careers, while eliminating any interference that experience may have on behavior. The participants of the research were also analyzed in relation to their possibilities of entering the teaching career and their preferences for different remuneration systems that involve different degrees of risk. The survey sought to directly measure the risk preferences of individuals at the moment they are confirming their occupational choice, and to relate these preferences to characteristics of the teaching profession, including income risk, job security, and chances of upward mobility within teaching careers. One of the fundamental takeaways regarding risk preferences is that context matters (Fouarge, Kriechel, & Dohmen, 2014). Thus, we use a context-specific measure of risk that allow us to correlate the influence of local contexts on risk behaviors.

Descriptive statistics demonstrate that individuals who choose a teaching career seems to be not more risk averse than other students, contrary to what theory has tended to predict. Being older, having parents with at least a high school education increase willingness to take risks. However, these results were unstable among the four measures of risk preferences, including two versions of general risk measure that we apply. It is possible that observable characteristics incorporate some aspects of individual risk preferences. Other potential explanations are discussed in the text. These results seems to suggest that teaching profession may attract individuals that might be, at least, more receptive to alternative compensation models, and should call attention to the importance of considering teachers'

preferences when designing new compensation systems for teachers. To address potential concern about endogeneity, we exploited information of having children and living with them during undergraduate courses. Using instrumental variable estimation, we find a negative correlation between individuals who choose a teaching career and willingness to take risks. This result applies only to the general risk measure on 11 points scale.

2. Risk Measures

To measure risk preferences, four variables were constructed based on survey questions that sought to capture how respondents would behave in hypothetical situations involving risk. We define these variables as general risk, risk context, contract risk, and financial risk. Risk attitudes are measured on a discrete scale, where higher values represent a greater inclination to take risks in different contexts. The measures were constructed based on (Dohmen, et al. 2005); (Dohmen, et al., 2011); (Bowen, et al. 2015). Table 1 presents a summary of the four risk measures and their format in the econometric models.

Table 1: Description of Dependent Variables

Dependent Variable	Question to Generate Measure	Functional Form
1. General Risk	How do you see yourself? Are you a person who is inclined to take risks, or do you avoid risks?	
Continuous		Continuous response scale from 0 to 10
General		Binary 1 = Risk-neutral or loving (responses ≥5) 0 = Risk averse (responses <5)
2. Risk Context (risk in the labor market–employability)	Choose to live in City 1 (low employment rate and relatively low salaries) or City 2 (high employment rate but higher salaries).	Binary 1 = Risk-neutral or loving (choose City 2, the riskier option); 0 = Risk averse (choose City 1, the less-risky option)
3. Contract Risk (risk in the labor market – different payment models)	Indicate preferences among different types of pay systems (using a satisfaction scale, with higher values representing greater satisfaction).	Binary 1 = Risk-neutral or loving (responses ≥5 for variable compensation based on individual and team performance) 0 = Risk averse (responses <5)
4. Financial Risk (hypothetical investment)	Suppose you won R$100,000 in the lottery. Immediately after receiving your prize, you receive an investment offer from a bank (of good reputation) with the following conditions: 1. It is possible to double the value of your investment in one year 2. It is equally possible to lose half of the value invested. Respondents should choose what fraction of the R$100,000 they should invest from a set of six possible options.	Scale constructed from six possible responses: 0 = don't invest; 1 = invest R$20,000; 2 = invest R$40,000; 3 = invest R$60,000; 4 = invest R$80,000; 5 = invest R$100,000; The larger the number, the lower the risk aversion

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Various studies have made use of general self-reported risk aversion measures, demonstrating the ability of these measures to predict individual risk-related behaviors (Dohmen, et al., 2005); (Fouarge, Kriechel, & Dohmen, 2014); (Dohmen & Falk, 2010). In the measures related to labor market risk, respondents are left free to imagine the risks involved in each choice.

Most of our analysis focuses on the general risk measure. It is possible to observe that it is a qualitative measure that does not involve any explicit lottery. Instead, consider the assessment of individual risk-taking in general, which may incorporate various types of lottery-based risk elicitation tools – including those that do not involve monetary rewards – that could be addressed in decision-making processes.

The approach follows that proposed by Dohmen et al. (2011, 2005). For the authors, as there are no specific stakes or probability in this general measure, there may be potential factors besides risk preferences that lead to a variation in individual responses. Specifically subjective beliefs about the degree of risk in the decision environment could affect the stated willingness to take risks. For this reason, it is important to evaluate if the general generic variable is able to explain the risk behavior in our model, compared to other measures that involve explicit risks. A positive result from the validation exercise would confirm that the measure does not only reflect subjective beliefs. The validation exercise is presented in section four.

Risk context was a measure coded as one for respondents who would prefer to live in a city with high unemployment and high average wages and zero for respondents who would choose a city with both low indicators, average wages and unemployment rate.

In the third measure respondents should choose their preferences from four different pay systems, two non-competitive (based on experience and qualifications) and two competitive ones (based on individual performance and team performance). Like general risk measure described above, this was constructed considering the discrete scale of grades from zero to ten, with higher values indicating a greater risk propensity. Given that interest here falls on the implications of individual heterogeneity in incentive contracts, regression models were considered only responses to pay systems based on performance, either individual or team.

The last measurement included in the survey is a hypothetical lottery. This measurement shares a common characteristic with other lottery measures in that it presents respondents with risks and probabilities for each decision, thus holding risk stable across individuals. As argued by Dohmen et al. (2005; 2011), this method allows responses to be more clearly attributed to risk preferences by holding subjective beliefs constant.

3. Data

The sample consisted of approximately 2,000 individuals distributed over 35 Brazilian municipalities that are representative of Brazil's five regions. In total, 66 higher education institutions (51% public and 49% private) were visited between June and December, 2015. Survey participants were approached by enumerators within these institutions' teaching departments. The universe of

participants was considered students enrolled in education courses[3] and teaching licensure programs[4], who planned to graduate within eighteen months of the interview. These individuals are referred to in the survey as "graduates."[5] Of the 2,000 face-to-face interviews conducted, 1,994 were completed successfully and were valid for analysis.[6] Surveyed individuals were drawn from the following majors: education, and seven teaching licensure programs: biology, physics, geography, history, literature, mathematics, and chemistry.

The survey collected information on individuals' educational background and demographic and socioeconomic characteristics, as well as information on professional plans, choice of college major and undergraduate educational trajectory. The key survey questioned focused on whether or not they intended to work as a basic education teacher upon graduation, and what their motivations were for this choice, including social influences, their perceptions of their own teaching abilities, the personal and social attractiveness of the teaching profession, job demands, social status, and financial considerations. Based on this survey, we construct two comparison groups that are relatively homogenous within themselves: individuals who choose to become **basic education teachers** upon graduating (57.1%), and individuals who affirm that they will not continue with a teaching career or are unsure of their plans (Table 2).

Table 2: Proportion of undergraduate students among possibilities of occupational choice[7]

Occupational Choices	Quantity	Participation in the total (%)
Act as teacher of Basic Education in the public sector	965	48.4%
Act as teacher of Basic Education in the private sector	173	8.7%
Act as a teacher in preparatory college courses	49	2.5%
Act as a teacher of Higher Education	389	19.5%
Acting in the area of Education, but not as a teacher	200	10.0%
Do not work in the area of Education	112	5.6%
Do not know	106	5.3%
Total	**1,994**	100.0%

Constructed by authors based on survey data described in text.

By focusing on undergraduate students who are preparing to enter the professional career, whether teaching or not, it is possible to focus on the issue of self-selection in potentially low-risk careers, while eliminating the interference that experience may have on behavior individual. Considering that the results estimated in the following sections depend on the construction of the comparison groups, it would be expected that there would be no significant difference between students wishing to be teachers of basic education and those who answered negatively or had doubts about becoming a teacher.

The results presented in Table A in the Appendix do not corroborate this differentiation. Individuals who intend to pursue a teaching career differ in terms of average for most of the

[3] Education courses trains teacher for preschool and the first years of elementary education.

[4] Teacher training courses in Brazil are called *licenciaturas*, translated here to licensure. They are four-year undergraduate courses encompassing various fields that lead to the teacher profession. Teachers with licensure have pedagogical training during those years.

[5] The sampling plan followed the Proportional Probability to Population Size method, considering the total number of graduates reported in the School Census (Censo Escolar) of 2011. Based on this framework, we proceeded by selecting states, municipalities within each state, and education institutions within each municipality with respect to proportionality over each of the three specialty areas mentioned.

[6] The survey was conducted by a company that offered multiple trained survey teams over Brazil's five regions. The survey took an average of 20 minutes to complete.

[7] Students should choose only the first preference among the alternatives presented.

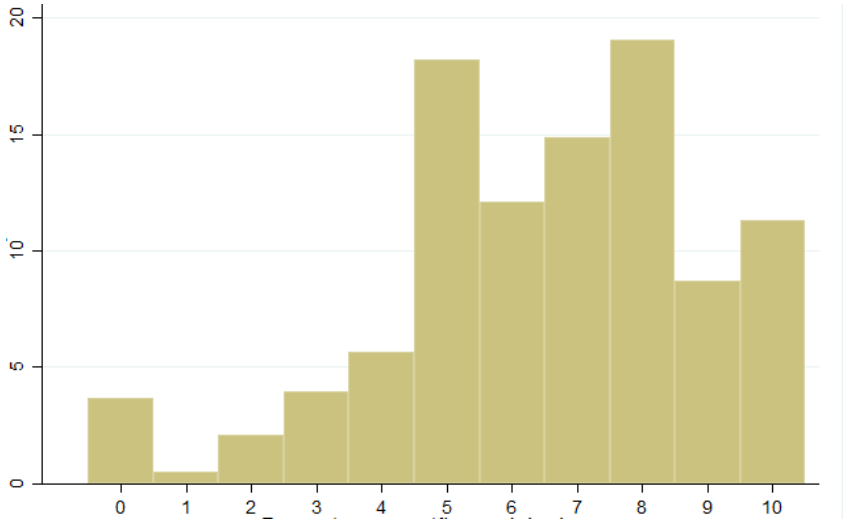
observable characteristics, statistically significant at 1%, when compared to those who do not or are unsure. This difference was found for the majority of controls: gender, age, parental schooling, previous work as teacher, except: color and socioeconomic level. Among the institutional characteristics, most of them presented differences: those who intend to pursue a teaching career study mainly in private institutions, in pedagogy courses and have attended high school in public schools. Regarding risk measures, the differences are not maintained: future teachers and non-teachers do not differ in terms of preferences regarding risk, regardless of the measure used.

Therefore, it is observed that, in general, the sample that was used to carry out the estimations of occupational choice underestimates individual characteristics, family background and school situation of the graduates wishing to pursue their career as teachers of basic education, but in terms of preferences in relation to risk, the differences are less relevant.

4. Determinants of Risk Preference Measures

This section presents the distributions of preferences regarding risk in the population of students to be become teachers measured by the general question. Figure 1 describes the distribution of risk preferences in our sample. Each bar represents the fraction of respondents who chose a particular point on the 11-point scale. The figure reveals some heterogeneity in risk preferences among the population: mode is 8, demonstrating that there seems to be a higher concentration of data at the higher levels, which may indicate individuals less risk averse. A fraction greater than 10% of the respondents chose the value 10, indicating that they are fully willing to take risks, while about 4% of all individuals chose 0, indicating that they would be totally at odds in taking risks. Nevertheless, it was observed that preferences regarding risk vary throughout the scale.

Figure 1: Willingness to take risks in general: full sample



Constructed by authors based on survey data described in text.

The next step is to assess whether any heterogeneity in preferences over risk is systematic, thus leading to differences in economic decisions between the two comparison groups. That is, to what extent this heterogeneity prevails when analyzing the impact of other observable traits that could affect attitudes toward risk: gender, age, color, wealth, and family background. These characteristics may be considered exogenous to preferences and risk behavior. Dohmen, et al. (2005; 2011) show that, if this were the case, some causal interpretation would be possible for correlations and regression results.

Table 3 summarizes the results. The coefficients presented in columns 1-4 correspond with average marginal effects, which capture effects on the mean graduate, while the results in column 1 are from Ordinary Least Squared (OLS) with heteroscedasticity-robust standard errors. The majority of estimated coefficients are not statistically significant, and this result appears stable across alternative risk measures. Nevertheless, it is important to highlight the impact of a few exogenous and statistically significant characteristics in each of the specifications. The dependent variable represents the individual responses to each of the risk measures described in the previous section.

Age appears to be positively correlated with disposition to take risks (statistically significant at the 5% level in columns 1 and 5). Older graduates would also be more satisfied with payment models based on either individual or team performance. The table also shows that whites are relatively more risk averse than black or brown individuals. These results are robust to changes in the formulation of the outcome variable and are negative and significant only in the general risk measure (columns 1 and 2). One possible explanation for this association may be self-selection of white individuals at the moment of choosing a course of university study. Less risk averse white students may self-select into riskier occupations, as characterized by greater variability in incomes. In this sense, those white students that become teachers would be disproportionately risk averse.

Furthermore, not only is access to higher education unequal between whites and blacks in Brazil; relative career opportunities are unequal as well. Relatively more black students are required to balance their time between pursuing their undergraduate degrees and participating in the labor market, and are more likely to pursue night courses or distance-learning, leading to lower participation in courses of study that require full-time participation or whose cost is high (e.g. medicine or engineering). For those black students that not only managed to make it to university, but who are within sight of graduating, the disposition to take risks is likely an important part of the characteristics that enabled them to get there.

The relation between our indicator of wealth per capita and measures of risk is substantially less consistent. Within theories of uncertainty, an important question regards whether risk aversion should increase or decrease with individual or family wealth (Nicholson & Christopher, 2008); (Weiss, 1972). Intuitively, one may argue that as family wealth increases, the disposition to take risks will increase as well, given that potential losses are less relevant. This would make wealth endogenous in our model. This is indeed the result identified, though only in the lottery risk measure (column 3) and only at the 10% level of significance.

The coefficients for parents' education are less robust. Father's education is statistically significant at the 5% level in the specification that analyzes determinants of preference for merit-based contracts. Evidently, having a more educated father is associated with increased satisfaction with merit-based contracts, while having a more educated mother has the opposite effect. In contrast, mother's education has a positive effect (significant at the 5% level) on general disposition to take risks.

A comparison of the results presented in columns 1-5 shows that the estimated coefficients for each of the observable characteristics in each of the risk measures seem to be – weakly – correlated with the way the risk preferences are measured. Although a causal interpretation is not possible, it does not seem that we can completely rule out the idea that these measures reflect only subjective opinions.

Table 3: Determinants of Risk Preferences in Different Contexts

Dependent	General Risk	Financial	Risk	Contract

Variable	Continuous	Binary	Risk	Context	Risk
	(1)	(2)	(3)	(4)	(5)
Female (=1)	0.264	0.0143	-0.0362	0.0234	-0.00724
	(0.206)	(0.0366)	(0.0574)	(0.0427)	(0.0338)
Age (in years)	0.0272**	0.00312	-0.00498	0.00205	0.00476**
	(0.0125)	(0.00234)	(0.00354)	(0.00256)	(0.00201)
Mother graduated high school	0.324	0.0808**	0.0123	-0.0280	-0.0788*
	(0.239)	(0.0362)	(0.0365)	(0.0406)	(0.0443)
Father graduated high school	-0.259	-0.0624	0.0839*	0.0561	0.0634**
	(0.206)	(0.0424)	(0.0435)	(0.0360)	(0.0292)
White (=1)	-0.519**	-0.103**	0.0620*	0.0557	0.0102
	(0.245)	(0.0454)	(0.0369)	(0.0516)	(0.0285)
Wealth *per capita*	0.137	0.0198	0.0379*	0.0205	0.00413
	(0.0968)	(0.0214)	(0.0207)	(0.0220)	(0.0140)
Constant	5.903***				
	(0.533)				
R-squared	0.051				
Observations	1,711	1,711	1,711	1,711	1,708

Note: All specifications include the complete sample of graduates. Colum 1 present average effects estimated based on a linear probability model (OLS). Columns 2 and 5 present average marginal effects estimated based on a probit model. The variable *High School Graduated* assumes a value of 1 in cases where each parent possesses at least a completed high school education, and assumes a value of 0 otherwise. The measure of wealth *per capita* was constructed based on questions regarding household assets and number of household members. The maximum value observed for this variable was 8. Robust standard errors are presented in parentheses. We estimate all models with standard errors clustered at the educational institutional level. Regional fixed effects are included in all models.
***, **, * indicate significance at the 1%, 5% e 10%, respectively.

The fact that we have a pre-selected sample of individuals who are relatively homogenous over observable characteristics facilitates our analysis of risk preferences by making it possible to separate background socioeconomic characteristics from risk-related behaviors. Furthermore, our focus on a specific occupational category allows us to examine the effects of individual heterogeneity in risk preferences on choices made by young individuals just as they are preparing to enter the labor market.

On the other hand, it is possible that individuals who have chosen teaching-related majors have already self-selected in terms of risk preferences. Fouarge, Kriechel, and Dohmen (2014) argue that self-selection on risk preferences may occur because individuals who are more disposed to risk-taking will be more likely to opt for riskier occupations, and to receive higher compensation as a result. In this sense, the predictive power of our measures of risk preferences may not be sufficiently strong to capture heterogeneity at the individual level.

5. Results: Are Future Teachers More Risk Averse?

One of our aims in this paper was to evaluate individual heterogeneity in students' decisions regarding career choice. To do so, we sought to understand the preferences of young, soon-to-be graduates of teacher licensure and education programs, who may be distinct from individuals who have already worked in the teaching profession for some time. Could it be the case that future teachers have already self-selected by opting for a course of study that is relatively less risky than engineering or medicine, for example? If this were true, these future teachers' preferences would still be less influenced by experience or the visions and opinions of the teaching profession than would the opinions of their future colleagues who have already taught for some time (Perez, 2011) [8].

[8] It is important to note that two in every ten graduates interviewed had already had some sort of teaching experience. One of the survey questions dealt directly with this topic: "Before beginning your current course of study, had you ever

The analyses above were focused on individual heterogeneity in risk preferences and the determinants of these individual differences. In this final section, we adopt a different perspective in order to evaluate whether measures of risk preferences are capable of predicting risk-related economic decisions, specifically the decision of whether or not to become a teacher. The hypothesis underlying this analysis supposes that the measures of risk are valid proxies of real risk preferences and that heterogeneity in these preferences is an important determinant of individual variation in risk-related behaviors among students deciding whether to become basic education teachers.

In order to analyze these questions, we focus on analyzing behavior of the two occupational groups as a function of the risk measures discussed previously. The empirical strategy was developed based on the idea that occupations offer systematically different risk profiles and lifetime earnings curves. To keep things simple and analogous to other studies that analyze occupational choices, we assume that risk is a characteristic that may be separated from the bundle of additional factors that determine individual occupational choice.

Each estimated coefficient is based on a regression of a reported occupational decision (whether or not to become a basic education teacher) on associated measures or risk preference. All regression specifications include an extensive set of control variables, including region, sex, race, wealth, family composition, parents' education, course of study, presence of children, a proxy for individual ability, an indicator of whether the respondent had previously worked as a teacher, and educational background. The outcome variable of interest is the binary variable that assumes a value of one if the respondent reports they will choose to enter the basic education profession as a teacher upon graduation, and assumes a value of zero if the respondent is unsure of their plans or plans to follow a different career path.

The estimated equation for the probit model takes the form:

$$\textbf{Equation 1: } y_i^* = \beta_0 + \beta_1 X_i + \beta_2 R_i + \epsilon_i$$

Where: y_i^* = 1, if the i-th student intend to become a teacher of Basic Education and y_i^* = 0, otherwise. *R* represents each of the risk measures considered separately in the regressions; *i* indexes each of the respondents and *X* contains a set of control variables. Our observations presuppose multiple individuals who study at the same institution of higher education, so we need to cluster our standard errors at the institutional level.

For each result, Table 4 presents average marginal effects based on estimates from a traditional probit model[9]. Columns 1 through 4 and 6 present the relationship between the outcome variable (occupational choice) and each of the measures of risk individually. Columns 5 and 7 estimates occupational choice as a function of all risk measures simultaneously. It is evident from the results that, independently of specification, there does not appear to be a significant association between willingness to take risks and the decision of whether or not to become a teacher. Previous international studies that sought to measure risk preferences have argued that a common problem among studies seeking to analyze occupational choice and risk preferences is that of self-selection (Guiso & Paiella, 2005). The idea behind this critique is that individuals' occupational choice is

worked before? [If necessary, mark more than one option]." The possible responses for a student who had already worked as a teacher before included: as a school teacher, as a private tutor, as a teaching assistant, or as a teacher in some other institution (college prep courses, nonprofits, companies, churches, social movements, etc.). As a robustness check, we opted to re-estimate all specifications in Table 4 including a variable to take into account whether the respondent had had some previous contact with the teaching profession. Results are similar in sign and significance when we include this measure of occupational choice.

[9] Coefficients were estimated for marginal effects at the mean and average marginal effects, which should yield similar results to those from a linear ordinary least squares model (Cameron & Trivedi, 2010). We present results only for the marginal effects at the mean, which take into account the behavior of the mean individual.

endogenous, since individuals who are more risk averse self-select into "safer" occupations with lower variability in pay (King, 1974) or less risky conditions (Bonin et al., 2007), which may include the teaching profession (Bowen, Buck, Deck, Mills, & Shuls, 2015). We specifically address to this problem in next section.

Table 4: Individual risk attitude and occupational sorting: Probit (Marginal Effects at Means –MEM) and OLS Models

Dependent Variable: Occupational choice of undergraduates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
General Risk – Binary Variable	-0.00513				-0.0102		
	(0.0362)				(0.0330)		
Financial Risk		0.0597			0.0574		0.0505
		(0.0406)			(0.0397)		(0.0394)
Risk Context			-0.0493		-0.0398		-0.0434
			(0.0404)		(0.0415)		(0.0407)
Contract Risk Performance				-0.0423	-0.0337		-0.0386
				(0.0327)	(0.0321)		(0.0320)
General Risk – Continuous Variable						0.00862	0.00774
						(0.00745)	(0.00685)
Observations	1,677	1,677	1,677	1,674	1,674	1,677	1,674

Note: Standard errors in parentheses. We estimate all models with standard errors clustered at the educational institutional level. Regional fixed effects are included in all models.
***, **, * indicate significance at the 1%, 5% e 10% levels, respectively.
Source: Constructed based on survey data described in text.

Thus, it is necessary to develop measures of risk preference that are consistent with individual behavior and specific to the context of economic choices (Dohmen, et al., 2005). Our study replicated specific measures of risk, and sought to explore individual heterogeneity by considering individuals who are near the point of making an occupational choice and who have previously self-selected into a specific course of study.

In a recent paper, Beauchamp, Cesarini & Johannesson (2017) associate the difficulty in evaluating the effects of individual risk preference heterogeneity on economic decision-making with errors in the construction of risk measurements. The authors estimate proxies for risk preferences that account for individual behavior in diverse risk contexts, including financial risks, alcohol consumption, smoking, or opening a new business. They draw data from a national survey of nearly 25,000 twins born in Sweden between 1926 and 1958. They use their proxies for risk preferences to estimate a model of generalized method of moments (GMM) to measure the role of risk in individual behavior. The authors find that their measures of risk preferences have robust and strongly significant effects, illustrating the importance of constructing meaningful and well-measured proxies for risk preferences.

Beyond the insignificant effects of risk measures on individual occupational choices, other characteristics do appear to be associated with the choice to enter the teaching profession. Estimated coefficients that appear statistically significant in any specification remain so over alternative

specifications. In terms of magnitude, the inclusion of risk measures appears to have little effect on the magnitudes of other estimated coefficients[10].

These results appear to confirm the findings of an extensive literature on teacher labor supply, which has largely focused on understanding which types of individuals feel attracted to the teaching profession. In sum, the profile of future basic education teachers is composed primarily of women, those with children and who are enrolled in academically weaker private education institutions. Many of these individuals come from families with lower levels of education, with parents employed in sectors such as commerce, services, and domestic services. If these characteristics already incorporate some levels of relative risk preferences, it is possible that the teaching profession does indeed attract individuals who are relatively more averse to risk.

6. Taking into account the selection effect

In this section we discuss a potential issue concerning to our analyses around career risk attitude and occupational sorting. Individual decisions can have an effect on risk attitudes. In other words, not only can risk attitudes affect individual decisions, but the opposite is possible as well. To address potential concern about endogeneity, we exploited information of having children and living with then during undergraduate courses. Using this variable as an instrumental variable estimation. The hypothesis behind this argument is that parents might be more risk averse. In our sample, 20% of undergraduate students have children and live with them.

We exploit the effect of having children on occupation sorting in instrumental variable estimations of the following form:

Equation 2:

First stage: $Risk\ Measures_i = \alpha + \beta_1 X_i + Kids_i + \epsilon_i$

Second stage: $y_i^* = \beta_0 + \beta_1 X_i + \beta_2 \widehat{Risk\ Measures}_i + \epsilon_i$

In order for the variable to live with the children to be a good instrument, it could not be correlated with the error term. The second requirement is that risk measures and having children are to some extent correlated. When we tested this correlation, we observed a negative correlation only regarding the generic measure of risk. Not all other risk measures are statistically significance and coefficients signals are now positive, sometimes negative in relation to the risk measures.

Estimates of IV regression are given in Table 5. Results shows that there is a negative relationship between willingness to become a teacher and general risk measure, statistically significant at 1%. This coefficient implies that, with the other fixed factors, those who wish to pursue a teaching career would be, on average, more risk averse than those who do not intend or are not sure about being a teacher of Basic Education. The findings in Table 5 hold once despite several relevant background characteristics. The covariates are reported at Annex C.

[10] The covariates are reported at Annex B.

Table 5: Individual Risk attitude and occupational sorting: IV Model

Dependent Variable: Occupational choice of undergraduates
Instrumental Variable: having children and live with them

VARIABLES	(1)	(2)	(3)	(4)	(5)
General Risk – Binary	-0.517				
	(0.520)				
Financial Risk		16.12			
		(185.1)			
Risk Context			-3.078		
			(8.096)		
Contract Risk: Performance				-2.351	
				(3.729)	
General Risk – Continuous					-0.401***
					(0.0225)
Observations	1,677	1,677	1,677	1,674	1,677

Note: Standard errors in parentheses. We estimate all models with standard errors clustered at the educational institutional level. Regional fixed effects are included in all models.
***, **, * indicate significance at the 1%, 5% e 10% levels, respectively.
Source: Constructed based on survey data described in text.

7. Discussion and Final Considerations

Heterogeneity in risk preferences is a frequently recurring feature of observational data. This paper makes two important contributions. First, it investigates a collection of measurements of risk as applied to a specific occupational group. Second, it investigates whether or not variation in measurement of risk preferences, based on cross-sectional data, may explain self-selection into the teaching profession, where risk preferences are measured in terms of alternative compensation models, job security, financial decisions, and general disposition to take risks. To do so, we surveyed a representative sample of young soon-to-be graduates of education and seven teacher licensure programs who were planning to enter the labor market or had entered only recently. Risk preferences were measured for each surveyed individual, taking into account these diverse scenarios.

Analyses of occupational choice did not demonstrate any effect of risk types or preferences. These findings appear to suggest that behaviors in risk-related activities do not constitute important factors in the determination of future decisions to enter the teaching profession. Further, results did not indicate that future teachers are more risk averse, as the literature has sometimes proposed. At the same time, it is not possible to affirm whether or not graduates were more or less favorable of merit-based compensation systems. It appears that the measurements of risk considered in our survey were not capable of explaining why some individuals choose to pursue teaching careers.

In the following paragraphs, we analyze five possible explanations for the lack of robustness in these results. First, our survey collected cross-sectional data from a sample of individuals who had not yet had substantial experience in the labor market. Studies on this topic have argued that one difficulty in responding accurately about one's risk preferences is that these preferences may only solidify some years after making one's occupational choice. Ideally, we would be able to measure risk preferences repeatedly over time for the same individuals (panel data) or measure preferences in comparison to other occupational groups or to more experienced teachers. These comparisons would assist us in disentangling the extent to which individuals who are attracted to certain aspects of the

teaching profession end up teaching, while other individuals who do not value these characteristics eventually abandon the profession (Bowen, Buck, Deck, Mills, & Shuls, 2015); (Findeisen, 2013)

Second, the questionnaires administered to students were relatively long, potentially reducing the level of attention and effort given to responses to specific questions. During the interviews, some of the risk-related questions were not explained as clearly as would be desirable due to time constraints, which may have led some respondents to answer without completely understanding the nuances of each question. Third, it is possible that future teachers responded to the risk-related questions without effectively considering the different levels of risk associated with different answers. This possibility is supported by the fact that students show themselves to be more disposed to take risks in hypothetical settings (financial risk) and that they may have erroneous or inflated expectations regarding their own future performance in the classroom (payment contract risk). Bowen, Buck, Deck, Mills & Shuls (2015) argue that respondents may potentially think that merit-based contracts would merely offer bonuses, without any risk of pay cuts. The questionnaire's focus on behavior under risk may have given the impression that merit-based contracts and risky financial investments would merely result in bonuses, with no risk of loss.

Fourth, risk preference measures were observed as continuously distributed categorical variables, thus imparting them with some sort of ordinal significance in our analysis. In fact, true risk preferences are unobservable. By imposing an ordinal pattern on these categorical variables, we are assuming that a graduate who evaluated their general disposition to take risks to have a value of eight is more risk tolerant than a comparable respondent who evaluated their preferences at six. However, given that, these responses are highly subjective and only proxy for an underlying latent variable (true risk preferences); it is not possible to interpret these reported values as exact magnitudes. By modeling the latent risk preference variable, it would be possible to exactly interpret the effects of risk preferences (Beauchamp, Cesarini, & Johannesson, 2017).

Finally, it could be the case that the observable characteristics that are robustly significant in our specifications already incorporate some aspect of individual risk preferences. The profile of future basic education teachers is disproportionately composed of women, with children, who are enrolled in academically weaker private education institutions, and who come from families or lower socioeconomic standing.

Though there are numerous limitations that should be taken into account when considering how individual risk preferences may influence the attractiveness of teaching careers, our results are relevant to future studies that focus on this topic in Brazil. We see this work as a first attempt at introducing research methods focused on measuring risk into a literature that asks if, how, and why risk preferences differ among future teachers. Finally, evaluating how occupational choices are correlated with risk preferences may add to our knowledge of public policies focused on improving the attractiveness of the teaching profession.

The results presented here complement an extensive literature on teacher labor supply (Dolton, 2006). The estimates presented in this chapter appear to suggest that teachers (and perhaps other public servants) respond to incentive schemes in more complex ways than the basic theory of incentives would predict. This theory suggests that payment contracts based on individual performance are a superior form of compensation when output is well defined and easily measurable. Riskier occupations would require greater compensation in order for individuals to feel motivated and enticed to enter these professions (Lazear, 2003). In general, performance-based incentives may conflict with fundamental characteristics of teachers and public servants more generally, who may be more motivated by benefits than career results (Dixit, 2002), (Watt et al., 2012). This is not to say that merit-based compensation models should not be considered, but that the specific design of these incentive contracts should take into account heterogeneity in individual preferences for incentives (Goldhaber, Bignell, Farley, Walch, & Cowan, 2016); (Perez, 2011).

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Appendix

TABLE A

Comparison of the characteristics of the sample of undergraduate students to become teachers of Basic Education with those who do not wish or have doubts

Comparison groups:	***Become teacher***	***Not to become teacher***	**Difference**
Demographic controls:			
Married (=1)	0,29613	0,22664	-0,0695***
	-0,457	-0,419	
Woman (=1)	0,73814	0,61916	-0,1190***
	-0,44	-0,486	
Age (in years)	28,03176	26,33768	-1,6941***
	-8,213	-6,981	
High School_mother (=1)	0,41434	0,49246	0,0781***
	-0,493	-0,5	
High School_father (=1)	0,35883	0,46183	0,1030***
	-0,48	-0,499	
White (=1)	0,43838	0,43126	-0,0071
	-0,496	-0,496	
Per capita wealth index (from 0 to 8)	1,29391	1,37155	0,0776
	-1,037	-1,116	
Bolsa Familia Program (=1)	0,06591	0,06192	-0,004
	-0,248	-0,241	
Previous teacher experience (=1)	0,2109	0,15421	-0,0567**
	-0,408	-0,361	
Interior (=1)	0,32337	0,30491	-0,0185
	-0,468	-0,461	
Private university (=1)	0,53866	0,43692	-0,1017***
	-0,499	-0,496	
Education Course	0,44728	0,35981	-0,0875***
	-0,497	-0,48	
Public High School (=1)	0,7833	0,65962	-0,1237***
	-0,412	-0,474	
Magisterio (=1)	0,50439	0,46846	-0,0359
	-0,5	-0,499	
Proxy University performance (=1 good)	0,43761	0,49409	0,0565*
	-0,496	-0,5	
Risk Measures			
General Risk – Binary	0,66784	0,64836	-0,0195
	-0,471	-0,478	
General Risk – Continuous	6,5536	6,4287	
	-2,393	-2,422	-0,1249
Financial Risk	0,69332	0,71028	0,017
	-0,461	-0,454	
Risk Context	0,55975	0,63084	0,0711**

	-0,497	-0,483	
Contract Risk – Individual and Team Performance	0,853	0,855	0,002
	-0,354	-0,352	
Observations	1138	856	1994

Note: Standard errors in parentheses.
***, **, * indicate significance at the 1%, 5% e 10% levels, respectively.
Source: Constructed based on survey data described in text.

TABLE B

Individual Risk attitude and occupational sorting: Probit (MEM) and OLS Models

Dependent variable: occupation choice of undergraduates					
VARIABLES	(1)	(2)	(3)	(4)	(5)
General Risk Binary	-0.517				
	(0.520)				
Financial Risk		16.12			
		(185.1)			
Risk Context			-3.078		
			(8.096)		
Contract Risk				-2.351	
				(3.729)	
General Risk – Continuous					-0.401***
					(0.0225)
Woman	0.119***	0.849	0.0541	0.144**	0.0941
	(0.0290)	(8.442)	(0.146)	(0.0715)	(0.105)
Age	-0.00613	-0.0321	-0.0171	0.00517	-0.0471*
	(0.0109)	(0.367)	(0.0560)	(0.0208)	(0.0268)
Age^2	0.000129	0.000824	0.000172	-2.94e-05	0.000763**
	(0.000153)	(0.00879)	(0.000601)	(0.000294)	(0.000332)
White	-0.0365	-0.300	0.00871	0.0367	-0.156
	(0.0342)	(3.144)	(0.101)	(0.111)	(0.0968)
High School Father	-0.0728**	0.166	0.102	0.0415	-0.118
	(0.0289)	(2.881)	(0.482)	(0.200)	(0.102)
High School Mother	0.0428	-0.850	-0.0737	-0.0439	0.0906
	(0.0478)	(9.864)	(0.252)	(0.102)	(0.104)
Wealth per capita	-0.0221	-0.251	0.0931	-0.00380	0.0709**
	(0.0137)	(2.603)	(0.301)	(0.0472)	(0.0353)
Married	0.000684	0.00983	0.0439	-0.0168	0.0353
	(0.0322)	(0.401)	(0.142)	(0.0714)	(0.138)
Previous work as teacher	0.0680	1.380	0.0991	0.106	0.108
	(0.0438)	(15.46)	(0.177)	(0.128)	(0.106)
Industry	-0.0995*	0.432	-0.302	-0.0396	-0.191
	(0.0545)	(5.814)	(0.637)	(0.117)	(0.156)
Services	-0.131***	-0.663	-0.188	-0.0806	-0.177
	(0.0500)	(6.744)	(0.315)	(0.0847)	(0.119)
Public Sector	-0.0695	-0.00276	-0.169	-0.0458	-0.302**
	(0.0571)	(0.765)	(0.409)	(0.100)	(0.140)
Education	-0.0606	-0.557	-0.264	-0.0984	-0.164
	(0.0603)	(6.168)	(0.623)	(0.159)	(0.130)

Others	-0.0536	0.771	-0.217	-0.0409	0.0457
	(0.0531)	(9.202)	(0.503)	(0.102)	(0.126)
Interior	0.0170	0.00901	0.0543	-0.0106	0.0162
	P(0.0479)	(0.594)	(0.198)	(0.110)	(0.116)
Private university	0.0969*	0.613	0.111	0.197	0.396***
	(0.0533)	(6.452)	(0.150)	(0.230)	(0.0922)
Education courses	0.0283	0.621	0.0517	6.94e-05	0.0272
	(0.0397)	(6.799)	(0.101)	(0.0683)	(0.0894)
Public High School	0.0775*	-0.416	0.212	0.192	-0.0231
	(0.0416)	(5.714)	(0.312)	(0.191)	(0.122)
Proxy University performance	-0.0301	-0.463	0.111	0.0834	-0.100
	(0.0294)	(4.957)	(0.350)	(0.180)	(0.110)
Constant	0.962**	-10.42	2.279	2.058	
	(0.409)	(126.7)	(4.705)	(2.428)	
Observations	1,677	1,677	1,677	1,674	1,677

Note: Standard errors in parentheses.
***, **, * indicate significance at the 1%, 5% e 10% levels, respectively.
Source: Constructed based on survey data described in text.

TABLE C

Individual Risk attitude and occupational sorting: IV Model

Dependent variable: Occupation choice of undergraduates					
	(1)	(2)	(3)	(4)	(5)
General Risk Binary	-0.517				
	(0.520)				
Financial Risk		16.12			
		(185.1)			
Risk Context			-3.078		
			(8.096)		
Contract Risk				-2.351	
				(3.729)	
General Risk Continuous					-0.401***
					(0.0225)
Woman	0.119***	0.849	0.0541	0.144**	0.0941
	(0.0290)	(8.442)	(0.146)	(0.0715)	(0.105)
Age	-0.00613	-0.0321	-0.0171	0.00517	-0.0471*
	(0.0109)	(0.367)	(0.0560)	(0.0208)	(0.0268)
Age²	0.000129	0.000824	0.000172	-2.94e-05	0.000763**
	(0.000153)	(0.00879)	(0.000601)	(0.000294)	(0.000332)
White	-0.0365	-0.300	0.00871	0.0367	-0.156
	(0.0342)	(3.144)	(0.101)	(0.111)	(0.0968)
High School_Father	-0.0728**	0.166	0.102	0.0415	-0.118
	(0.0289)	(2.881)	(0.482)	(0.200)	(0.102)
High School_Mother	0.0428	-0.850	-0.0737	-0.0439	0.0906
	(0.0478)	(9.864)	(0.252)	(0.102)	(0.104)
Wealth per capita	-0.0221	-0.251	0.0931	-0.00380	0.0709**
	(0.0137)	(2.603)	(0.301)	(0.0472)	(0.0353)
Married	0.000684	0.00983	0.0439	-0.0168	0.0353
	(0.0322)	(0.401)	(0.142)	(0.0714)	(0.138)
Previous work as teacher	0.0680	1.380	0.0991	0.106	0.108

	(0.0438)	(15.46)	(0.177)	(0.128)	(0.106)
Industry	-0.0995*	0.432	-0.302	-0.0396	-0.191
	(0.0545)	(5.814)	(0.637)	(0.117)	(0.156)
Services	-0.131***	-0.663	-0.188	-0.0806	-0.177
	(0.0500)	(6.744)	(0.315)	(0.0847)	(0.119)
Public Sector	-0.0695	-0.00276	-0.169	-0.0458	-0.302**
	(0.0571)	(0.765)	(0.409)	(0.100)	(0.140)
Education	-0.0606	-0.557	-0.264	-0.0984	-0.164
	(0.0603)	(6.168)	(0.623)	(0.159)	(0.130)
Others	-0.0536	0.771	-0.217	-0.0409	0.0457
	(0.0531)	(9.202)	(0.503)	(0.102)	(0.126)
Interior	0.0170	0.00901	0.0543	-0.0106	0.0162
	(0.0479)	(0.594)	(0.198)	(0.110)	(0.116)
Private university	0.0969*	0.613	0.111	0.197	0.396***
	(0.0533)	(6.452)	(0.150)	(0.230)	(0.0922)
Education courses	0.0283	0.621	0.0517	6.94e-05	0.0272
	(0.0397)	(6.799)	(0.101)	(0.0683)	(0.0894)
Public High School	0.0775*	-0.416	0.212	0.192	-0.0231
	(0.0416)	(5.714)	(0.312)	(0.191)	(0.122)
Proxy University performance	-0.0301	-0.463	0.111	0.0834	-0.100
	(0.0294)	(4.957)	(0.350)	(0.180)	(0.110)
Constant	0.962**	-10.42	2.279	2.058	
	(0.409)	(126.7)	(4.705)	(2.428)	
Observations	1,677	1,677	1,677	1,674	1,677

Note: Standard errors in parentheses.
***, **, * indicate significance at the 1%, 5% e 10% levels, respectively.
Source: Constructed based on survey data described in text.