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Cognitive ability and economic preferences: evidence from survey and experimental data in Mexico

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Abstract

This paper contributes to the debate about the relationship between cognitive ability and economic preferences. We employ both national representative survey data and experimental data, and apply different elicitation procedures for risk and time preferences in a developing country, Mexico. Our findings are based on three different samples—adult and adolescent survey data, and experimental data for young adults—and a total of 13 tests, two with monetary incentives and the rest without these incentives. Our results show no statistically significant relationship between cognitive ability and economic preferences using different elicitation procedures with three different samples.

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1. Introduction

There is ongoing debate about the relevance of cognitive ability to economic preferences, based on the accuracy and suitability of the instruments used in their measurement. Unpaid, non-experimental measurements are often regarded as incompatible with incentives. In recent years, however, serious efforts have been made to validate measurements for inclusion in household surveys (Dohmen et al. 2011; Falk et al. 2016; Vischer et al. 2013).[1] These and previous studies showed a relationship between greater cognitive skills, more positive attitudes toward risk, and increased patience (Benjamin, Brown, and Shapiro 2013; Burks et al. 2009; Dohmen et al. 2010), but a recent and influential study has challenged these findings. Andersson et al. (2016) show that different presentations of the preference-elicitation task can produce either positive or negative correlations. Taylor (2016) also finds that the relationship between risk aversion and cognitive abilities is not robust.

Our study contributes to this debate by employing both experimental data (with monetary incentives) and national representative survey data (without monetary incentives), using various elicitation procedures, to examine risk and time preferences in a developing country, Mexico. We employ a total of 13 tests with different samples and procedures. The samples we analyze focus on young adults (experimental data), teenagers (survey data), and adults (survey data). Our results from these three different samples show no significant relationship between cognitive ability and economic preferences in either the incentivized or non-incentivized setting.

Our study is an important contribution to the literature. Dohmen et al. (2010) find for different demographic groups in Germany that greater cognitive ability is related to increased willingness to take risks (see also Dohmen et al. 2018). Burks et al. (2009) and Benjamin et al. (2013), studying tractor-trailer drivers in the United States and high school students in Chile, respectively, find that greater cognitive ability is related to increased patience. All of these studies used monetary incentives to elicit economic preferences. Previous studies have argued that non-incentivized measurements are related to incentivized economic preferences (Dohmen et al. 2011; Falk et al. 2016). Hence, a key question is whether prior results regarding the relationship between cognitive ability and economic preferences can be replicated. In this paper, we compare different samples (adults, teenagers, and young adults) to elicit economic preferences in the same way as earlier studies, but without monetary incentives. In one sample, however, that of young adults, we also use monetary incentives, as in these previous studies. We find similar results for both samples, suggesting that the outcome is not affected by the use of monetary incentives or by inconsistency in the risk measurement.

2. Data

We first analyze a new dataset of information from surveys of Mexican adults and their adolescent children, interviewed separately; we then evaluate data from an experiment conducted in Mexico (2016). The survey was conducted without monetary incentives; in the experiment we use monetary incentives to elicit risk preferences. We use the same instruments to assess cognitive ability in the experiment as in the survey. Two instruments to elicit risk preferences and two to

[1] Vischer et al. (2013) validated a general question to elicit time preferences, which is included in the German Socio-Economic Panel (SOEP). Dohmen et al. (2011) and Falk et al. (2016) also validated a direct question related to risk preferences.

elicit time preferences are used in both, and we include a third elicitation procedure, commonly employed in this type of study, to elicit risk preferences in the experiment. Overall, we work with three samples—the adult and adolescent survey data and the experimental data—and a total of 13 tests (two with monetary incentives and the rest with no monetary incentives).

The Survey of Social Mobility in Mexico (SMS-2015)[2] consists of 2,616 households with teenage children (12-18), and is representative at the urban level (+100,000 inhabitants). For each household, a teenager was interviewed along with one of their parents. Sociodemographic information was collected, as well as data related to dwelling and employment. A key aspect of the SMS-2015 is the inclusion of measures of cognitive skills, risk aversion, and patience for each interviewee. Cognitive skills and preferences of teenagers and adults were measured with identical procedures, conducted in separate rooms.

The experiment was conducted in 14 sessions held in 2016 in Mexico City. While it was designed to study social preferences, we also collected data suited for the current analysis. We recruited 404 participants, mainly young adults (average age 24 years, s.d. 4.12), holding or working towards a university degree and seeking their first job. All participants answered a computer-based questionnaire. The first two questions elicited risk preferences with monetary incentives (a winning range of 0-300 ECUs for the first and 25-80 ECUs for the second).[3] Subsequent questions elicited time preferences without monetary incentives. All participants also took a cognitive test.

We measured risk preferences as follows. First, using the procedure in Dohmen et al. (2011) and Falk et al. (2016), we asked participants: "On a scale from 1 to 10, where 1 is not at all willing to take risks and 10 is completely willing to take risks, how willing are you to take risks?" Second, we asked participants to bet some portion of a given amount with the possibility of losing or increasing it—a risky but potentially profitable bet (Gneezy and Potters 1997): "Imagine you have 100 pesos and are betting on a coin flip. If you guess correctly you triple your money, but if you are wrong you lose the amount you bet. How much would you be willing to bet?" In the household survey, this question was not incentivized; it merely proposed the hypothetical 100 pesos. In the experiment we gave the participants 100 ECUs.

Finally, the experiment included a third element not present in the survey: a list of increasingly risky choices, similar to that employed by Holt and Laury (2002). Each participant was given a list of 12 choices, each including one safe option offering progressively higher fixed sums, and another option offering a constant 50 percent chance of winning 100 ECUs. The fixed sum began at 25 ECUs and increased in intervals of 5 ECUs to a maximum of 80 ECUs. Participants were asked to decide between the two options, one at a time, starting with the lowest fixed sum. A participant who selects the lowest fixed sum is considered very risk-averse, while one who is always willing to take a chance on the 100 pesos is considered very risk-seeking. In all three procedures, we standardize the responses within the relevant sample for comparison purposes

[2] Encuesta de Movilidad Social 2015, http://movilidadsocial.colmex.mx/index.php/encuesta.

[3] Transactions during the sessions were made using experimental currency units (ECUs). At the end of the session, we exchanged the ECUs for Mexican pesos (MXN) at the rate of 10 ECUs per peso. Earnings of participants in the risk elicitation section were 197 ECUs (on average). There was also a payment of $50 MXN for showing up. Including this latter payment, participants obtained on average close to $70 MXN (approximately $7.90 USD in PPP). They also obtained earnings from other experimental games not included in this paper.

(in the third procedure we standardize the row in which participants choose the safe option over the risky one).

To elicit time preferences, we used two procedures. The first is a general question about patience correlated with experimental measures (Vischer et al. 2013). We asked respondents to indicate their general level of patience: "On a scale of 1 to 10, where 1 is very patient and 10 is very impatient, how patient or impatient do you consider yourself to be?" The second procedure, suggested by the methodology of Burks et al. (2009), is a task requiring participants to choose between receiving a smaller payment sooner or a larger one later. With the results of this task, Burks et al. (2009) are able to calculate both the discount rate and the present-bias coefficient. We use similar questions but without monetary incentives. The wording is as follows: "Imagine that someone owes you $1,000 [MXN], due today. How much would they have to pay you to delay payment by three months? How much would they have to pay you to delay payment by one year?" A larger amount indicates a greater level of impatience. The measurement of impatience is the standardized prediction based on the principal component analysis of the two responses.[4]

Finally, participants' cognitive ability is measured using a version of Raven's Progressive Matrices test, where participants are asked to respond to 10 items in five minutes. This test assesses general logical reasoning and skills for detecting patterns and solving previously unknown problems. Our measure for cognitive ability is the standardized (within sample) sum of correct answers on this test.[5]

Averages by gender for each variable are shown in Table I. There are more women than men in the sample of adults and young adults (experimental sample); in the teenager sample the numbers are nearly equal. As expected, the adult sample is older on average than the young adult sample. We calculate a wealth index using a principal component analysis of assets in the household.[6] The cognitive skill measure shows statistically significant differences in favor of men for the adult and teenager samples. For the risk measures, our results are generally consistent with previous studies showing that women are more risk averse than men (Croson and Gneezy 2009); the only exception is in the teenager sample, with the risk measure of the amount wagered (Gneezy and Potters 1997).

One potential weakness in our approach is that economic preferences might suffer from measurement error (Gillen et al. 2018). We use economic preferences as dependent variables and the key explanatory variable is cognitive ability. If there is measurement error only in economic preferences, then there is no bias in the estimate but standard errors are greater. In order to reduce

[4] The results are robust to including the discount rate, or the present bias term, as dependent variables (Burks et al. 2009), instead of the standardized measure. We prefer the latter measure, as it is easier to compare across samples and preferences.

[5] The SMS-2015 includes other instruments to assess cognitive abilities. Robustness results are provided in the supplementary materials. The measurement of cognitive ability is not the same as in Dohmen et al. (2010). They use a combined measure of a symbol-digit correspondence test (matching numbers and symbols) and a word fluency test (mention as many animals as possible in 90 seconds).

[6] The wealth index is computed using a principal component analysis of dummy variables for asset ownership of the following: shower, washing machine, gas or electric stove, refrigerator, landline telephone, water heater, television, car, indoor bathroom, and domestic workers employed. We also include information on parental ethnic background (indigenous or not), parental education (completed elementary school or not), the number of bedrooms per household member, and whether the household was located in a rural or urban area. The index is defined in the same way for all data sources; for the teenager sample, the parent's wealth index was used. For survey data, the sampling weights were used to generalize the results to the urban population.

measurement error, we combine different measures of each economic preference into one index using principal component analysis. The row in Table I for the variable "Aggregated measure of risk" shows the results across samples. This procedure shows similar, statistically significant differences between men and women for the adult and young adult samples; in the teenager sample, these differences are not statistically significant. However, the difference between men and women in the aggregated measure is greater than in each measure individually. Finally, average time preferences are similar between men and women across samples. When we aggregate the measure using principal component analysis there are no statistically significant differences between men and women.

Table I. Average Values by Gender across Samples

	Adults			Teenagers			Young Adults		
	N	Female	Male	N	Female	Male	N	Female	Male
% female	2,616	56%		2,616	49%		404	53%	
Age	2,616	41.7	44.0	2,616	15.0	14.8	404	24.2	24.8
Years of schooling	2,616	10.0	10.3	2,616	8.3	7.9			
Wealth index	2,616	0.00	0.00	2,616	-0.03	0.03	397	-0.05	0.06
Cognitive skill	2,616	-0.05	0.06**	2,616	-0.08	0.08**	404	-0.04	0.04
Risk measure 1: Willingness to take risks	2,550	-0.10	0.13*	2,545	-0.04	0.04**	403	-0.09	0.10**
Risk measure 2: Amount wagered	2,607	-0.07	0.09*	2,616	0.07	-0.07*	403	-0.07	0.08
Risk measure 3: 12 lotteries as in Holt & Laury (2002)							403	-0.07	0.08
Aggregated measure of risk	2,541	-0.12	0.15**	2,545	0.02	-0.01	403	-0.11	0.13**
Time measure 1: Self-reported impatience	2,611	-0.01	0.01	2,612	0.05	-0.05*	403	0.01	-0.01
Time measure 2: Unwillingness to delay gratification	2,499	0.00	0.01	2,521	-0.05	0.05*	360	0.00	0.01
Aggregated measure of impatience	2,494	-0.00	0.01	2,518	-0.01	0.01	360	-0.02	0.02

Notes: Columns refer to sample type and rows to variables. The wealth, cognitive skill, and preference measures are standardized. An * (**) represents a significant statistical difference between men and women at a level of 10% (5%). Risk measure 1 refers to the question: "On a scale from 1 to 10, where 1 is not at all willing to take risks and 10 is completely willing to take risks, how willing are you to take risks?" Risk measure 2 refers to "Imagine you have 100 pesos and are betting on a coin flip. If you guess correctly you triple your money, but if you are wrong you lose the amount you bet. How much would you be willing to bet?" Risk measure 3 refers to a list of lotteries, as in Holt and Laury (2002). Time measure 1 refers to the question "On a scale of 1 to 10, where 1 is very patient and 10 is very impatient, how patient or impatient do you consider yourself to be?" Time measure 2 refers to the question "Imagine that someone owes you $1,000 [MXN], due today. How much would they have to pay you to delay payment by three months? How much would they have to pay you to delay payment by one year?"

How related are the measures of economic preferences? The risk measures in the adult and teenager sample show a correlation of 0.06-0.07 that is statistically significant at the 5% level. The measures in the young adult (experimental) sample show higher correlations, from 0.14 to 0.24 (significant at the 1% level). Falk et al. (2016) find that the correlation between self-reported risk and an experimental measure of risk with monetary incentives is 0.35. The time measures are weakly correlated (less than 0.03) and are not statistically significant. This suggests that risk measures are more consistent than time measures, especially in the young adult sample.

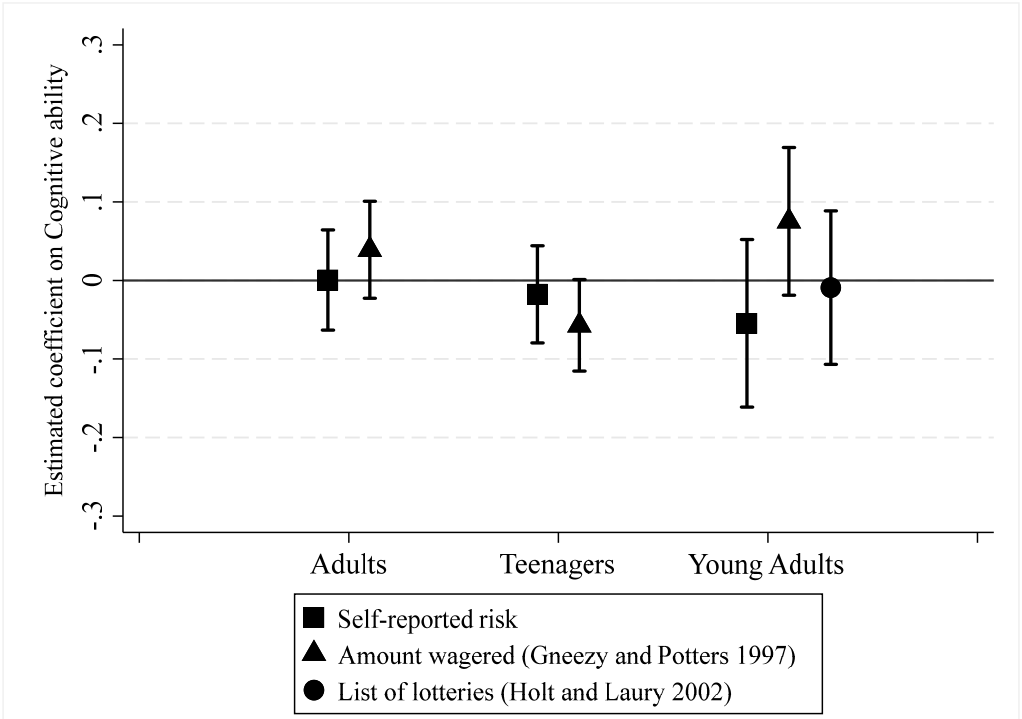
3. Results

Figure 1 shows the estimated OLS coefficients of a regression using Economic Preference (Risk or Time) as the dependent variable and Cognitive Ability as the key explanatory variable; both variables are standardized. The figure also includes robust confidence intervals at the 95% level. The regression controls for Age, a dummy variable of Gender, Years of Schooling, and a current wealth index. Panel A shows the estimated coefficient of cognitive abilities with respect to risk preferences, and panel B shows this coefficient for time preferences. Overall, we conduct 13 different regressions on the survey data (adults and teenagers) and experimental data (young adults). The only questions with monetary incentives relate to the experimental sample for the amount wagered (Gneezy and Potters 1997) and the list of lotteries (Holt and Laury 2002).

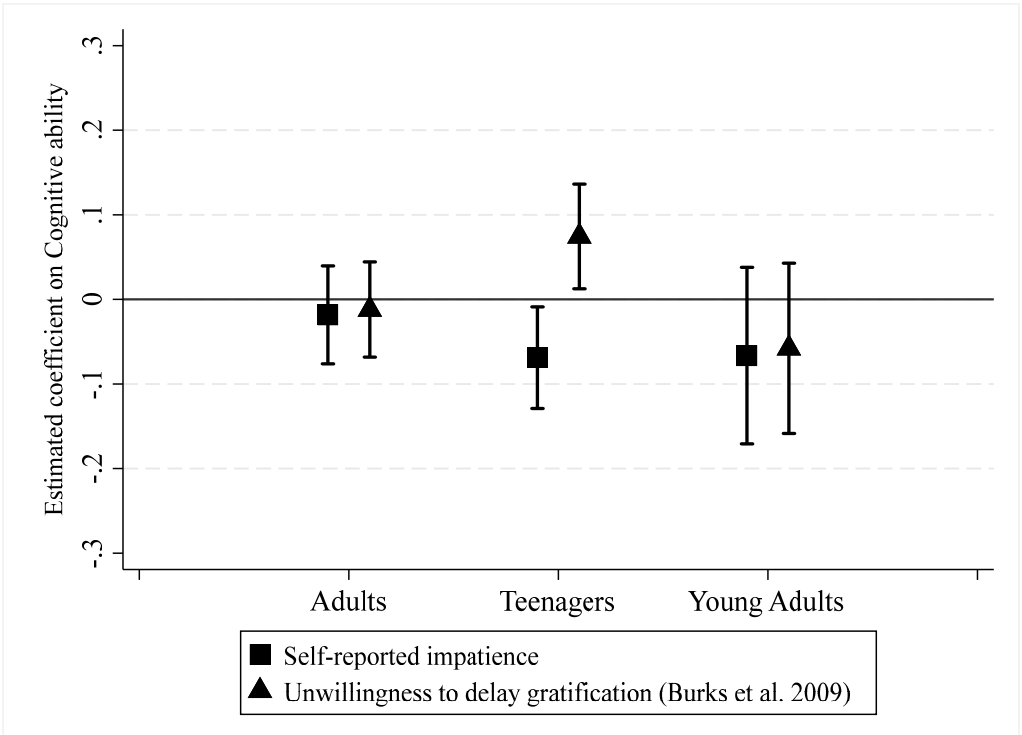
Regarding risk preferences (the willingness to take risks and amount wagered in both the survey and the experimental data, and the 12 risk options in the experimental data), the analysis shows an effect of cognitive ability on risk preferences that is not statistically significant. The measurement of impatience based on a direct question and the measurement of willingness to delay gratification also fail to show a statistically significant effect for both the adult portion of the survey and the experimental group. For the teenagers in the survey, both measurements are marginally significant but contradictory: self-reported impatience indicates a negative relationship and willingness to delay gratification a positive one.

Figure 1. Regression Analysis of the Relationship between Preferences and Cognitive Ability by Sample

A. Risk Preferences



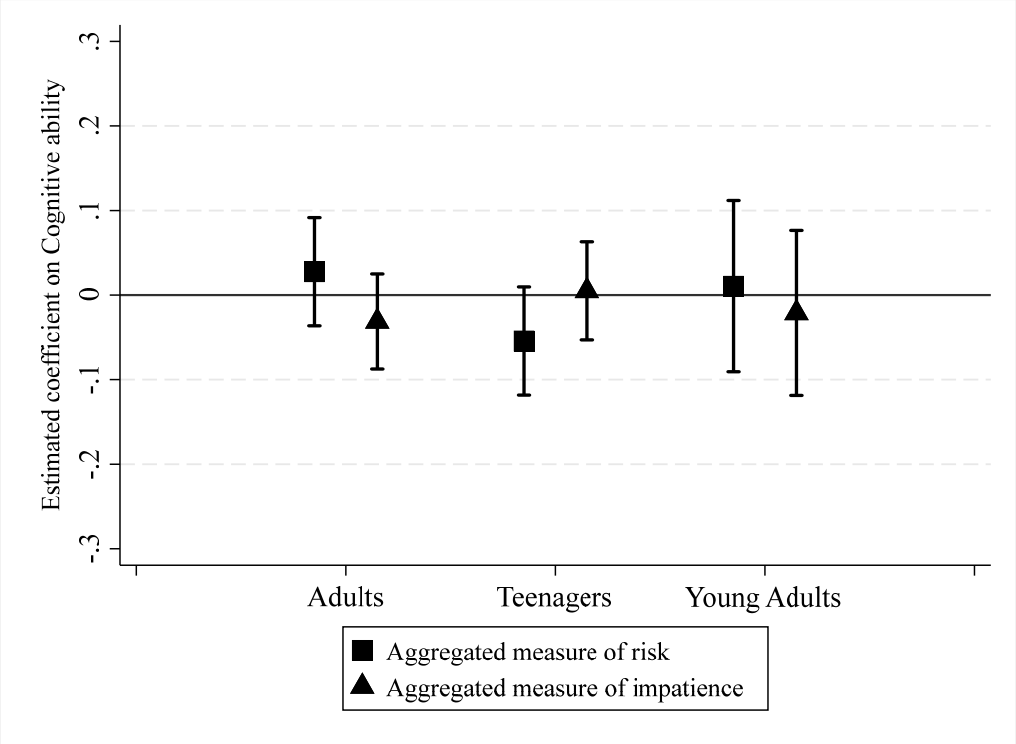
B. Time Preferences



Notes: Each point is obtained from a regression on cognitive ability with the measure of economic preference as dependent variable and the following control variables: Gender, Age, Years of Schooling, and a wealth index. For risk preferences, a positive coefficient means greater cognitive ability and is related to a greater willingness to take risks. For time preferences, a negative coefficient means greater cognitive ability and is related to a higher level of patience (or a lower level of impatience). The risk measure "Self-reported Risk" refers to the question: "On a scale from 1 to 10, where 1 is not at all willing to take risks and 10 is completely willing to take risks, how willing are you to take risks?" The risk measure "Amount Wagered" refers to "Imagine you have 100 pesos and are betting on a coin flip. If you guess correctly you triple your money, but if you are wrong you lose the amount you bet. How much would you be willing to bet?" The risk measure "List of Lotteries" refers to a list of lotteries as in Holt and Laury (2002). The time measure "Self-reported Impatience" refers to the question "On a scale of 1 to 10, where 1 is very patient and 10 is very impatient, how patient or impatient do you consider yourself to be?" The time measure "Unwillingness to Delay Gratification" refers to the question "Imagine that someone owes you $1,000 [MXN], due today. How much would they have to pay you to delay payment by three months? How much would they have to pay you to delay payment by one year?" The full results are included in the Supplementary Materials.

One concern regarding these results is that there may be measurement error in each independent elicitation measure (Gillen et al 2018). If this is the case, standard errors increase and could lead to a false non-rejection of the null hypothesis. We attempt to improve our economic preference measures by constructing one index for each preference, using all of the different measures for each sample, with a principal component analysis. This procedure reduces noise if the measurement error is not correlated across elicitation procedures. The results are shown in Figure 2. As in Figure 1, we plot the OLS coefficient from a regression with the economic preference measure as dependent variable, using principal component analysis. The key explanatory variable is Cognitive ability, and both variables are standardized. Using this method, we find no statistically significant effect. We also explore regression estimates by gender (not shown), by aggregating only the measures with monetary incentives (Young adults); none are statistically different from zero at the 1% or 5% levels. In the Supplementary Materials we also include data from using non-linear effects and a different measure of cognitive ability; the results do not change. These results are in line with those shown in Andersson et al. (2016) and Taylor (2016).

Figure 2. Regression Analysis of the Relationship between the Aggregated Measure of Preferences and Cognitive Ability, by Sample



Notes: Each point is obtained from a regression on cognitive ability with the aggregated measure of economic preference as dependent variable, and the following control variables: Gender, Age, Years of Schooling, and a wealth index. For risk preferences, a positive coefficient means greater cognitive ability and is related to greater willingness to take risks. For time preferences, a negative coefficient means greater cognitive ability and is related to a higher level of patience (or a lower level of impatience). The aggregated measures were obtained using principal component analysis of the variables shown in Figure 1 for each sample. The full results are included in the Supplementary Materials.

4. Conclusions

This study contributes to the debate about the relationship between cognitive abilities and economic preferences. We employ different sources of data (survey and experimental) and incentivized and non-incentivized measurements to study the relationship between cognitive abilities and economic preferences in a developing country, Mexico. We do not find a significant relationship between cognitive ability and economic preferences. Our results suggest that the relationship may depend on context and the elicitation procedures used. One potential caveat concerns the possibility of measurement error. We attempted to minimize such error by aggregating different elicitation procedures using a principal component analysis. The results are qualitatively similar to using each procedure separately.

References

Andersson, O., H. J. Holm, J.-R. Tyran, and E. Wengström (2016) "Risk aversion relates to cognitive ability: Preferences or noise?" *Journal of the European Economic Association* **14**, 1129-54.

Benjamin, D., S. Brown, and J. Shapiro (2013) "Who is 'behavioral'? Cognitive ability and anomalous preferences" *Journal of the European Economic Association* **11**, 1231–55.

Burks, S., J. Carpenter, L. Goette, and A. Rustichini (2009) "Cognitive skills affect economic preferences, strategic behavior, and job attachment" *Proceedings of the National Academy of Sciences* **106**, 7745-50.

Croson, R. and U. Gneezy (2009) "Gender differences in preferences" *Journal of Economic Literature* **47**, 448-74.

Dohmen, T., A. Falk, D. Huffman, and U. Sunde (2010) "Are risk aversion and impatience related to cognitive ability?" *The American Economic Review* **100**, 1238-60.

Dohmen, T., A. Falk, D. Huffman, U. Sunde, J. Schupp, and G. Wagner (2011) "Individual risk attitudes: Measurement, determinants, and behavioral consequences" *Journal of the European Economic Association* **9**, 522-50.

Dohmen, T., A. Falk, D. Huffman, and U. Sunde (2018) "On the relationship between cognitive ability and risk preference" *Journal of Economic Perspectives* **32**, 115-34.

Falk, A., A. Becker, T. Dohmen, D. Huffman, and U. Sunde (2016) "The preference survey module: A validated instrument for measuring risk, time, and social preferences" The Institute for the Study of Labor (IZA), IZA DP No. 9674.

Gillen, B., E. Snowberg and L. Yariv (2018) "Experimenting with measurement error: Techniques with applications to the Caltech cohort study" *Journal of Political Economy*, forthcoming.

Gneezy, U. and J. Potters (1997) "An experiment on risk taking and evaluation periods" *The Quarterly Journal of Economics* **112**, 631-45.

Holt, C. A. and S. K. Laury (2002) "Risk aversion and incentive effects" *The American Economic Review* **92**, 1644-55.

Taylor, M. P. (2016) "Are high-ability individuals really more tolerant of risk? A test of the relationship between risk aversion and cognitive ability" *Journal of Behavioral and Experimental Economics* **63**, 136-47.

Vischer, T., T. Dohmen, A. Falk, D. Huffman, J. Schupp, U. Sunde, and G. Wagner (2013) "Validating an ultra-short survey measure of patience" *Economics Letters* **120**, 142-45.