Risk Attitudes, Investment Behavior and Linguistic Variation

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Outline of the Presentation

- Main objectives and novelties.
- Starting Point: Linguistic variation; Linguistic Relativity Hypothesis: Linguistic Variation and Perception.
- Measuring Linguistic Variation: new linguistic marker.
- Direct effect of Linguistic Variation on Risk Aversion.
- Indirect effect of Linguistic variation on asset accumulation through risk aversion - Two Stage Estimation.
- Main Results and Concluding remarks.

The aim of this paper

- Explore whether specific linguistic structures directly influence the individual perception of uncertainty and risk attitudes.
- Explore indirect effect of linguistic characteristics on asset accumulation through risk aversion.

Novelties:

(1) New linguistic marker based on the intensity of use of grammatical categories concerned with the expression of uncertainty (rigorous and unambiguous).

(2) Correlation between linguistic markers (*exogenous*) and individual self - declared risk aversion (*endogenous*).

(3) Linguistic marker as an instrument for the individual attitudes towards risk (structural equation for investment).

Linguistic Variation

- **Linguistic Variation**
- Differences in linguistic structures across languages.
- Nothing to do with linguistic variation over time.
- Reference point: standardized grammars, no dialectal variation, no "dialects of age" (*slang*) etc.
- **Linguistic structures**
- Set of rules regarding language use that native speakers know (not always consciously).
- Morphology: structure of words, Volabulary: number of words for basic colors, etc. Syntax: how words combine to form grammatical sentences; use of different verbal moods to interpret a fact or a situation ...

Linguistic Relativity Hypothesis

- **Linguistic Relativity Hypothesis** (LRH henceforth) (Sapir, 1921; Whorf and Carroll, 1964): languages are relative as they vary in their expression of concepts in noteworthy ways, and semantic expression of concepts has some degree of influence on the *conceptualization* in the cognitive domain.
- Languages categorize (explain the meaning) the reality differently: number of basic color terms, number of words for snow (Eskimo) - language structure segments reality in a different way.
- The way in which the language conceptualizes the reality influences our interpretation of facts.
- Becoming relevant for research in psychology, anthropology, sociology, and recently in economics.

- The evidence in support of LRH concentrated on conceptual contents of languages:
  - Davies and Corbett (1997), Roberson et al. (1999), and Winawer et al. (2007) suggest that words for colors may influence color perception.
  - Santacreu-Vasut et al. (2013) find that pervasiveness of gender distinctions in grammar is an important correlate for gender political quota, even after controlling for economic development, religion and the political system.

- **Key Point**: If LRH is correct, linguistic structures may influence the perception of several phenomena closely related to economic decision making, such as the perception of uncertainty, impatience, and consequently savings, health behavior, investment attitudes etc.
- The literature on the relationship between language and economic behavior is still very poor (almost absent).

Language and Economic Behavior

- Chen (2013), "Language and economic behavior"; *AER*: first (and only) attempt to analyse the correlation between linguistic differences and individual economic behavior.
- Linguistic differences: typological distinction in Dahl (2000) and Thierhoff (2000) - **Future Time Referencing** (FTR henceforth)
  - Speakers of languages that separate the future and the present tense ("**strong FTR**" languages) are more prone to dissociate the future from the present with respect to speakers of languages that do not display future time reference ("**weak FTR**" or "futurless" languages)
- Strong FTR speakers perceive future as more distant (less known) and put less weight on it - Higher Discount Rate.

Language and Economic Behavior; Chen (2013)

- Chen (2013) examines how these linguistic differences correlate with future-oriented behavior such as saving, exercising, abstaining from smoking, retirement savings, and long-run health.
- **Linguistic-Savings Hypothesis**: Speakers of weak FTR languages (those for which future appears closer) have higher probability to save, accumulate more wealth by retirement, smoke less frequently and are more physically active (and, hence, lower probability of being obese).
- Across and within linguistically heterogeneous countries - the correlation between FTR and individual behavior strong and robust.

Linguistic Variation: Future Marking; Chen (2013)

- Classification adopted in Chen (2013) sort languages into one of the two categories with respect to *contexts* involving prediction (such as weather forecasts) - and *only* with respect to these contexts.
- **Potential Problem**: there are other contexts denoting future time reference apart from prediction-based ones.
- **Examples**: Schedules, plans, ongoing processes having a natural *terminus* in the future are also contexts involving a future time reference.
- Different criteria may result in different classifications - not obvious that the classification adopted in Dahl (2000) and Thierhoff (2000) should be preferred to other classifications.

Linguistic Variation: Interpretation of possible situations

- In this paper we propose to consider LRH on the background of a different grammatical property and in a different economic context: linguistic treatment of possible (not actual) "worlds" or situations; relate to general perception of uncertainty.
- Possible "worlds"/situations are defined as alternative states of facts, which cannot be asserted as of the world we actually live in (the "actual world / situation").
- In other words, these situations do not concern actual facts = they refer to possible or uncertain situations.
- Examples of "possible" worlds:

Linguistic Variation: Examples of possible situations

(1) "*If it were sunny, I would go for a walk.*"

This sentence does not assert that it is sunny and that the speaker is having a walk. The "actual" world could be: "*It is sunny and I am having a walk.*"

(2) "*I think the meeting has finished.*"

This sentence does not assert that the meeting has finished - it may be finished, the speaker in fact believes that it has, but one's belief may turn out to be wrong.

- **Key Point**: Languages use different grammatical categories (**moods**) to describe/conceptualize situations involving the "world" parameter = languages differ in terms of the extent of uncertainty attributed to uncertain situations!

Conceptualization of possible situations: Moods

- **Mood**: grammatical category concerned with the expression of situations involving the "world" or "situation" parameter:
  - **Indicative** is the mood *generally* used to assert that a proposition is true as of the actual world. In "possible worlds" the indicative asserts that the situation is less distant from the "actual world" with respect to:
  - **Non-Indicative**: subjunctive, conditional, imperative. A given "possible" situation is attributed a higher degree of not-actuality/uncertainty.
- In both cases the situation remains "not actual" but if I use a non-indicative mood to describe it, I am even more uncertain about its "truthfulness".

Non-Indicative Moods: How frequently are they used?

- As in the case of future marking, there are several syntactic contexts in which the indicative or non-indicative mood can be used to to handle with possible situations (**irrealis** contexts).
- **Idea**: Develop a specific linguistic **marker (indicator)** defined on the basis of the number of contexts that trigger the use of non-indicative moods.
- **Indicator of Linguistic Variation**: The extent of use of different non-indicative moods in these syntactic contexts.
- **Issue**: Identification of syntactic contexts - less problematic. How many syntactic contexts? - possibly all. **Good news**:

  From a cross-linguistic viewpoint there are no more than **six contexts** *that trigger non-indicative moods more consistently - no arbitrariness.*

Irrealis Contexts

(1) **Context 1**: *to be possible, to be likely, to be necessary*;

(2) **Context 2**: *to want, to wish, to desire*;

(3) **Context 3**: *to think, to believe, to doubt*;

(4) **Context 4**: *to regret, to be happy, to be sad*;

(5) **Context 5**: *to say, to tell, to announce*;

(6) **Context 6**: *the protasis (the if - clause) and the apodosis (the main clause) in a conditional sentences*: *If he had studied harder, he would have passed the exam.*.

Indicator of Linguistic Variation

- Data on grammatical mood are mainly collected from Rothstein and Thieroff (2010) (RT).
- For languages not in RT (only 5) - additional literature + questionnaire compiled by linguists.
- We assign the value 1 to the occurrence of a non-indicative mood in each syntactic context and 0 to indicative moods.
- Adding the values, we obtain an indicator of how frequently non-indicative forms are used in a language:
  - Languages with 0 non-indicative moods across 6 irrealis contexts: "moodless" languages.
  - Languages that use to a different extent NI moods in irrealis contexts: variability 1-6.

Linguistic Mapping: Irrealis

- Our mapping consists in 39 mostly European languages:
  - 6 "moodless" languages; 8 languages with 2 Irrealis; 7 languages with 3 Irrealis; 14 languages use NI moods in 4 Irrealis contexts and only 3 languages in all of the six contexts.
- Example: **0 Irrealis**: Hebrew, English; **2 Irrealis**: Dutch, German; **3 Irrealis**: Catalan, French; **4 Irrealis**: Spanish, Arabic, Russian; **6 Irrealis**: Italian, Portuguese, Islandic.
- Significant variability:
  - Relevant for linguistically heterogeneous countries (Spain, Israel, Belgium, Switzerland, Luxembourg, Estonia, etc.).
  - Spain: $3 + 4$; Israel: $0 + 4$; Belgium: $2 + 3$; Switzerland: $2 + 3 + 6$; Luxembourg: $2 + 3$; Estonia: $3 + 4$, etc.

Linguistic variation and Uncertainty: Hypothesis

- **H1**: In line with LRH, speakers of languages with more intensive usage of non-indicative moods (IRR henceforth) should perceive the world as being more mutable and uncertain with respect to speakers of languages where these forms are less frequently used, or do not exist at all.
- Perception of uncertainty influences individual risk aversion:
  - Individuals identical in all aspects except for the number of IRR in their respective languages, differ in terms of attitudes toward risk (both across and within countries) = More IRR, More Risk Aversion, *ceteris paribus*.
- **Direct effect** of IRR linguistic marker on risk perception and risk attitudes.

Linguistic variation and Uncertainty: Hypothesis

- **H2**: **Indirect effect** of linguistic variation on asset accumulation through risk aversion.
  - Issue: Risk - aversion variable (survey - elicited) endogenous: omitted variables. Linguistic marker as potential instrument.

- **H3**: **Direct effect** of Individual Time Preferences (subjective discount rate) on asset accumulation.
  - Individuals that discount more future benefits (utility) invest less in risky assets. Proxy for individual discount rate: FTR linguistic marker (Chen, 2013; *AER*).
  - Strong FTR speakers = higher discount rate - lower asset accumulation, *ceteris paribus*.

Linguistic variation, Risk Attitudes and Investment Behavior: Data

- Individual data - together with information on risk attitudes, investment behavior and other variables, we need info on language spoken by individuals.
- Data sources: Survey on Health and Aging in Europe (**SHARE**, Wave 2, release 2.6.0 and Wave 5, release 1.0.0) + World Value Survey (**WVS**, release 5 and 6).
- SHARE: 16 European countries + Israel, 17 languages; WVS: 39 countries, 22 languages.
- No explicit question on language in SHARE - choice of questionnaire (different language): proxy for the language spoken on the daily basis. WVS - explicit question.

Linguistic variation, Risk Attitudes and Investment Behavior: Empirical Analysis

- Empirical analysis:
  (1) Direct effect of IRR on Risk Aversion (**H1**).
    - Equation for individual self - declared risk aversion (linguistic marker among covariates);
    - Set of Fixed Effects for individual characteristics, controls for Linguistic Families and Sub - Families.

  (2) Indirect effect of IRR on asset accumulation (**H2**). Two-stage estimation: structural equation for the propensity to invest in risky financial assets - stocks or bonds. Linguistic marker as instrument for risk aversion.

  (3) Direct effect of discounting on asset accumulation (**H3**). Equation for individual propensity to asset accumulation: time preferences (FTR linguistic marker, Chen(2013)).

Linguistic variation, Risk Attitudes and Investment Behavior: Empirical Analysis

- **Dependent**: Self-declared risk aversion (high versus low and intermediate, binary), Has invested in risky financial assets (stocks or bonds) or not (binary).
- **Explanatory and Control**: Demographic, Socio-Economic, Family Composition, Trust, Cognitive and Health controls.
- **Estimation methods**: probit, conditional probit, ivreg2 (first stage and test statistics), recursive bivariate probit (second stage).
- We consider only individuals responsible for financial matters in the household (head of household). First and second generation of immigrants excluded.

Part I. Direct Effect: IRR and Risk Aversion

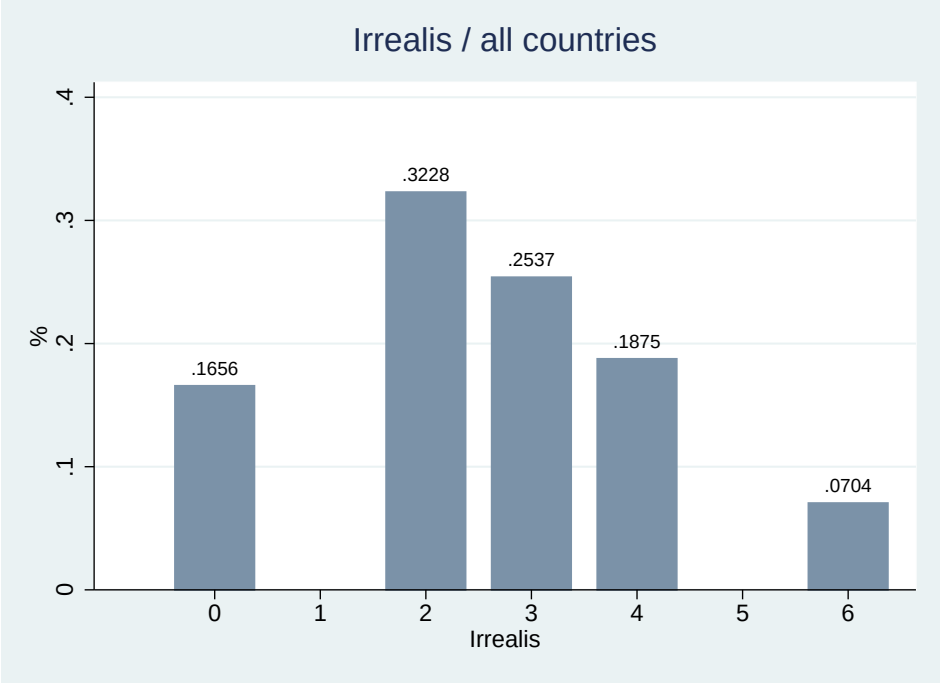
- Degree of risk tolerance (risk aversion) elicited from a risk tolerance question. 4 levels of risk tolerance:

  1) Take substantial financial risk expecting to earn substantial returns; **2)** Take above average financial risks expecting to earn above average returns; **3)** take average financial risk expecting to earn average returns; and **4)** Not willing to take any financial risk.

- SHARE: 75.45% declare to be highly risk averse, 20.43% intermediate risk takers, 4.11% risk lovers. Similar distribution in WVS.

- Intermediate and low risk aversion aggregated in one category.

Part I. Direct Effect: IRR and Risk Aversion



Source: SHARE, Wave 2 and Wave 5. N. Observations: 75 273 (all countries).

- Linguistic marker (IRR): limited discrete variable (range 0 - 6) and categorical variable: 0; 2+3; 4+6.

Part I. Direct Effect: IRR and Risk Aversion

- Bellante and Green (2004), Dohmen et al. (2011), Lin (2009): higher education increases risk tolerance.
- Guiso and Paiella (2008), Riley Jr. and Chow (1992), Dohmen et al. (2011): risk aversion decreases in income and wealth.
- Occupational status: employed less risk averse than unemployed (Hartog, 2002); Dohmen et al. (2011) shows that occupational status not relevant.
- Married individuals more risk averse (Cohen and Einav, 2007); number of children increases risk aversion (Dohmen et al., 2011; Lin, 2009).
- Other factors: age (Halek and Eisenhauer, 2001), gender, poor health, cognitive abilities (Bellante and Green, 2004; Bonsang and Dohmen, 2015).

Part I. Direct Effect: IRR and Risk Aversion

- Covariates (other than IRR):
  - Demographic characteristics: gender, age (**X**).
  - Socio-Economic characteristics: education, income, wealth, occupational status (**X**).
  - Household characteristics: marital status, number of children (**X**).
  - Controls: Trust in others, Cognitive abilities (reading, writing), Health conditions (chronic diseases and limitations) (**Z**).
- In all model specifications we control for the country and wave fixed effects (**CW**). Robust SE are clustered by country.
- Empirical Model:

$$hRA_i = \alpha + \beta \cdot IRR_i + \gamma \cdot \mathbf{X_i} + \theta \cdot \mathbf{Z_i} + \rho \cdot \mathbf{CW_i} + \epsilon_i$$

Probit model: Probability of being highly risk - averse. Marginal effects. SHARE data.

High RA (d)	HRA 1	HRA 2	HRA 3	HRA 4	HRA 5	HRA 6
IRR	**0.038*** **	**0.033*** **	**0.030*** **	**0.029*** **	**0.027*** **	
	(0.009)	(0.008)	(0.009)	(0.009)	(0.009)	
CatIRR1 (d)						**0.129*** **
						(0.014)
CatIRR2 (d)						**0.161*** **
						(0.005)
Age	0.006***	0.004***	0.004***	0.003***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female (d)	0.107***	0.086***	0.089***	0.089***	0.092***	0.093***
	(0.005)	(0.006)	(0.006)	(0.006)	(0.008)	(0.008)
Low Education (d)		0.076***	0.071***	0.070***	0.064***	0.064***
		(0.006)	(0.006)	(0.006)	(0.007)	(0.007)
High Education (d)		-0.091***	-0.084***	-0.082***	-0.075***	-0.075***
		(0.009)	(0.009)	(0.009)	(0.008)	(0.008)
Income		-0.016***	-0.016***	-0.015***	-0.014***	-0.015***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Owner (d)		-0.030***	-0.028***	-0.026***	-0.022***	-0.022***
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Trust People			-0.012***	-0.012***	-0.012***	-0.012***
			(0.001)	(0.001)	(0.001)	(0.001)
Retired (d)				0.034***	0.033***	0.033***
				(0.007)	(0.008)	(0.008)
Unemployed (d)				0.050***	0.050***	0.051***
				(0.009)	(0.009)	(0.009)
Disabled (d)				0.060***	0.044***	0.045***
				(0.010)	(0.010)	(0.010)
Cognitive, Health	No	No	No	No	Yes	Yes
N. Observations	75273	74148	73338	71907	65985	65985
N. Countries	17	17	17	17	17	17

Probit model: Probability of being highly risk - averse. Marginal effects. SHARE data. **LH Countries**.

High RA (d)	HRA 1	HRA 2	HRA 3	HRA 4	HRA 5	HRA 6
IRR	**0.033*** **	**0.028*** **	**0.026*** **	**0.026*** **	**0.023*** **	
	(0.008)	(0.007)	(0.008)	(0.007)	(0.008)	
CatIRR1 (d)						**0.109*** **
						(0.013)
CatIRR2 (d)						**0.138*** **
						(0.006)
Age	0.005***	0.003***	0.003***	0.002***	0.001***	0.001***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Female (d)	0.084***	0.068***	0.070***	0.072***	0.074***	0.074***
	(0.006)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Low Education (d)		0.074***	0.074***	0.074***	0.066***	0.066***
		(0.006)	(0.005)	(0.005)	(0.006)	(0.006)
High Education (d)		-0.086***	-0.082***	-0.079***	-0.066***	-0.065***
		(0.013)	(0.012)	(0.012)	(0.010)	(0.010)
Income		-0.014***	-0.014***	-0.013***	-0.012***	-0.012***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Owner (d)		-0.027***	-0.027***	-0.026***	-0.022***	-0.022***
		(0.004)	(0.005)	(0.004)	(0.005)	(0.005)
Trust People			-0.009***	-0.009***	-0.009***	-0.009***
			(0.001)	(0.001)	(0.001)	(0.001)
Retired (d)				0.033***	0.034***	0.033***
				(0.012)	(0.012)	(0.013)
Unemployed (d)				0.045***	0.040***	0.040***
				(0.009)	(0.012)	(0.012)
Disabled (d)				0.046***	0.030**	0.031**
				(0.016)	(0.014)	(0.014)
Cognitive, Health	No	No	No	No	Yes	Yes
N. Observations	25356	25023	24664	24136	22967	22967
N. Countries	6	6	6	6	6	6

Robustness Check. Probit model: Probability of being highly risk - averse. Marginal effects. WVS data.

High RA (d)	HRA 1	HRA 2	HRA 3	HRA 4	HRA 5
StrongIRR (d)	**0.091*** **	**0.090** **	**0.090*** **	**0.088*** **	**0.087** **
	(0.034)	(0.035)	(0.035)	(0.033)	(0.034)
AgeCat	0.006***	0.006***	0.006***	0.005***	0.005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female (d)	0.105***	0.107***	0.106***	0.106***	0.100***
	(0.005)	(0.006)	(0.006)	(0.006)	(0.007)
Low Education (d)		-0.000	-0.007	-0.009	-0.011
		(0.008)	(0.008)	(0.008)	(0.008)
High Education (d)		-0.025***	-0.017**	-0.014	-0.013
		(0.008)	(0.008)	(0.008)	(0.008)
HHIncome			-0.011***	-0.012***	-0.012***
			(0.002)	(0.002)	(0.002)
Married (d)				0.057***	0.054***
				(0.007)	(0.008)
Num. Children				0.005**	0.005**
				(0.003)	(0.002)
Retired (d)					0.019
					(0.014)
Unemployed (d)					-0.003
					(0.013)
Homemaker (d)					0.020**
					(0.009)
Cognitive, Health	N/A	N/A	N/A	N/A	N/A
N. Observations	36684	34488	33647	33452	33391
N. Countries	39	39	39	39	39

Part II. Risk Aversion and Asset Accumulation: Two Stage Estimation

- Propensity to invest in stocks and other risky assets is inversely related to individual risk aversion. Moreover, risk aversion is decreasing in individual income and wealth (Arrow, 1971).
- Correlations not causal effects: omitted variables (unobservables) and/or reverse causality
- Our empirical problem consists of estimating the following causal relationship:

$$AS_i = \alpha + \beta \cdot RA_i + \gamma \cdot \mathbf{X_i} + \theta \cdot \mathbf{Z_i} + \rho \cdot \mathbf{CW_i} + \epsilon_i$$

Part II. Risk Aversion and Asset Accumulation: Two Stage Estimation

- First Stage:

$$hRA_i = \alpha + \pi_{i1} \cdot IRR_i + \pi_{i2} \cdot \mathbf{X_i} + \pi_{i3} \cdot \mathbf{Z_i} + \pi_{i4} \cdot \mathbf{CW_i} + \mu_i$$

- Second Stage: plug the first stage fitted values - reduced form model for asset accumulation:

$$AS_i = \alpha + \beta \cdot \widehat{hRA_i} + \gamma \cdot \mathbf{X_i} + \theta \cdot \mathbf{Z_i} + \rho \cdot \mathbf{CW_i} + error_i.$$

- From 1st stage: test statistics (strength of instrument, correct specification);
- Interpretation of coefficients (causal effect of RA): 2nd stage (biprobit).

1st stage (linear): Probability of being highly risk - averse. SHARE data. LH countries.

High RA	FS1_ML	FS2_ML	FS3_ML	FS4_ML
IRR	0.034***	0.031***		
	(0.005)	(0.005)		
CatIRR1 (d)			0.164***	0.155***
			(0.030)	(0.030)
CatIRR2 (d)			0.189***	0.177***
			(0.029)	(0.029)
Country Wave FE	Yes	Yes	Yes	Yes
Cognitive, Health	No	Yes	No	Yes
N. Observations	16509	15405	16509	15405
N. Countries	6	6	6	6
Strong Instrument	**53.16**	**42.06**	**25.02**	**21.54**
Endogenous RA	0.0000	0.0000	0.0000	0.0000
Overidentification	—	—	**0.7324**	**0.7597**

First Stage Test Statistics

- The F statistics is significantly larger than a commonly used threshold of 10 (or 16) - the instrument is strongly correlated with the endogenous variable even after controlling for the effect of other regressors.
- J Hansen statistics (model specification/over-identification) - accept the H that the model is correctly specified and that both instruments are exogenous (CatIRR).
- Not possible to test directly the exogeneity of the instrument - no reason to suspect that there is any reverse effect of the propensity to invest in risky assets on the instrument.
- Exclusion restrictions: we can rule out (hopefully) any direct effect of linguistic variation on the propensity to invest in risky assets through omitted variables (we control for **X**, **Z** and **CW**).

2nd stage: Bivariate Probit model: Probability of investing in risky assets. SHARE data. LH countries.

Pr(Risky Assets)	**Risk Aversion**	**Discounting**	**Discounting**
RiskAversion (d)	**-0.107*** **		
(instrumented)	(0.025)		
Strong_FTR (d)		-0.045***	**-0.039*** **
(High disc. rate)		(0.002)	(0.004)
Owner (d)	0.019***	0.024***	0.023***
	(0.005)	(0.006)	(0.007)
Income	0.009***	0.012***	0.011***
	(0.001)	(0.001)	(0.001)
Low Education (d)	-0.024***	-0.041***	-0.035***
	(0.006)	(0.004)	(0.003)
High Education (d)	0.018***	0.048***	0.037***
	(0.007)	(0.010)	(0.009)
Married (d)	0.014***	0.011	0.009
	(0.005)	(0.008)	(0.008)
Num. Children	-0.009***	-0.008***	-0.008***
	(0.002)	(0.002)	(0.002)
Age	0.001***	0.000	0.001**
	(0.000)	(0.000)	(0.000)
Female (d)	-0.016***	-0.031***	-0.031***
	(0.005)	(0.004)	(0.004)
Retired (d)	0.022***	0.022***	0.019***
	(0.006)	(0.007)	(0.007)
Unemployed (d)	-0.013	-0.018	-0.016
	(0.012)	(0.014)	(0.015)
Disabled (d)	-0.011	-0.031***	-0.018**
	(0.012)	(0.005)	(0.007)
Homemaker (d)	0.041***	0.028***	0.037***
	(0.002)	(0.004)	(0.004)
Trust People	0.002***	0.004***	0.004**
	(0.001)	(0.001)	(0.002)
Cognitive, Health	Yes	No	Yes

Concluding remarks

- Strong correlation between IRR and Risk Aversion: language structure - perception of uncertainty - attitudes toward risk.
- Endogeneity issue: effect of RA on investment behavior almost three times larger than the effect of discounting (11% vs. 3.9%).
- Only investment behavior? Works with uncertainty in general: Kovacic and Orso (2016): Why do some countries fear immigration more than others? Evidence from Europe.
- More intensive IRR users are significantly more intolerant toward immigration with respect to other identical individuals speaking a different language.
- Important: evidence in line with experimental literature in the field - alternative to experimental approach - large samples.