The Effect of Language on Economic Behavior: Evidence from Savings Rates, Health Behaviors, and Retirement Assets

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Abstract

Languages differ widely in the ways they partition time. In this paper I test the hypothesis that languages which do not grammatically distinguish between present and future events (what linguists call weak-FTR languages) lead their speakers to take more future-oriented actions. First, I show how this prediction arises naturally when well-documented effects of language on cognition are merged with models of decision making over time. Then, I show that consistent with this hypothesis, speakers of weak-FTR languages save more, hold more retirement wealth, smoke less, are less likely to be obese, and enjoy better long-run health. This is true in every major region of the world and holds even when comparing only demographically similar individuals born and living in the same country. While not conclusive, the evidence does not seem to support the most obvious forms of common causation. Implications of these findings for theories of intertemporal choice are discussed.

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1 Introduction

Languages differ in whether or not they require speakers to grammatically mark the futurity of events. For example, a German speaker predicting precipitation can naturally do so in the present tense, saying: *Morgen regnet es* which translates to '*It *rains* tomorrow'.[1] In contrast, English would require the use of a future marker 'will' or 'is going to', as in 'It *will rain* tomorrow'.[2] In this way, English encodes a distinction between present and future events that German does not. Could this characteristic of language influence speakers' intertemporal choices?

In this paper I test a linguistic-savings hypothesis: that being required to speak in a grammatically distinct way about future events leads speakers to take fewer future-oriented actions. Put another way, I ask whether a habit of speech which distinguishes present from future, can lead to a habit of mind that devalues future rewards. This prediction arises naturally when well-documented effects of language on perception are merged with any of the most widely-used models of choice over time. Somewhat counterintuitively, this linguistic-savings effect does not require that language systematically bias people's perceptions of time, only that people who are linguistically required to grammatically locate events in time, will hold *more precise beliefs* about the timing of events.

The bulk of this paper investigates whether this prediction is borne out in the decisions people make. To do so, I first review the linguistics literature on future-time reference (FTR); which studies both when and how languages require speakers to mark the timing of events. For the purposes of simplicity and clarity, I adopt the criterion developed by Dahl (2000) as part of the European Science Foundation's "Typology of Languages in Europe" (EUROTYP) project. This criterion separates those languages that *require* grammatical future-time marking (GFTM) when making predictions about the future from those that do not.[3] Differences between languages on this dimension are surprisingly common, even within small geographical regions. For example, Western Europeans speak languages that range from an absence of any systematic GFTM (like Finnish),[4] to languages in which verbs have distinct and obligatory future forms (like Spanish).[5]

I then examine how these linguistic differences correlate with future-oriented behaviors such as saving, exercising, and abstaining from smoking. I also look at the cumulative effects of these behaviors such as retirement savings and long-run health. To avoid conflating differences in languages with other differences in the economic or social environment, my analysis includes extensive controls for individual and family characteristics, including country of birth and residence. Effectively, my analysis only compares individuals who have the same demographics, family structure, and country of birth and residence, but who speak different languages.

Consistent with my hypothesis, I find that speakers of languages with little to no grammatical

[1] I follow the general linguistics norm of marking ungrammatical sentences with an *.

[2] In English future reference is possible without future markers in certain contexts: specifically with scheduled events or events resulting from law-like properties of the world. See Copley (2009) for details. In my coding I set aside these cases because as shown in Dahl (1985) and Dahl (2000), "in many if not most languages, this kind of sentence is treated in a way that does not mark it grammatically as having non-present time reference... even for languages where future-time reference is otherwise highly grammaticalized." In other words, how scheduled events are treated does not reflect a language's overall treatment of future reference.

[3] Dahl defines "futureless" languages as those which do not require "the obligatory use [of GFTM] in (main clause) prediction-based contexts". In this framework, a *prediction* is a statement about the future that has no *intentional* component. Predicting the weather would be a canonical example. See Dahl (2000) and Thieroff (2000) for a discussion of the basis and aureal properties of this distinction.

[4] Dahl (2000) writes that Finnish and Estonian stand out in Europe as "extreme examples of languages with no systematic marking of future time reference (although this does not imply a total absence of devices that show future time reference)".

[5] See section 4.1 for details on the EUROTYP criterion developed by Dahl (2000), and the Appendix for a complete list of coded languages.

distinction between the present and future (weak-FTR language speakers) engage in much more future-oriented behavior. Weak-FTR speakers are 30% more likely to have saved in any given year, and have accumulated an additional 170 thousand Euros by retirement. I also examine non-monetary measures such as health behaviors and long-run health. I find that by retirement, weak-FTR speakers are in better health by numerous measures: they are 24% less likely to have smoked heavily, are 29% more likely to be physically active, and are 13% less likely to be medically obese.

I then attempt to determine if differences in language are directly causing these differences in behavior, or if these correlations derive from cultural values or traits that are coincident with language differences. For example, most (but not all)[6] Germanic languages have weakly-grammaticalized FTR: could there also be a "Germanic" cultural value towards savings that is widely held by Germanic-language speakers but not directly caused by language? While not conclusive, the evidence does not support the most obvious forms of common causation.

Most notably, several waves of the World Values Survey (WVS) asked respondents about both their savings behavior, the language which they speak at home, and the degree to which "savings and thrift is an important value to teach children". I find that both a language's FTR and the degree to which a person thinks savings is an important value predict savings behavior. Interestingly though, these effects are completely independent: neither effect attenuates nor boosts the other. Indeed, in the World Values Survey a language's FTR is almost entirely uncorrelated with its speakers' stated values towards savings ($corr = -0.07$). This suggests that the language effects I identify operate through a channel which is independent of conscious attitudes towards savings.

Finally, I examine the effect that this differential propensity to save has on national savings rates of Organization for Economic Cooperation and Development (OECD) member countries. Several interesting patterns emerge. First, the FTR of a country's language has a significant effect on that country's aggregate savings rate. Countries with weak-FTR languages save on average six percent more of their GDP per year than their strong-FTR counterparts. This result is unaffected by the addition of life-cycle savings control variables, and holds in every major region of the world.

Second, this finding reverses the long-standing pattern of northern-European countries saving more than their southern counterparts. In specific, language effects induce an aggregation reversal in European savings rates. That is, while it is true that northern-European countries tend to save more, northern-Europeans also tend to speak weak-FTR languages. Once the effect of language is accounted for the effect of Latitude flips; within language classes, northern-European countries actually save less than their southern counterparts. This suggests that what has been commonly thought of as a north-versus-south divide in European savings rates may actually be more fully explained by language.

The paper proceeds as follows. Section 2 reviews the linguistics literature on future-time reference, details the ways it differs across languages, and lays out my hypothesis and potential mechanisms. Section 3 organizes these mechanisms in the context of a simple model of language, beliefs, and behavior. Section 4 details my empirical methods and the data I use for estimation. Section 5 presents conditional correlations between a language's FTR and its speakers future-oriented behaviors. More detailed regressions investigate the degree to which these correlations can be taken as evidence of causation. A final set of regressions investigates the relationship between language and national savings rates within the OECD. Section 6 discusses several related literatures on the effect of language on though: most notably the large number of studies on how language effects spatial and color perception. Section 6 also discusses issues surrounding the interpretation of my results before concluding.

[6]Interestingly, English is a notable outlier among Germanic languages. I discuss this at length in section 2.

2 Languages and Future-Time Reference

Languages differ widely in both *how* and *when* they require speakers to signal that they are talking about the future. For example, English primarily marks the future with two periphrastic constructions, 'will' and 'be going to'. In contrast, some languages accomplish FTR using a much larger and diverse set of constructions. For example, Bittner (2005) documents that Kalaallisut (West Greenlandic), which had been thought to have 3 future tenses, actually has at least 28 distinct constructions which mark future time:

> "...nineteen verb-extending suffixes (sixteen transitivity preserving..., three transitive-deriving...), four verbal roots (one complex predicate forming...), one noun-extending suffix..., one de-nominal verb-forming suffix... and three mood inflections".

More subtly, languages also differ in *when* they require speakers to specify the timing of events, or when timing can be left unsaid. The linguist Roman Jakobson explained this difference as: "Languages differ essentially in what they *must* convey and not in what they *may* convey" (Jakobson, 1956).

For example, if I wanted to explain to an English-speaking colleague why I can't attend a meeting later today, I could not say '*I *go* to a seminar'. English grammar would oblige me to say 'I (*will go, am going, have to go*) to a seminar'. If on the other hand I were speaking Mandarin, it would be quite natural for me to omit any marker of future time and say *Wǒ qù tīng jiǎngzuò* (I *go* listen seminar):

Wǒ	*qù*	*tīng*	*jiǎngzuò*	
I	go.PRS	listen	seminar	(1)
'I am going to listen to a seminar'				

with no FTR, since the context leaves little room for misunderstanding.[7]

In this way, English forces its speakers to habitually divide up time between the present and future in a way that Mandarin (which has no tenses) does not. Of course, this does not mean that Mandarin speakers are unable (or even less able) to understand the difference between the present and future, only that they are not required to attend to it every time they speak. This difference in the *obligatory use of GFTM* is the basis of the EUROTYP classification, and is the characteristic of languages I exploit in my study of savings behaviors.

This difference in the use of FTR is surprisingly widespread, and even occurs within the languages of the same country. For example Thieroff (2000) documents what Dahl (2000) calls a "futureless area" in Northern and Central Europe, including most Finno-Ugric and all Germanic languages except English. European languages range from a tendency to rarely distinguish present and future time (like Finnish) to languages like French, which have separate and obligatory "future" forms of verbs.[8] A Finnish speaker for example, would say both *Tänään on kylmää* (today *is* cold)

[7] In this and all subsequent examples I follow the Leipzig glossing rules, where FUT and PRS indicate future and present morphemes. See Croft (2003) for details.

[8] Languages where verbs have distinct future forms are said to have an "inflectional" future. In Europe, this includes the romance languages (except Romanian), and most Slavic and Semitic languages. See Dahl (1985) for source data on inflectional futures in Europe, and Dahl & Velupillai (2011) for a broad survey of inflectional futures around the world.

and *Huomenna on kylmää* (tomorrow *is* cold) using the unmarked verb *on:*

(2)

a. *Tänään on kylmää*
Today be.PRS cold
'It is cold today'

b. *Huomenna on kylmää*
Tomorrow be.PRS cold
'It will be cold tomorrow'

while French speakers would switch from *Il fait froid aujourd'hui* (it *is* cold today), to *Il fera froid demain* (it *will-be* cold tomorrow):

(3)

a. *Il fait froid aujourd'hui*
It do/make.PRS cold today
'It is cold today'

b. *Il fera froid demain*
It do/make.FUT cold tomorrow
'It will be cold tomorrow'

English is a notable outlier in Europe; in all other Germanic languages GFTM is optional when making predictions that have no intentional component. That is, while a German speaker predicting precipitation or forecasting a freeze could say *Morgen regnet es,* or *Morgen ist es kalt* (both in the present tense):

(4)

a. *Morgen regnet es*
Tomorrow rain.PRS it
'It will rain tomorrow'

b. *Morgen ist es kalt*
Tomorrow is.COP it cold
'It will be cold tomorrow'

an English speaker would have to grammatically mark future time (it *will rain* tomorrow, and It *will be* cold tomorrow).[9]

2.1 Future-Time Reference and a Linguistic-Savings Hypothesis

In this paper I investigate the hypothesis that people whose languages require them to grammatically distinguish the present and future will take fewer future-oriented actions. This hypothesis arises naturally in two ways, which I discuss intuitively before deriving formally.

The first way that language may naturally affect future choices is by leading speakers to have more or less *precise beliefs* about the timing of future rewards. A language with strong FTR forces its speakers to grammatically distinguish the present and future. It seems plausible that habitually

[9] This observation that German and English differ dramatically in obligatory GFTM is not new: Comrie (1985) cites English and German as exemplars of strong and weak FTR languages. For a detailed analysis of this difference between English and German see Copley (2009). Copley demonstrates that in English, "futurates" (sentences about future events with no FTR) can only be used to convey information about planned / scheduled / habitual events, or events which arise from law-like properties of the world. This restriction is not present in German, and futurates are common in German speech and writing.

dividing time in this way could lead to more precise beliefs about the timing of events. Note that this does not require *biased* beliefs, only differences in how diffuse beliefs are. If this is true, then strong-FTR speakers will be less willing to save (as I show in proposition 1 below), which is my hypothesis.

The second way that language may naturally affect future choices is by leading speakers to bias their beliefs about future time, or (equivalently) the value they put on future events. Put another way, it seems at least possible that a habit of speech to treat the present and future as distinct, can lead to a habit of mind that treats future rewards as more distant. This bias in either time perception or discount rates would have the same effect as our first mechanism and also lead strong-FTR speakers to take up fewer future-oriented actions.

3 A Simple Model of Language and Savings Decisions

To illustrate these mechanisms, consider a simple savings / investment problem. Suppose a decision maker must decide whether or not to pay cost C now in exchange for reward $R > C$ at some time in the future. She is uncertain about *when* reward R will materialize, and holds beliefs with distribution $F(t)$. If the decision maker discounts at rate δ then she will prefer to save / invest if and only if:

$$C < \int e^{-\delta t} R dF(t) \tag{5}$$

3.1 Mechanism One: Obligatory distinctions lead to more precise beliefs.

Recall that languages with strong-FTR force their speakers to differentiate present and future events when speaking about them. It seems plausible that with *finer distinctions* in timing comes *greater precision* of beliefs.[10] To see the effect this kind of linguistic-precision effect would have, assume strong-FTR speakers (who must separate the future and present) hold more precise beliefs about the timing of R than speakers of weak-FTR languages. More concretely, if $F_W(t)$ and $F_S(t)$ are the beliefs of weak-FTR and strong-FTR language speakers, then we might expect $F_W(t)$ to be a mean-preserving spread of $F_S(t)$. That is to say,we might imagine that speakers of weak-FTR languages would hold more diffuse beliefs about the timing of future events, but that both groups beliefs would be accurate on average. The following proposition establishes that the more precise beliefs of strong-FTR speakers would lead them to view simple savings / investment opportunities less favorably.[11]

Proposition 1 *If $F_W(t)$ is a mean-preserving spread of $F_S(t)$, then $\int e^{-\delta t} R dF_W(t) > \int e^{-\delta t} R dF_S(t)$.*

Proof. Note that if $F_W(t)$ is a mean-preserving spread of $F_S(t)$, then $F_S(t)$ second-order stochastically dominates $F_W(t)$. Also note that for any discount rate $\delta > 0$, $e^{-\delta t}$ is a strictly-convex function. Therefore $\int e^{-\delta t} R dF_W(t) > \int e^{-\delta t} R dF_S(t)$. ■

[10] There are numerous findings that suggest that linguistically-obligatory distinctions leads to more precise beliefs. Some languages require their speakers to know their cardinal direction in order to describe relative positions (North-facing speakers refer to their "West" and "East" hands). Speakers of these languages both know (and remember) which directions they are (and were) facing with much more precision than English speakers (Boroditsky 2010). Russian obligatorily distinguishes between light blue (*goluboy*) and dark blue (*siniy*). Russian speakers display a greater ability than English speakers to recall subtle differences in shades of blue when the two colors span the siniy/goluboy border, but not when they do not (Winawer 2007), a difference not present in pre-linguistic infants (Franklin 2008). See section 6.2 for a more detailed discussion of these linguistic effects.

[11] For experimental confirmation of risk-seeking behavior in response to timing uncertainty response to timing uncertainty, see Redelmeier and Heller (1993). This behavior is also commonly observed in animal studies, see Kacelnik and Bateson (1996) for an excellent summary.

Proposition 1 establishes that a decision maker with beliefs $F_W(t)$ will value future rewards more than one who holds beliefs $F_S(t)$. In other words, if more finely partitioning events in time leads to more precise beliefs, weak-FTR language speakers will be more willing to save than their strong-FTR counterparts. Intuitively, since discounting implies that the value of future rewards is a strictly-convex function of time, uncertainty about the timing of future payoffs makes saving *more* attractive.

Note that exponential discounting is not unique in this regard: nearly *every widely studied theory of discounting* is strictly convex.[12] Risk-seeking behavior in response to timing uncertainty is both an observed feature of human decisions (see Redelmeier and Heller 1993), and is also commonly observed in animal studies (see Kacelnik and Bateson 1996). Also note that this mechanism for a linguistic effect does not require language to introduce any *bias* in beliefs about the future, only that requiring attention to timing of future events leads to more precise beliefs about the timing of future payoffs.

3.2 Mechanism Two: Obligatory distinctions bias beliefs.

Speakers of languages with weak-FTR do not grammatically distinguish between present and future events, while strong-FTR speakers must differentiate them. It seems at least possible that this would lead weak-FTR speakers to treat future events as less distant than strong-FTR speakers would.

There are two ways one might represent such a bias. One could represent this as language systematically shifting beliefs. For example, if speaking about future and present events identically makes them seem more temporally similar, then $F_S(t)$ would first-order stochastically dominate $F_W(t)$. It is easy to see how this would affect the decision to save:

$$\text{if } \forall t, F_W(t) \geq F_S(t), \text{ then } \int e^{-\delta t} R dF_W(t) \geq \int e^{-\delta t} R dF_S(t) \tag{6}$$

Equivalently, we could imagine that speaking identically about the future and present leads speakers to discount the future less. That is, we could imagine that high and weak-FTR speakers hold discount rates $\delta_W < \delta_S$. This would lead to the same relationship between language and saving:

$$\text{if } \delta_W < \delta_S, \text{ then } \int e^{-\delta_W t} R dF(t) > \int e^{-\delta_S t} R dF(t) \tag{7}$$

If either mechanism 1 or 2 is active, all else equal people who speak languages in which the future and present are grammatically indistinguishable should save, exercise, and plan more, and spend, smoke, and over-consume less. I will now present a set of empirical findings which test this hypothesis, then return to a more general discussion of language and cognition.

4 Data and Methods

4.1 Coding Languages

In all of the regressions to follow the independent variable of main interest is $StrongFTR$ (strong future-time reference), a criterion developed as part of the European Science Foundation's Typology

[12] See Frederick, Lowenstein, and O'Donoghue (2002) for an excellent review of both models and evidence on discounting behavior.

of Languages in Europe (EUROTYP) project.[13] This binary criterion is meant to capture whether a language *systematically requires GFTM* when speaking about future events. Future-time reference was a focal area of the EUROTYP Theme Group on Tense and Aspect, which studied the typological and areal distribution of grammaticalized FTR.

Summarizing the general patterns by the EUROTYP project, Dahl (2000) defines futureless languages as those which do not require "the obligatory use [of GFTM] in (main clause) prediction-based contexts". That is, English is a strong-FTR language because marking future-time grammatically is often obligatory, even when making predictions that have no intentional or promissory component (e.g., tomorrow it *will be* warm). Thieroff (2000) notes that at least in Europe, this distinction maps more generally onto whether future events can be left unmarked (i.e. discussed in the present tense). That is, the use of FTR in prediction-based contexts maps onto the broader question of whether the use of FTR is generally obligatory.

Most analyses in this paper (Tables 4 through 10), study languages directly analyzed by the EUROTYP Theme Group. In those regressions, strong-FTR languages are the exact compliment of what Dahl calls "futureless" languages and Thieroff (2000) calls "weakly-grammaticalized future" languages. Some regressions (Tables 1, 2, and 3) analyze the World-Values Survey, whose participants speak many non-European languages not analyzed by either Dahl or Thieroff. To extend their characterization to this broader set, I rely on several other cross-linguistic analyses that have studied how languages mark future time (most notably Bybee et al. 1994, Dahl & Kós-Dienes 1984, Nurse 2008, and Cyffer et al. 2009), and on individual grammars for languages that are extensively spoken in the WVS but not covered by these broader analyses. A table of all languages included in this study and their coding is in the appendix.[14]

4.2 Alternative Codings

While in this paper I focus for simplicity on the primary EUROTYP criterion of weak vs. strong FTR languages, there are several related criterion that may be important. A weaker criterion than the one I adopt might be the presence of *any systematic GFTM*, be it inflectional (the future-indicating verb forms common in Romance languages) or periphrastic (the English "will"). Mandarin is an example of a widely spoken language that lacks GFTM; Dahl (2000) notes that in Europe, Finnish and Estonian stand out as examples. A different, structural criterion might be the presence of an inflectional future, which would include most Romance languages but exclude English. Set-theoretically, these alternative criterion would satisfy:

$$AnySysGFTM \subset_1 WeakFTR \subset_2 StrongFTR \subset_3^? InflectionalFTR \quad (8)$$

with inclusions 1 and 2 being logically necessary, and inclusion 3 represents a typological regularity (for which I do not have a counterexample).

[13] The idea for the European Project on the Typology of Languages in Europe (EUROTYP) was developed at a European Science Foundation conference (Rome, January 1988). At those meetings, it was established that a cross-linguistic study of the tense and aspect systems of European Languages would form one of EUROTYP's nine focus areas. The resulting working group summarized their findings in an volume edited by Östen Dahl (2000), and their work is the basis for the weak / strong FTR coding I adopt in this paper.

[14] Most importantly, several African countries are well represented in the WVS, have several national languages, but are not comprehensively studied by any large cross-language tense study. For these languages I rely on individual grammars which discuss the structure of that language's FTR strategies. Most important were Adu-Amankwah (2003) for Akan, Nurse (2008) for Bantu languages, Olawsky (1999) and Lehr, Redden & Balima (1966) for Dagbani and Moore, Newman (2000) for Hausa, Carrell (1970), Emenanjo (1978), Ndimele (2009), and Uwalaka (1997) for Igbo, and Awobuluyi (1978), and Gaye & Beecroft (1964) for Yoruba.

For simplicity and transparency, in this paper I have adopted the main criterion advocated by the EUROTYP working group for "futureless" languages, which corresponds to inclusion 2. An additional reason for this choice is that as Thieroff notes, in the EUROTYP data weak-FTR languages are those in which "the future is not obligatory in sentences with future-time reference". Since this is the characteristic of languages (a more or less granular obligatory discretization of future time) that is central to the mechanism I propose, inclusion 2 seems the most direct test of my hypothesis.[15]

4.3 Savings Regressions in the WVS

My first set of regressions examines the World-Values Survey (2009), which was intended to be a global survey of world cultures and values. Although five waves of the WVS are available, I study only the last three, which ran from 1994 to 2007. In these (but not earlier) waves, participants were asked what language they normally speak at home, which I use a proxy for the language most likely to structure their thought. This allows me to study individuals across a set of 79 countries for which language data are available.

In these data, I estimate fixed-effect Logit models of an individual's propensity to save (versus not save) in the current year, regressed on the FTR strength of that individual's language and a rich set of fixed-effects for country and individual characteristics.[16] These fixed effects control for a person's: country of residence, income decile within that country, marital status (with 6 different classifications), sex, education (with 8 different classifications), age (in ten-year bins), number of children, survey wave, and religion (from a set of 74) all interacted (for a total of 1.4 billion categories). Effectively, this analysis matches an individual with others who are identical on every dimension listed above, but who speak a different language. It then asks within these groups of otherwise identical individuals, do those who speak strong-FTR languages behave differently than those who speak weak-FTR languages? In addition, immigrants are excluded from this analysis so as to avoid conflating differences in a household's primary language with differences between natives and immigrants.

The WVS allows me to study the interaction between the effect of language on savings behavior, and several beliefs and values questions asked of participants. This allows me to examine to what degree the measured effect of language on savings behavior is attenuated by such things as how much a person reports trusting other people, or how much they report that saving is an important cultural value. To a limited extent, this allows me to investigate whether language acts as a marker of deep cultural values that drive savings, or whether language itself has a direct effect on savings behavior.

4.4 Retirement Assets and Health Behaviors in the SHARE

The second dataset I analyze is the SHARE, the Survey of Health, Ageing, and Retirement in Europe (Börsch-Supan & Jürges 2005). The SHARE is a panel survey that measures the socioeconomic status and health of retired households in 13 European countries. This allows me to complement my earlier analysis of saving from the WVS with analyses of both accumulated household wealth,

[15] As a robustness check, it is possible to include all three inclusions as nested effects. While I do not have enough statistical power to disentangle these three effects, in all specifications I examine results suggest increasingly strong effects as you move from inclusions 1 to 3, and a joint significance of the three effects similar to the significance levels I report for weak-vs-strong FTR.

[16] I use Chamberlain's (1980) fixed-effect (or conditional) logit model to estimate these regressions, since I have very few observations within each group defined by my fixed effects. The Chamberlain model solves the resulting incidental-parameters problem.

and other future-oriented behavior measures such as smoking, exercise, and long-run health. Like my regressions in the WVS, my analysis of the SHARE looks only at within-country language variation among natives. Unfortunately, the SHARE does not record what language households speak at home. Instead, I exploit the fact that the survey instrument is offered in multiple languages; households can choose to take the survey in any of the national languages of their country. I use this choice as a proxy for their primary language.

Towards an analysis of the language and accumulated savings, I estimate several OLS models of total net household retirement assets regressed on a household's language and increasingly rich sets of fixed effects. The SHARE survey attempts a comprehensive measure all assets a household has, including income, private and public benefit payments, and all forms of assets (stocks, bonds, housing, etc.) For my other analyses I study the effect of language on several health measures. The SHARE contains several questions on health behaviors (such as smoking and exercise) as well as several physical-health measurements: body-mass-index, walking speed (as measured by a walking test), grip strength (as measured by a dynamometer), and respiratory health (peak expiratory air flow).

All of these regressions include fixed effects similar to those in the WVS so as to aid in comparing results across datasets. The richest of these regressions includes fixed effects for a household's: country of residence (13), income decile within that country, marital status (with 6 different classifications), sex, education (with 8 different classifications), age (in ten-year bins), number of children, and survey wave (2004 and 2006), all interacted for a total of 2.7 million categories. Again, immigrant families are excluded to avoid conflating differences driven by language with differences in immigrant families.

4.5 National Savings in the OECD

Finally, I study the relationship between language and the national accounts of the OECD from 1970 to present. These data are collected and harmonized by the OECD for all 34 member countries as well as for the Russian Federation.[17] Details on the exact construction of each OECD measure can be found in the Data Appendix. Importantly, all annual GDP measures are computed using the expenditure method, with constant PPPs using the OECD base year (2000).

These regressions attempt to determine whether the FTR structure of a country's language appears to affect national savings. The form of the national savings equation is a simple linear relation that follows closely from life-cycle savings theory (see Modigliani 1986 for a review). Essentially, I regress national-savings rates on the level and growth rate of GDP as well as a number of other country demographics. To this regression I add a weighted measure of the FTR strength of that country's languages. This is simply the FTR strength of each of that country's major languages, weighted by the percent of the country's population reports speaking those languages.[18] This language measure does not vary by year: these regressions test if the unexplained components of national savings vary cross-sectionally with a country's language, and do not try to identify off of demographic shifts within a country across time.

[17] I include the Russian Federation in this analysis because as of the writing of this paper they were in the process of joining the OECD, and were included in the harmonized OECD data.

[18] These relative language shares were obtained for each country from their national census taken closest to the year 2000.

5 Results

If speaking strong-FTR languages leads individuals to discount the future more, then the propensity to save should be negatively correlated with strong FTR. I examine this correlation in a regression framework which allows for a rich set of controls.

5.1 Language, Beliefs and Savings

My first set of regressions examines the savings behavior of individuals in the World Values Survey. These regressions are carried out using fixed-effect (or conditional) logistic analysis, where the dependant variable $save_{it}$ is an individual reporting having saved in net this year.[19] I estimate the equation:

$$\Pr(save_{it}) = \frac{\exp(z_{it})}{1 + \exp(z_{it})}, \tag{9}$$

where

$$z_{it} = \beta_1 StrongFTR + \beta_2 X_{it} + F_{it}^{ex} \times F_{it}^{en} \times F_t^c.$$

In equation 9, the main variable of interest $StrongFTR$ is a binary-coded characteristic of the language that the individual speaks at home. X_{it} are characteristics of individual i at time t, such as their self-reported beliefs about trust and savings. The F variables are sets of fixed effects that are jointly interacted to form groups for the basis of analysis: the conditional-likelihood function is calculated relative to these groups. That is, individuals are compared only with others who are identical on every F variable. F_{it}^{ex} is a set of fixed effects that can be taken as exogenous, these are non-choice variables such as age and sex. F_{it}^{en} is a set of fixed effects that are likely endogenous to an individual's discount rate, such as income, education and family structure. F_t^c is a set of country-wave fixed effects. In using these extensive fixed effects to compare like families, this estimation strategy mirrors that of Poterba, Venti, & Wise (1995) and the international comparisons of household savings in Poterba (1994). Empirical estimates of equation 9 are presented in Table 1; all coefficients are reported as odds ratios.

[19] See Chamberlain (1980) for details on conditional-logistic analysis, and the data appendix for the exact wording of this and other questions in the WVS.

Table 1: An Individual Saved This Year (WVS)

	(1) Saved	(2) Saved	(3) Saved	(4) Saved	(5) Saved	(6) Saved
Strong FTR	0.462	0.717	0.720	0.706	0.695	0.697
	[0.070]**	[0.113]*	[0.115]*	[0.102]*	[0.091]**	[0.092]**
Unemployed			0.677	0.693	0.687	0.688
			[0.031]**	[0.044]**	[0.044]**	[0.044]**
Trust					1.082	1.083
					[0.045]	[0.045]
Saving is Important						1.111
(to teach children)						[0.043]**
Fixed Effects:						
Age × Sex	Yes	Yes	Yes	Yes	Yes	Yes
Country × Wave	No	Yes	Yes	Yes	Yes	Yes
Income × Edu	No	Yes	Yes	Yes	Yes	Yes
Married × Num Chil	No	No	No	Yes	Yes	Yes
All FEs Interacted	Yes	Yes	Yes	Yes	Yes	Yes
Observations	152,056	64,017	64,017	24,933	23,658	23,658

Regressions are fixed-effect (or conditional) logistic regressions with coefficients reported as odds ratios. Immigrants are excluded from all regressions. Robust standard errors are reported in brackets; all regressions are clustered at the country level. * significant at 5%; ** significant at 1%.

Regression 1 controls only for F_{it}^{ex}, (non-choice variables age and sex), so as to summarize the average difference in the propensity to save between strong and weak-FTR individuals. The coefficient of 0.462 can be interpreted as strong-FTR families saving only 46% as often (at the yearly level) as weak FTR families. Regressions 2 and 3 add fully-interacted fixed effects for country, time, income, and education. On top of these, regressions 4 through 6 include controls for family structure. Regression 4 can be interpreted as demonstrating that even when comparing only individuals that are identical on every dimension discussed above, individuals who speak a language with strong FTR are roughly 30% less likely to report having saved this year. This effect is nearly as large as being unemployed (31%).

Regression 5 adds "Trust", (the most studied variable in the large literature on social capital) as an additional control. "Trust" measures whether an individual thinks "most people can be trusted". This measure has a large and marginally significant effect on the propensity of an individual to save; individuals who think others are generally trustworthy are on average 8% more likely to have saved this year. Interestingly, this effect appears to be largely independent of the effect of language. Indeed, by comparing regressions 4 and 5 we see that the inclusion of "Trust" if anything, increases the measured effect of language.

Regression 6 adds a variable intended to measure saving as an important cultural value. Specifically, this question asks whether "thrift and saving money" is a value which is important to teach children.[20] Unsurprisingly, individuals who report that saving money is important are more likely to save. Interestingly though, this effect is both smaller than the effect of language (11% versus 30%), and does not attenuate the effect of language on savings behavior. This can be seen by comparing regressions 5 and 6. Indeed, across individuals the belief that saving is an important value is almost completely uncorrelated with the FTR of their language ($corr = -0.07$).

[20]See the data appendix for the full wording of these questions in the WVS.

Parameter estimates from this first set of regressions indicate that a language's FTR is an important predictor of savings behavior. This effect is both large (larger than that of other widely-studied variables) and survives an aggressive set of controls. Interestingly, this correlation is statistically independent of what was designed to be a good marker of saving and thrift as a cultural value. This suggests that the channel through which language affects the propensity to save is largely independent of the saving as a self-reported value. Later, I will discuss what this non-attenuation result suggests about the causal link between language and savings behavior.

Next, I look at which countries in the WVS have numerous native speakers of both weak and strong-FTR languages. Figure 1 plots the percent of households who reported savings for countries in the WVS, organized by what percent of the country's survey respondents report speaking a strong-FTR language at home.

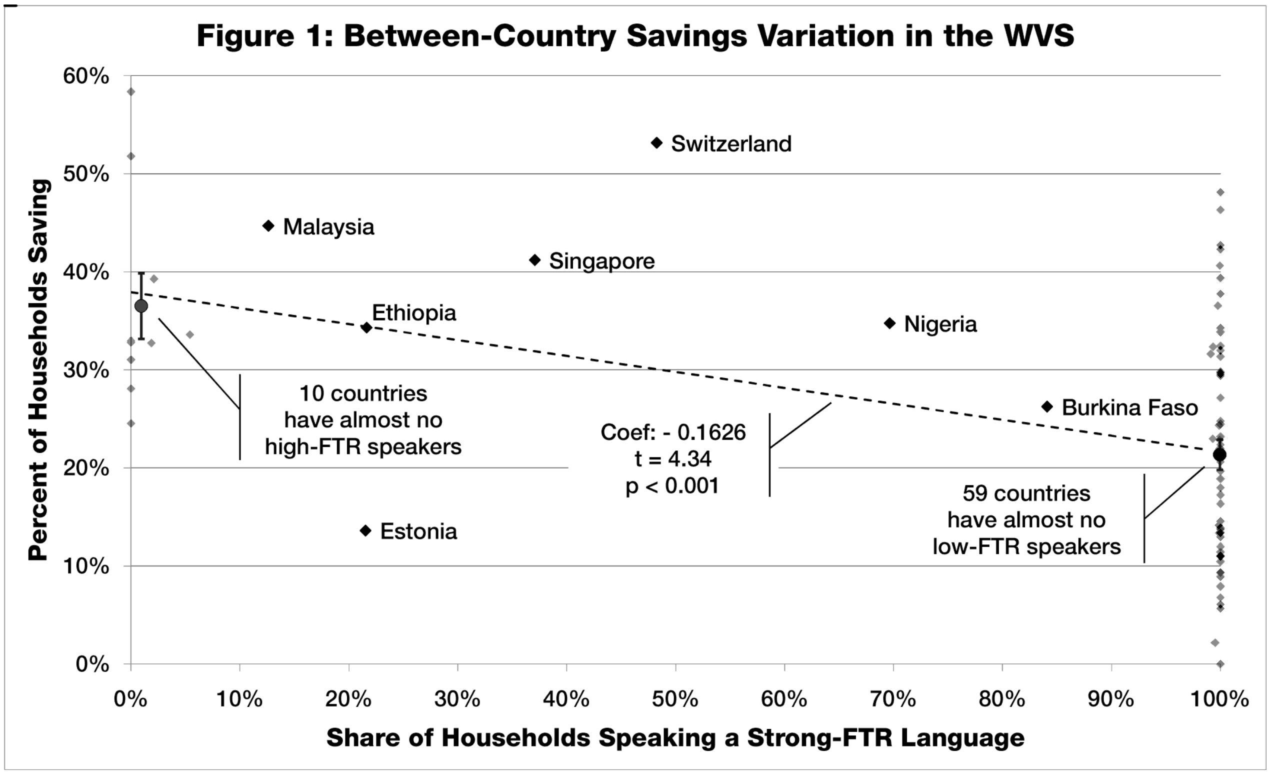

Figure 1 plots the least-squares regression of the percent of a country which reports saving on the percent of that country which speaks a strong-FTR language at home. The large number of countries with extreme strong-FTR percentages (< 5% and > 95%), are summarized by their means and standard errors.

As Figure 1 shows, the between-country relationship between savings and language is both clear and highly significant in the WVS. However, the vast majority of countries (69 of 76) have basically no intra-country variation in FTR. This is because in most countries one language dominates, and in most countries with multiple languages those languages share a common FTR structure. For example, even though Canada has both large English and French speaking populations, both French and English are strong-FTR languages.

In 7 of 79 WVS countries however, at least 5% of the population speak languages that has a different FTR structure than the majority. These are the countries which provide the majority of identification for the full fixed-effect regressions. Table 2 enumerates these countries, and reports the coefficient on *Strong FTR* when my regression with the most aggressive controls (regression 6 from Table 1) is estimated in only that country. Also listed are the percents of the sample that speak either strong or weak-FTR languages in that country, the languages they speak, and the sample size of that country-specific regression.

Table 2: Countries with Large Within-Country FTR Differences in the WVS

Country	Weak-FTR Languages	%	Strong-FTR Languages	%	Coef. and SE on Strong FTR	N
Burkina Faso	Dyula	16	French, Fula, Moore	84	0.700, [0.391]	137
Estonia	Estonian	78	Russian	22	0.000, [0.000]	31
Ethiopia	Amharic, Oromo, Sidamo	78	Chaha, Gamo, Tigrinya	22	0.825, [0.359]	208
Malaysia	Malay, Mandarin	87	English, Tamil	13	0.742, [0.230]	449
Nigeria	Yoruba	30	English, Hausa, Igbo	70	0.764, [0.355]	121
Singapore	Malay, Mandarin	63	English, Tamil	37	0.821, [0.151]	664
Switzerland	German	52	French, Italian	48	0.362, [0.132]	172

Coefficients (reported as odds ratios) are from fixed-effect (or conditional) logistic regressions with the same specification as regression 6 in Table 1. Listed languages are the most common weak and strong-FTR languages in that country; percents are the share of that country's sample that speak weak and strong FTR languages. Immigrants are excluded from all regressions.

Notably, all 7 regressions display coefficients less than 1, consistent with our overall effect. The coefficient in Estonia is 0 because in that regression, no Estonian speaker who was able to be matched with a Russian speaker reported not saving. Other than this outlier (which is largely driven by the small sample size in Estonia) the estimated effect is remarkably stable across this set of countries, which span multiple continents, regions, and sets of languages.

To confirm this and to explore the robustness of my initial results to additional controls, I estimate an additional set of regressions summarized in Table 3. First, I estimate the full regression (regression 6 in Table 1) separately in the 72 countries with little, and the 7 countries with sizable within-country FTR variation. I also examine whether these results are being driving by minority languages, by including as additional regressors for each household both the share of a country's speakers who speak their language, and the share that speak a language with the same FTR structure. Finally, I add as an additional control fixed-effects for self-reported religious denomination (74 in total), interacted with all of our previous fixed effects.

Table 3: Additional Control Regressions in the WVS

	(1)	(2)	(3)	(4)	(5)
	Saved	Saved	Saved	Saved	Saved
Strong FTR	0.934	0.678	0.679	0.528	0.529
	[0.261]	[0.100]**	[0.101]**	[0.115]**	[0.115]**
Unemployed	0.692	0.637	0.688	0.749	0.748
	[0.046]**	[0.155]	[0.044]**	[0.068]**	[0.067]**
Trust	1.071	1.273	1.083	1.068	1.068
	[0.046]	[0.136]*	[0.044]	[0.051]	[0.051]
Saving is Important	1.124	0.979	1.110	1.057	
(to teach children)	[0.047]**	[0.082]	[0.043]**	[0.060]	
Language Share			0.759	0.700	0.699
			[0.119]	[0.129]	[0.130]
FTR Share			1.071	0.467	0.461
			[0.190]	[0.193]	[0.192]
Full set of FEs					
from Table 1	Yes	Yes	Yes	Yes	Yes
Religion FEs	No	No	No	Yes	Yes
All FEs Interacted	Yes	Yes	Yes	Yes	Yes
Country's FTR Variation	< 5% (69)	> 5% (7)	All	All	All
Observations	21,876	1,782	23,658	13,263	13,263

Regressions are fixed-effect (or conditional) logistic regressions with coefficients reported as odds ratios. Immigrants are excluded from all regressions. Robust standard errors are reported in brackets; all regressions are clustered at the country level. * significant at 5%; ** significant at 1%.

Regressions 1 and 2 confirm our intuition that only the seven countries enumerated in Table 2 have enough within country variation to identify our full regression with country fixed effects. The coefficient of 0.678 is statistically indistinguishable from the coefficient of 0.697 I measure when the regression is run on the whole sample.

Returning to the whole sample: as an additional control, regressions 3, 4 and 5 adds controls for the share of a country which speaks a household's language, and what share speak a language with the same FTR level. These results demonstrates that the effect of language is not driven either by minority languages nor by minority FTR structures. Regressions 4 and 5 include additional fixed-effects for religious denomination (74 in total), interacted with all of our previous fixed effects. This inclusion does not attenuate the effect of language; comparing regression 3 to 4, the measured effect actually increases by 15%. Comparing regression 4 to 5 replicates our earlier non-attenuation finding: the addition saving as a self-reported value does not attenuate the main language effect. After the inclusion of religious controls both "trust" and saving as a cultural value attenuate enough to become statistically insignificant, while the effect of language, if anything, strengthens.

5.2 Language and Retirement Assets in Europe

If individuals who speak strong-FTR languages save less in any given year, then we would expect them to accumulate less savings over time. My next set of regressions examines the cumulative retirement assets of individuals in the retired households in the SHARE. Table 4 summarizes regressions which estimate the equation:

$$ra_{it} = \alpha + \beta_1 StrongFTR + \beta_2(F_{it}^{ex} \times F_{it}^{en} \times F_t^c) + \varepsilon_{it} \qquad (10)$$

In equation 10 the dependant variable ra_{it} is the estimated value of a retired household's net worth, including all real assets (homes, businesses and cars), and financial assets (money, stocks, bonds, and life insurance), minus any debt. Unfortunately, unlike the WVS, the SHARE does not ask households what language they speak at home. Here, the main variable of interest $StrongFTR$ is coded using the language that the head of household asked to take the survey in.

The F variables are sets of fixed effects that are jointly interacted to form groups similar to those in my analysis of the WVS. That is, households are compared only with others who are identical on every F variable, but who asked to take the survey in a different language. F_{it}^{ex} is my set of exogenous fixed effects; here it is the age of the head of household. F_{it}^{en} is a set of fixed effects that are likely endogenous to a household's discount rate, such as income, education and family structure. F_t^c is a set of country-wave fixed effects. Empirical estimates of equation 10 are presented in Table 4; all coefficients are reported in base-year Euros.[21]

Table 4: Household Retirement Assets (SHARE)

	(1)	(2)	(3)	(4)	(5)
	HHAssets	HHAssets	HHAssets	HHAssets	HHAssets
Strong FTR	-154,515	-150,498	-145,151	-173,880	-178,744
	[68,481]*	[12,703]**	[15,656]**	[9,723]**	[25,300]**
Fixed Effects:					
Age	Yes	Yes	Yes	Yes	Yes
Country × Wave	No	Yes	Yes	Yes	Yes
Income	No	No	Yes	Yes	Yes
Education	No	No	No	Yes	Yes
Married × Num Chil	No	No	No	No	Yes
All FEs Interacted	Yes	Yes	Yes	Yes	Yes
Observations	39,665	39,665	39,665	39,665	39,350
F stat	5.09	140.37	85.96	319.81	49.91

Regressions are fixed-effect OLS regressions where the dependent variable is net household retirement assets in Euros. Immigrant households are excluded from all regressions. Robust standard errors are reported in brackets; all regressions are clustered at the country level. * significant at 5%; ** significant at 1%.

Regressions 2 through 5 identify only off of within-country variation in language. These regressions are identified almost entirely off the fact that Belgium has large Flemish (weak-FTR) and French (strong-FTR) speaking populations, and Switzerland has large German (weak-FTR), and French, Italian, and Romansh (strong-FTR) speaking populations.

[21] Details on variable construction: Age is coded in ten-year bins, Income is coded as an intra-country decile, and Education falls within one of 8 categories provided in the SHARE. For more details on the construction of variables and the measuring of household net-worth in the SHARE, see Börsch-Supan and Jürges (2005).

Regressions 1 through 5 show our predicted effect; retired households that speak strong-FTR languages have saved around 170 thousand Euros less by the time they retire. Looking at regressions 1 and 2, we see that the addition of country fixed effects does not significantly attenuate the effect of language. The differences in cross-country in savings attributable to language appear to be roughly the same size as the differences between different FTR groups within Belgium and Switzerland.[22]

Table 5 summarizes regressions that contain the same set of demographic fixed effects as in Regression 5 from Table 4, but increase the level of spatial control by including fixed effects for intra-country regions. This allows us to examine whether language may be proxying (even within country) for unobserved differences between regions, counties or even cities. If for example, families tend to segregate across regions by language, then I may be attributing institutional differences between regions to language.

Table 5: Household Retirement Assets in Belgium and Switzerland

	(1) HHAssets	(2) HHAssets	(3) HHAssets	(4) HHAssets	(5) HHAssets
Strong FTR	-178,744	-187,424	-256,369	-105,840	-147,410
	[44,038]**	[39,268]**	[318,346]	[338,223]	[744,983]
Full set of FEs from Table 4	Yes	Yes	Yes	Yes	Yes
Region FEs	2 (BE & CH)	1	11	1	7
All FEs Interacted	Yes	Yes	Yes	Yes	Yes
Country	BE & CH	Belgium	Belgium	Switzerland	Switzerland
Observations	5,937	4,394	4,393	1,543	1,543
F stat	16.47	22.78	2.44	0.10	0.16

Regressions are fixed-effect OLS regressions where the dependent variable is net household retirement assets in Euros. Immigrant households are excluded from all regressions. Robust standard errors are reported in brackets; all regressions are clustered at the household level. * significant at 5%; ** significant at 1%.

Comparing regressions 2 and 3 (in Belgium) and regions regressions 4 and 5 (in Switzerland) shows that the addition of finer spatial controls (in the form of region dummies) does not appear to attenuate the effect of language on retirement savings. This suggests that the language effect we are measuring is not explained by unobserved spatial differences, at least not on the level we are able to capture with the regions coded in the SHARE.

5.3 Language and Health

The SHARE, in addition to measuring household wealth, also asks each member of the household about their health behaviors and records several measures of physical health. I look at these measures next, since if a languages affect their speakers intertemporal choices, this should also have implications for their speakers' health behaviors and long-run health. More specifically, if obligatory FTR reduces the psychological importance of the future, we would predict that it would lead to more smoking, less exercise, and worse long-run health.

To investigate this, Table 6 summarizes regressions investigating the effect of FTR on health variables found in the SHARE. Some of these measures are binary, such as ever having smoked

[22] The average net-household assets in the SHARE is 347 thousand Euros, but the coefficients in Table 2 are estimated almost entirely off of Switzerland and Belgium, which are higher (695K and 374K Euros, respectively). Swiss household net assets were recorded in Francs, which I convert to Euros using the average rate in the year the survey was taken (1.534 and 1.621 in waves 1 and 2 of the SHARE).

heavily, remaining physically active, and being medically obese. For these regressions I estimate fixed-effect logit model similar to equation 9. The other measures I examine, walking speed, grip strength, and peak expiratory flow, are commonly studied measures of long-run health. These measure the spread at which a person comfortably walks, the maximum among of force they can apply while squeezing a dynometer, and their maximum exhalatory air flow (lung strength). For these regressions I estimate fixed-effect OLS regressions similar to equation 10.

Table 6: Health Behaviors and Measures of Health (SHARE)

	(1)	(2)	(3)	(4)	(5)	(6)
	Smoked	Phy Act	Obesity	Walk Sp	Grip Str.	Peak Flow
Strong FTR	1.241	0.709	1.131	-0.028	-0.899	-16.083
	[0.042]**	[0.025]**	[0.007]**	[0.101]	[0.049]**	[2.806]**
Full set of FEs from Table 4	Yes	Yes	Yes	Yes	Yes	Yes
All FEs Interacted	Yes	Yes	Yes	Yes	Yes	Yes
Observations	15,750	9,135	11,958	6,038	51,571	26,836
R-squared				0.85	0.84	0.73

Regressions 1, 2, and 3 are fixed-effect (or conditional) logistic regressions with coefficients reported as odds ratios. The dependent variables are having ever smoked daily for a year or more, engaging in regular physical activity, and being medically obese. Regressions 4, 5, and 6 are fixed-effect OLS regressions for measures of old-age health; walking speed (m/sec), grip strength (kg), and peak expiratory flow(L/min). Immigrants are excluded from all regressions. Robust standard errors are reported in brackets; all regressions are clustered at the country level. * significant at 5%; ** significant at 1%.

Regression 1 indicates that a strongly grammaticalized FTR leads to a 24% higher probability of having ever smoked (daily for a year or more). This is consistent with our findings on savings if the decision to smoke trades off immediate benefits versus future health costs. Similarly, regression 2 indicates that a strong-FTR language leads to a 29% lower probability of being physically active. Regressions 3, 4, 5, and 6 examine the effect of strong FTR on long-run measures of health. While there appears to be no effect on walking speed, speaking a strong-FTR language is associated with a 13% higher probability of being medically obese, a reduction in grip strength of almost a kilogram, and a reduction in peak expiratory flow of 16 liters per minute.

5.4 Linguistic Effects on National Savings Rates in the OECD

The evidence on both individual and household behavior we have presented so far supports our hypotheses that strongly grammaticalized FTR languages are associated with less future-oriented choices by its speakers. If my hypothesis about language and willingness to save is true however, it would also have implications for aggregate behavior. It seems natural to expect that countries in which strong-FTR languages are spoken would have both lower equilibrium household savings, and (to the degree governments aggregate individual preferences) government savings.[23] Figure 2, which graphs the relationship between language and savings rates for OECD countries (without any controls), suggests that the results we find amoung households also seem to hold for national savings rates.

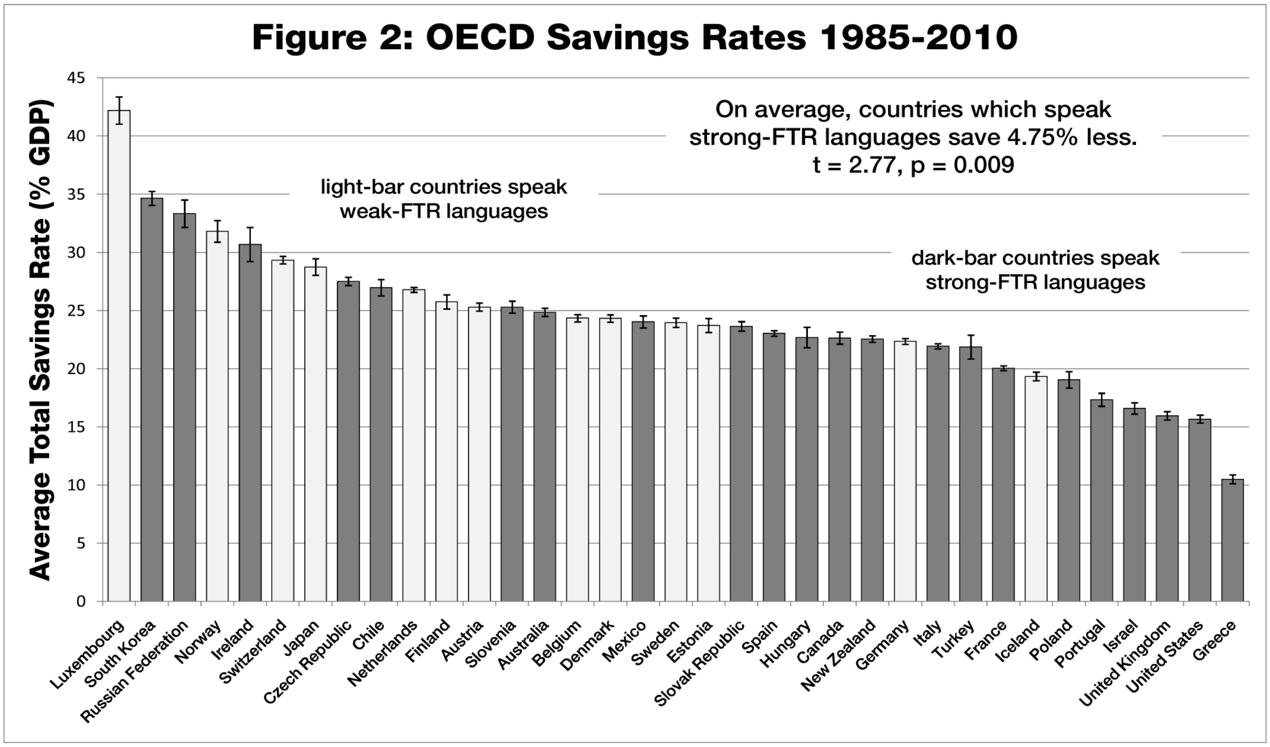

Figure 2 shows average total savings rates, accounting for both private and government consumption. Data from before 1985 are included in the regressions below but excluded here to normalize time periods across countries. Both Switzerland and Belgium have significant within-country FTR variation; for simplicity they are shaded according to their majority-FTR status. Difference in means are computed using a OLS regression where observations are clustered at the country level.

[23] This prediction does not immediately follow from theory, however. Samuelson (1937) showed that when the duration of a potential project is fixed, the value of that project may not be even weakly decreasing in the interest rate. Arrow and Levhari (1969) established that if an agent controls when a project terminates, then in deterministic settings the natural monotonic relationship must hold; the value of investment in projects must be monotonically decreasing in the interest rate. In Hick's book *Capital and Time* (1973), this is referred to as the *Fundamental Theorem of Capital*. Under the conditions for which this relationship holds then, it is natural to predict that countries with strong FTR languages will, on average, save less.

Table 7 summarizes a first set of regressions which comprise a more careful test of this prediction. These regressions closely follow Barrow and McDonald (1979), who run similar regressions on the same OECD national savings data that we investigate here. The basic functional form of these regressions is:

$$((Y - C)/Y)_{it} = \alpha_0 + \alpha_1(StrongFTR)_i + \alpha_2(1/Y)_{it} + \alpha_3(Y_{t-1}/Y_t)_{it} + \alpha_4(CAGR)_i + \varepsilon_{it} \quad (11)$$

where annual observations for each country in the OECD are indexed by country $i = 1, ..., 35$ and year $t = 1970, ..., 2009$. Details on the construction of each variable can be found in the Data Appendix, most importantly: C is total consumption (including government expenditure) while Y is GDP, $CAGR$ is the average growth rate of the country from 1993 to 2009 (the earliest date for which data is available for all countries), and $StrongFTR$ is weighted by the percent of the country's population reports speaking each of their major languages.

This form of this savings equation is a simple linear relation that is based on simple forms of the Life-Cycle Hypothesis (LCH) of savings (see Modigliani 1986 for a review of the LCH). Notice that as equation 11 is written, all terms in the savings equation except $(1/Y)_{it}$ imply that a savings function that is homogeneous of degree 0, which is to say that the savings rate is independent of the level or unit of income. This assumption has theoretical support in the LCH model, and allows for a specification in which units of measurement do not need to be comparable across countries. It may be violated if, as Feldstein (1977) points out, higher incomes lead to a increase in the share of life spent in retirement. This leads to the presence of the $1/Y_{it}$ term, which can test for such effects as measured by a positive α_2. Essentially this term allows the marginal propensity to consume out of income to differ by the level of development of a country. In addition, OECD data allows for the inclusion of a number of important demographic controls:

$$\alpha_5(Unemployment)_{it} + \alpha_6(Old)_{it} + \alpha_7(Young)_{it} + \alpha_8(SocSec)_{it}$$

These control for the unemployment rate, the fraction of the population that are over 65, the fraction under 15, and the per-capita fraction of GDP spent on social security payments (defined as % GDP spent on disability, old age, and survivors benefits divided by the fraction of the population that are over 65). Empirical estimates of equation 11 are presented in Table 7.

Table 7: Gross Domestic Savings Rates in the OECD

	(1) GDSR$_t$	(2) GDSR$_t$	(3) GDSR$_t$	(4) GDSR$_t$	(5) GDSR$_t$
Strong FTR	-8.035	-5.518	-5.309	-6.020	-4.556
	[2.813]**	[1.503]**	[1.786]**	[1.284]**	[1.496]**
PCGDP$_{t-1}$ / PCGDP$_t$	-37.106	-23.486	-20.016	-22.006	-14.269
	[10.179]**	[6.645]**	[7.423]*	[5.714]**	[4.017]**
CAGR	-0.110	-0.248	-0.302	-0.162	-0.010
	[0.096]	[0.039]**	[0.125]*	[0.088]	[0.284]
Unemployment$_t$ (%)	-0.061	-0.344	-0.163	-0.071	-0.009
	[0.237]	[0.177]	[0.174]	[0.132]	[0.131]
Old$_t$ (%)	-1.186	-1.077	-1.222	-1.079	-1.210
	[0.408]**	[0.327]**	[0.356]**	[0.336]**	[0.187]**
Young$_t$ (%)	-0.464	-0.856	-0.993	-0.644	-0.341
	[0.337]	[0.277]**	[0.313]**	[0.301]*	[0.293]
1 / PCGDP$_t$		136.863	143.727	37.142	-62.222
		[48.654]**	[57.394]*	[43.588]	[62.488]
Soc Sec$_t$ (%GDP / Old)			-4.184	-4.004	-5.990
			[2.872]	[1.733]*	[2.371]*
Protestant				-4.309	-3.005
				[0.816]**	[1.135]*
Common Law					1.960
					[1.453]
Fixed Effects:	None	None	None	None	Region (7)
Observations	904	904	614	614	614
R-squared	0.56	0.67	0.66	0.76	0.81

Regressions are OLS regressions where the dependent variable is a country's Gross Domestic Savings Rates in year t. Observations are for OECD countries from 1970 to 2009. Protestant is a binary variable which measures if the country is majority protestant or not, and Common Law is a binary variable which measures whether a country has a common-law system (vs. civil law). All regressions are weighted by the population of the country in that year. Robust standard errors are reported in brackets and clustered at the country level. * significant at 5%; ** significant at 1%.

Regression 1 estimates a version of equation 11 that is fully homogeneous of degree 0; regressions 2 through 5 add 1 / PCGDP$_t$ which allows savings rates to vary with the size of the economy and not just its short and long-run growth rates. These regressions suggests that countries with a strong-FTR language save on average around five percentage points less per year than do countries with weak-FTR language, a result consistent with our earlier results on household savings and health measures. Regression 5 adds controls commonly found in the literature on economic growth: Protestantism and the presence of a common-law legal regime.[24] Regression 5 also includes region fixed-effects, where the OECD countries are apportioned into 7 regions: Australia, E & W Europe, the Middle East, N & S America, and SE Asia. Overall, the measured effect of FTR on national savings rates is stable to the inclusion of these controls.

[24] A large literature has argued that common-law countries provide stronger protection of outside investors from expropriation by corporate insiders; see La Porta 2008 for an excellent survey.

5.5 Language and Savings in the OECD: Robustness Checks

To get a sense of the stability of my measured effect over time, I re-estimate equation 11 separately for each decade that OECD data is available. These estimates are reported in Table 8.

Table 8: Gross Domestic Savings Rates in the OECD by Decade

	(1)	(2)	(3)	(4)	(5)
	$GDSR_t$	$GDSR_t$	$GDSR_t$	$GDSR_t$	$GDSR_t$
Strong FTR	-5.518	-3.726	-6.608	-5.116	-5.325
	[1.503]**	[1.613]*	[1.861]**	[2.184]*	[1.829]**
$PCGDP_{t-1}$ / $PCGDP_t$	-23.486	-23.355	-19.889	-17.361	-22.252
	[6.645]**	[9.968]*	[17.093]	[11.767]	[11.163]
CAGR	-0.248	0.452	-0.220	-0.490	-0.162
	[0.039]**	[0.524]	[0.281]	[0.330]	[0.046]**
$Unemployment_t$ (%)	-0.344	-0.682	-0.112	-0.091	-0.632
	[0.177]	[0.323]	[0.171]	[0.197]	[0.253]*
Old_t (%)	-1.077	-1.689	-1.097	-1.950	-1.079
	[0.327]**	[0.445]**	[0.349]**	[0.399]**	[0.496]*
$Young_t$ (%)	-0.856	-1.041	-0.457	-1.018	-1.302
	[0.277]**	[0.238]**	[0.378]	[0.290]**	[0.403]**
1 / $PCGDP_t$	136.863	174.466	108.626	92.323	184.817
	[48.654]**	[36.509]**	[56.251]	[49.834]	[59.888]**
Years:	All	1970-79	1980-89	1990-99	2000-09
Observations	904	103	185	290	326
R-squared	0.67	0.92	0.80	0.70	0.55

Regressions are OLS regressions where the dependent variable is a country's Gross Domestic Savings Rates in year t. All regressions are weighted by the population of the country in that year. Robust standard errors are reported in brackets and clustered at the country level. * significant at 5%; ** significant at 1%.

While statistical power becomes an issue when subdividing these data, the measured effect of language on savings rates appears stable across time, and is significant in every decade. Earlier regressions have fewer observations due to OECD expansion in the 1980's and early 1990's. Increasing membership in the OECD also makes it hard to compare coefficients across time periods; however in a pooled regression the interactions between language and decade dummies are insignificant.

Another concern with the result that strong-FTR countries tend to save more is that the FTR strength of countries is spatially correlated. In Western Europe for example, most strong-FTR countries are in the northern half of the continent. This leads to the possibility that (at least in Western Europe), the effects I attribute to strong FTR could actually be due to correlated spatial factors (like climate or distance from Mediterranean trade routes) which lead northern-European countries to save more than their southern-European counterparts. Similar stories might also invalidate our results on other continents.

To examine whether these types of spatial confounds are a concern, I re-estimate equation 11 while restricting the regression to various regions of the OECD, and include an additional control variable, "distance from equator". This is the distance from a country's capital to the equator in thousands of miles. If the effects of language reported in Tables 7 and 8 were actually due to spatial factors, we might expect these regressions to show an attenuated coefficient on language. Table 9 reports the results of these regressions.

Table 9: Gross Domestic Savings Rates in the OECD by Region

	(1) GDSR$_t$	(2) GDSR$_t$	(3) GDSR$_t$	(4) GDSR$_t$	(5) GDSR$_t$
Strong FTR	-5.518	-5.578	-7.343	-8.951	-16.31
	[1.503]**	[1.456]**	[1.814]**	[4.634]	[5.560]*
PCGDP$_{t-1}$ / PCGDP$_t$	-23.486	-24.360	-35.846	-2.111	-23.717
	[6.645]**	[5.504]**	[4.326]**	[8.143]	[8.045]*
CAGR	-0.248	-0.246	0.117	-0.191	1.169
	[0.039]**	[0.040]**	[0.624]	[0.085]	[0.608]
Unemployment$_t$ (%)	-0.344	-0.329	0.070	-0.642	-0.433
	[0.177]	[0.185]	[0.119]	[0.120]**	[0.234]
Old$_t$ (%)	-1.077	-1.061	-0.157	-1.158	-1.103
	[0.327]**	[0.335]**	[0.379]	[0.698]	[0.315]**
Young$_t$ (%)	-0.856	-0.859	0.607	-1.017	-0.798
	[0.277]**	[0.277]**	[0.334]	[0.443]	[0.350]
1 / PCGDP$_t$	136.863	135.863	-163.861	19.524	127.156
	[48.654]**	[49.985]*	[87.815]	[37.737]	[79.621]
Dist from Equator		-0.277	-5.007	-2.300	9.766
(1K miles)		[0.983]	[2.050]*	[3.485]	[4.260]
Region:	All	All	W EU	E EU & Mid. East	All others
Observations	904	904	539	109	256
R-squared	0.67	0.67	0.41	0.73	0.85

Regressions are OLS regressions where the dependent variable is a country's Gross Domestic Savings Rates in year t. Observations are for OECD countries from 1970 to 2009. Regression 3 includes: Austria, Belgium, Denmark, Finland, France, Germany, Great Britain, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, and Switzerland. Regression 4 includes: Czech Republic, Estonia, Hungary, Israel, Poland, Russian Federation, Slovak Republic, Slovenia, and Turkey. Regression 5 includes: Australia, Canada, Chile, Japan, Mexico, New Zealand, South Korea, and the United States. All regressions are weighted by the population of the country in that year. Robust standard errors are reported in brackets and clustered at the country level. * significant at 5%; ** significant at 1%.

The results in Table 9 suggest that spatial confounds (at least those related to Latitude) seems unlikely. Regressions 2 through 5 demonstrate that the effects I attribute to language are not attenuated by the addition of "distance from equator", neither in Western Europe nor in any other major OECD region. Comparing regressions 1 and 2, we see that the effect of language on savings is unchanged by the addition of Latitude controls. If anything, comparing regressions 1 and 2 suggests that the inclusion of "distance from equator" strengthes the measured effect of language.

Interestingly, the coefficient on "dist from equator" in regression 3 is the opposite sign of the common observation that northern-European countries tend to save more than their southern counterparts. Quite the contrary, I find that when language controls are included, European countries save on average 5 percentage of their GDP *less* for every thousand miles further north they lie. To further investigate this finding, I re-estimate equation 11 restricted to Western Europe, examining what effect the inclusion and removal of language controls have on the measured effect of distance from the equator. Table 10 details these regressions.

Table 10: Language and Latitude in Western Europe

	(1)	(2)	(3)	(4)	(5)
	$GDSR_t$	$GDSR_t$	$GDSR_t$	$GDSR_t$	$GDSR_t$
Dist from Equator	0.980	1.510	-5.007	-2.582	-4.786
(1K miles)	[1.999]	[1.675]	[2.050]*	[2.002]	[2.095]
Strong FTR			-7.343		
			[1.814]**		
$PCGDP_{t-1}$ / $PCGDP_t$		-29.947	-35.846	-34.836	-34.282
		[6.735]**	[4.326]**	[4.986]**	[7.738]**
CAGR		-0.130	0.117	1.266	-0.576
		[0.707]	[0.624]	[0.381]**	[0.961]
$Unemployment_t$ (%)		-0.084	0.070	-0.391	0.209
		[0.173]	[0.119]	[0.148]*	[0.157]
Old_t (%)		-1.103	-0.157	-0.036	-0.455
		[0.444]*	[0.379]	[0.321]	[0.688]
$Young_t$ (%)		-0.539	0.607	-0.035	0.254
		[0.387]	[0.334]	[0.288]	[0.289]
1 / $PCGDP_t$		-71.439	-163.861	-106.322	-100.616
		[98.879]	[87.815]	[67.106]	[155.671]
FTR of Country:	All	All	All	Weak	Strong
Observations	720	539	539	323	216
R-squared	0.01	0.19	0.41	0.58	0.24

Regressions are OLS regressions where the dependent variable is a country's Gross Domestic Savings Rates in year t. Observations are for Western-European OECD countries from 1970 to 2009. Regression 4 includes: Austria, Belgium, Denmark, Finland, Germany, Iceland, Luxembourg, Netherlands, Norway, Sweden, and Switzerland. Regression 5 includes: France, Great Britain, Greece, Ireland, Italy, Portugal, and Spain. Regressions 1, 2, and 3 include both sets of countries. All regressions are weighted by the population of the country in that year. Robust standard errors are reported in brackets and clustered at the country level. * significant at 5%; ** significant at 1%.

These regressions suggest that what is often thought of as a north-versus-south divide in European savings rates may be better explained by language than geography. In specific, language patterns appear to induce an *aggregation reversal* in savings rates. That is, while northern-European countries tend to save more that southern-European countries; after controlling for language the opposite is true (countries save more the further South they are). The coefficient in regression 2 can be interpreted as saying that holding economic conditions constant, a western-European country saves 1.5% of GDP more per year for every one thousand miles more north their capital lies (though this effect is not statistically significant). However after controlling for "strong FTR" in regression 3 the sign flips: a country saves on average 5% *less* for every thousand miles it lies further north. Regressions 4 and 5 demonstrate this reversal more directly; within both sets of western European countries (strong and weak-FTR), countries that lie further north save less than their southern counterparts.

6 Discussion

6.1 Language, Thought, and Behavior

The idea that language can impact the way people think and act has a rich history in economics, linguistics, philosophy, and psychology. Saussure, the founder of both structural linguistics and semiotics, characterizes reality is an inherently continuous phenomena that is discretized and organized by language, writing: "if words stood for pre-existing entities they would all have exact equivalents in meaning from one language to the next, but this is not true" (Saussure 1916). In his *Tractatus Logico-Philosophicus* (1922), Wittgenstein formulates a theory of language as the means by which people both picture and reason about reality, famously concluding: "*Wovon man nich sprechen kann, darüber muss man schweigen*" (Whereof one cannot speak, thereof one must be silent).

More recently, the idea that language can influence thought has become know as the Sapir-Whorf hypothesis (SWH, Whorf 1956). Brown (1976) first enumerates what has become known as the *weak* SWH,[25] which claims that differences in linguistic categorization can systematically affect cognition. This hypothesis has generated several interesting lines of research in cognitive linguistics and psychology, which have found robust effects across a number of cognitive domains. Since my hypothesis that strong-FTR languages will lead speakers to hold more precise beliefs can be thought of as an instance of the weak SWH, I briefly review major SWH findings.

6.1.1 Language, Attention, and Precision of Beliefs

Experimental research on the link between language and thought has focused primarily on the relationship between language and two phenomena: metaphors between space and time, and color perception. For example, Tversky, Kugelmass, & Winter (1991) finds that English speakers spontaneously organize time as moving from left to right while Hebrew speakers organize time from right to left: both following the direction in which their languages write. Even more interestingly, speakers of cardinal-direction languages (who when facing North are obliged to refer to their left hand as their "west" hand), spontaneously organize time as running from east to west (Boroditsky & Gaby 2010).

More closely related to my hypothesis are several sets of findings that show that linguistically-obligatory color distinctions are correlated with precision of beliefs. Differences in how finely languages partition the color spectrum are widespread; MacLaury (1992) summarizes a large set of cross-linguistic surveys which find that languages around the wold possess anywhere from 2 to 11 "basic color terms".[26] In one of the first studies examining the cognitive correlates of these differences, Brown and Lenneberg (1954) find that both English and Zuñi speakers have trouble remembering nuanced differences in colors that are not easily definable by their language.[27] For example, Zuñi speakers (who classify green and blue together) have trouble remembering nuanced differences between blue/green colors.

More recent studies have confirmed the direct role of language in these findings. Russian makes an obligatory distinction between light blue (*goluboy*) and dark blue (*siniy*). Winawer et al. (2007) finds: Russian speakers do better than English speakers in distinguishing blues when the two colors

[25] Brown (1976) distinguishes the weak Sapir-Whorf hypothesis: "structural differences between language systems will, in general, be paralleled by nonlinguistic cognitive differences" from the strong: "The structure of anyone's native language strongly influences or fully determines the world-view he will acquire as he learns the language".

[26] MacLaury (1992) defines 'basic color terms' as: "the simplest forms of broadest meaning that most speakers of a language will routinely apply to colors in any context".

[27] The Zuñi (one of the Pueblo peoples), are a Native-American tribe that live primarily in western New Mexico.

span the *goluboy*/*siniy* border (but not when then do not), and these differences are eliminated when subjects must simultaneously perform a verbal (but not a spatial) distractor task. Further implicating language in this differential precision, Franklin et al. (2008) finds that this difference holds for adults, but not for pre-linguistic infants.

Similar correlations have been found between linguistic categorization and spatial perception. Levinson (2003) summarizes a large literature which studies the relationship between the way a languages express direction and position, and the relative ease with which speakers can solve puzzles requiring a particular spatial transformation. From Levinson:

> "In a nutshell: there are human populations scattered around the world who speak languages which have no conventional way to encode 'left', 'right', 'front', and 'back' notions, as in 'turn left', 'behind the tree', and 'to the right of the rock'. Instead, these peoples express all directions in terms of cardinal directions, a bit like our 'East', 'West', etc. Careful investigation of their non-linguistic coding for recall, recognition, and inference, together with investigations of their deadreckoning abilities and their on-line gesture during talk, shows that these people think the way they speak, that is, they code for memory, inference, way-finding, gesture and so on in 'absolute' fixed coordinates, not 'relative' or egocentric ones."

Most notably, Boroditsky & Gaby (2010) find that cardinal-direction language speakers do much better than English speakers when asked to point which way 'North' is. That is, speakers who are required to categorize space in terms of cardinal direction, encode their current physical orientation with much more precision.

Also relevant to my hypothesis, several papers have studied the question of how children acquire the ability to speak about and conceptualize time. Harner (1981) finds that among English-speaking children, the use of the future tense begins by age 3 and is relatively developed by age 5. Szagun (1978) finds that the time-path of this development is identical in matched pairs of English and German children, with these pairs of children showing no discernible difference in the rate at which they acquire and use the future tense. Since English is a strong-FTR language while German a weak-FTR language, this suggests that differences between languages in FTR do not manifest in early language acquisition. The FTR difference between English and German is reflected in Szagun's study, but only among adults: the German-speaking parents of the children Szagun studied used FTR much less often than their English-speaking counterparts. While far from conclusive, this suggests that the differences that I study between weak and strong-FTR languages do not reflect either innate cognitive nor cultural differences between speakers of different languages, at least as reflected in the development of children through age five.

6.1.2 Scepticism of the Weak Sapir-Whorf Hypothesis

While these studies have been taken to support the weak SWH, there are a large number of scholars who argue that on balance, the idea that cognition is shaped by language is misguided. Many of the most persuasive arguments against a Whorfian interpretation of experimental data come from linguists and anthropologists who subscribe to the Chomskyan school of linguistics.

In his seminal work *Syntactic Structures* (1957), Chomsky argues that humans have an innate set of mechanisms for learning language, and that this constrains all human languages to conform with a "universal grammar". Taken in strong form, this implies that all languages share the same underlying structure, which severely curtails the scope for differences in language structure to affect cognition. In his book *The Language Instinct* (1994), Pinker argues exactly this: that humans do not think in the language we speak in, but rather in an innate "mentalese" which precedes natural language. He concludes that: "there is no scientific evidence that languages *dramatically* shape their speakers' ways of thinking" (emphasis mine).

In an influential study, Berlin and Kay (1969) apply this type of critique to the color-categorization studies I discuss above. They argue that differences in how languages divide the color spectrum do not support the weak SWH, arguing that languages around the world share many common color-naming tendencies, and that these tendencies map onto human color-vision physiology. For example, Berlin and Kay note that all languages have basic terms for 'black' and 'white', and if they have a third it always contains 'red'. While Berlin and Kay's universal theory of color has needed to be revised in light of newly discovered languages (MacLaury 1992), color-categorization support for the weak SWH remains an hotly debated topic (see Wierzbicka 2008).

6.1.3 Work on Language in Economics

Work on language in economics has primarily focused on whether language, either by evolution or design, maximizes some objective function. Mandelbrot (1959) proved what Zipf (1943) speculated: that the observed power-law distribution of word frequency can arise from a "principle of least effort", in which language evolves to minimize the cost of communication for a given rate of information. Marschak (1965) broadens this analysis to ask both what linguistic traits will be selected as languages evolve, and what objectives policy makers should have in mind when shaping a language, either directly (as in the case of the *Académie française)*[28] or through educational policy. More recently, Lipman (2009) asks what signaling game could (in equilibrium) give rise to the ubiquitous use of vague terms such as "tall". Closest in objective to this paper, Rubinstein (2000) writes down a model in which decision makers use language to both perceive and verbalize decisions. It follows that: "interesting restrictions on the richness of a language can yield interesting restrictions on the set of an economic decision maker's admissible preferences". This "expressibility effect" is essentially a much stronger form of what I test for here: the ability of language to affect beliefs and behavior.

6.1.4 The Determinants of Discounting

Despite this large set of studies on the effects of language, to my knowledge no papers have directly studied the effects of language on intertemporal choice. Since the introduction of the discounted-utility model by Samuelson (1937), most economic models take the level of time discounting as exogenous. Notable exceptions include Barro & Becker (1989) which models discount rates as a function of fertility, and Becker & Mulligan (1997) which models a consumer who invests in lowering their own discounting of future utility. Other fields have also modeled the determinants of time-preference. In sociobiology, Rogers (1994) models the effect of natural selection on time preferences. He finds that if evolution sets the discount rate equal to the rate of substitution of Darwinian fitness, then people will discount the future at a rate of ln(2) per generation, which is about 2% per year.

Some empirical findings suggest that individual's time preferences are closely linked with other characteristics. Warner & Pleeter (2001) found large amounts of variation in personal discount rates among military personal who were offered either a lump-sum payment or an annuity upon leaving the military. Suggestively, these discount rates were highly correlated with age, race, sex, and scores

[28] The *Académie francaise* is made up of 40 members (know as *immortels*) who are elected by existing members to terms for life. The *Académie* is France's official authority on the vocabulary and grammar of the French language, and publishes the *Dictionnaire de l'Académie française*, the official dictionary of the French language.

on an IQ-like test. Similarly, Frederick (2005) finds that even at elite universities, students who score high on an IQ-like "cognitive-reflection test" showed much lower discount rates. Inconsistent with any frame-independent discount function, Lowenstein (1988) finds a temporal reference-point effect: people demand much more compensation to delay receiving a good by one year, (from today to a year from now), than they are willing to pay to move up consumption of that same good (from a year from now to today). Similarly, Read et al. (2005) show that discount rates are lower when time is described using calendar dates (e.g., on October 17) than when described in terms of the corresponding delay (e.g., in six months).[29]

7 Conclusion

Overall, my findings are largely consistent with the hypothesis that languages with obligatory future-time reference lead their speakers to engage in less future-oriented behavior. On savings, the evidence is consistent on multiple levels: at an individual's propensity to save, to long-run effects on retirement wealth, and in the aggregate with national savings rates. These findings also extend to health behaviors ranging from smoking to exercise, as well as several measures of long-run health. All of these results survive after comparing only individuals who are identical on numerous demographic levels, and who were born and raised in the same country.

One important issue in interpreting these results is the possibility that language is not *causing* but rather *reflecting* deeper differences that drive savings behavior. These available data provide preliminary evidence that much of the measured effects I find are causal, for several reasons that I have outlined in the paper. Mainly, self-reported measures of savings as a cultural value appear to drive savings behavior, yet are completely uncorrelated with the effect of language on savings. That is to say, while both language and cultural values appear to drive savings behavior, these measured effects do not appear to interact with each other in a way you would expect if they were both markers of some common causal factor.

In addition, differences in the use of FTR do not seem to correspond to cognitive or developmental differences in the acquisition of language. This suggests that the effect of language that I measure occurs through a channel that is independent of either cultural or cognitive differences between linguistic groups.

Nevertheless, the possibility that language acts only as a powerful marker of some deeper driver of intertemporal preferences cannot be completely ruled out. This possibility is intriguing in itself, as the variation across languages in FTR which identify my regressions is very old. In Europe for example, most Germanic and Finno-Ugric languages have been futureless for hundreds of years. Indeed, Dahl (2000) suggests that proto-Germanic was futureless at least two thousand years ago. Finding additional evidence of language's role in shaping intertemporal choice is one of the goals of ongoing experimental work (Boroditsky & Chen, 2011), which tries to isolate the channel through which this linguistic-savings effect occurs.

[29] See Frederick, Lowenstein, & O'Donoghue (2002) for an excellent review of the literature on intertemporal choice.

8 Data Statements

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9 Data Appendix

9.1 Wording of Questions in the WVS

FAMSAVED: During the past year, did your family (read out and code one answer):
- Save money (23%)
- Just get by (51%)
- Spent some savings and borrowed money (14%)
- Spent savings and borrowed money (12%)

TRUST: Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people? (Code one answer):
- Most people can be trusted. (26%)
- Need to be very careful. (74%)

CHILDSAVE: Here is a list of qualities that children can be encouraged to learn at home. Which, if any, do you consider to be especially important? Please choose up to five! (Code five mentions at the maximum):

Independence	Hard work
Feeling of responsibility	Imagination
Tolerance and respect for other people	Thrift, saving money and things (37%)
Determination, perseverance	Religious faith
Unselfishness	Obedience

9.2 Variables in the SHARE

HHNETWORTH: A household net worth in the SHARE "HHNetWorth" is attempt to measure all real assets net of any debts on them. It is equal to the estimated value of a household's: main residence, real estate other than the main residence, businesses, cars, bank accounts, bonds, stocks, mutual funds, life insurance, minus mortgage and other debt.
SMOKED: This codes whether an individual reports: "Have you ever smoked cigarettes, cigars, cigarillos or a pipe daily for a period of at least one year?"
PHYSICALLY ACTIVE: Physical inactivity is defined as "never or almost never engaging in neither moderate nor vigorous physical activity." Being physically active is not being inactive.
OBESITY: This is defined as a body-mass-index of 30 or greater.
WALKING SPEED: This was measured only among individuals aged 76 years and older. Walking speed was averaged over two tests of walking speed, as measured in meters per second.
GRIP STRENGTH: Grip strength is measured with a dynamometer at the interview (in kg).
PEAK FLOW: Peak expiratory flow measures a person's maximum exhalation air-flow, as measured with a peak-flow meter (in L/min).

9.3 OECD Variables

All GDP-based measures are computed using the expenditure method, with constant PPPs using the OECD base year (2000). CAGR is the average growth rate of the country from 1993 to 2009 (the earliest date for which data is available for all countries). Old_t and Young_t are the percent of the population that are older than 65 and younger than 15 in year t. Social Security is the percent of a country's GDP spent in a given year on disability, old age, and survivors benefits, divided by the percent of the population over 65.

Appendix Table: Coded Languages and FTR Values

Language	Family	Genus	FTR
Afrikaans	Indo-European	Germanic	Strong
Akan	Niger-Congo	Kwa	Strong
Alawa	Australian	Maran	Strong
Albanian	Indo-European	Albanian	Strong
Amharic	Afro-Asiatic	Semitic	Weak
Arabic	Afro-Asiatic	Semitic	Strong
Armenian	Indo-European	Armenian	Strong
Azari	Altaic	Turkic	Strong
Azerbaijani	Altaic	Turkic	Strong
Bandjalang	Australian	Pama-Nyungan	Strong
Bambara	Niger-Congo	Western Mande	Weak
Basque	Basque	Basque	Strong
Belorussian	Indo-European	Slavic	Strong
Bemba	Niger-Congo	Bantoid	Strong
Bengali	Indo-European	Indic	Strong
Beja	Afro-Asiatic	Beja	Weak
Bosnian	Indo-European	Slavic	Strong
Bulgarian	Indo-European	Slavic	Strong
Cantonese	Sino-Tibetan	Chinese	Weak
Catalan	Indo-European	Romance	Strong
Cebuano	Western Malayo-Polynesian	Meso-Philippine	Weak
Chaha	Afro-Asiatic	Semitic	Strong
Chichewa	Niger-Congo	Bantoid	Strong
Croatian	Indo-European	Slavic	Strong
Czech	Indo-European	Slavic	Strong
Dagbani	Niger-Congo	Gur	Strong
Danish	Indo-European	Germanic	Weak
Dutch	Indo-European	Germanic	Weak
Dyula	Niger-Congo	Western Mande	Weak
English	Indo-European	Germanic	Strong
Estonian	Finno-Ugric	Finnic	Weak
Ewe	Niger-Congo	Kwa	Strong
Finnish	Finno-Ugric	Finnic	Weak
Flemish	Indo-European	Germanic	Weak
French	Indo-European	Romance	Strong
Frisian	Indo-European	Germanic	Weak
Fula	Niger-Congo	Northern Atlantic	Strong
Gamo	Afro-Asiatic	North Omotic	Strong
Galician	Indo-European	Romance	Strong
Georgian	Kartvelian	Kartvelian	Strong
German	Indo-European	Germanic	Weak
Greek	Indo-European	Greek	Strong
Guarani	Tupian	Tupi-Guarani	Strong
Gujarati	Indo-European	Indic	Strong

Appendix Table: Coded Languages and FTR Values (Continued)

Language	Family	Genus	FTR
Hakka	Sino-Tibetan	Chinese	Weak
Hausa	Afro-Asiatic	West Chadic	Strong
Hawaiian	Eastern Malayo-Polynesian	Oceanic	Weak
Hebrew	Afro-Asiatic	Semitic	Strong
Hindi	Indo-European	Indic	Strong
Hungarian	Finno-Ugric	Ugric	Strong
Icelandic	Indo-European	Germanic	Weak
Igbo	Niger-Congo	Igboid	Strong
Irish	Indo-European	Celtic	Strong
Isekiri	Niger-Congo	Defoid	Strong
Indonesian	Western Malayo-Polynesian	Sundic	Weak
Italian	Indo-European	Romance	Strong
Japanese	Japanese	Japanese	Weak
Javanese	Western Malayo-Polynesian	Sundic	Weak
Kammu	Austro-Asiatic (Mon-Khmer)	Palaung-Khmuic	Strong
Kannada	Dravidian	Southern Dravidian	Strong
Karaim	Altaic	Turkic	Strong
Korean	Korean	Korean	Strong
Kikuyu	Niger-Congo	Bantoid	Weak
Kurdish	Indo-European	Iranian	Strong
Latvian	Indo-European	Baltic	Strong
Lithuanian	Indo-European	Baltic	Strong
Lozi	Niger-Congo	Bantoid	Strong
Luganda	Niger-Congo	Bantoid	Strong
Luxembourgish	Indo-European	Germanic	Weak
Malay	Western Malayo-Polynesian	Sundic	Weak
Maltese	Afro-Asiatic	Semitic	Weak
Macedonian	Indo-European	Slavic	Strong
Mandarin	Sino-Tibetan	Chinese	Weak
Maori	Western Malayo-Polynesian	Oceanic	Weak
Moldavian	Indo-European	Romance	Strong
Montenegrin	Indo-European	Slavic	Strong
Moore	Niger-Congo	Gur	Strong
Norwegian	Indo-European	Germanic	Weak
Oromo	Afro-Asiatic	Cushitic	Weak
Panjabi	Indo-European	Indic	Strong
Persian	Indo-European	Iranian	Strong
Polish	Indo-European	Slavic	Strong
Portuguese	Indo-European	Romance	Strong
Quechua	Quechuan	Quechuan	Strong
Romanian	Indo-European	Romance	Strong
Romansh	Indo-European	Romance	Strong
Russian	Indo-European	Slavic	Strong

Appendix Table: Coded Languages and FTR Values (Continued)

Language	Family	Genus	FTR
Serbian	Indo-European	Slavic	Strong
Slovak	Indo-European	Slavic	Strong
Slovene	Indo-European	Slavic	Strong
Soddo	Afro-Asiatic	Cushitic	Weak
Sotho (Northern)	Niger-Congo	Bantoid	Strong
Seraiki	Indo-European	Indic	Strong
Sesotho	Niger-Congo	Bantoid	Strong
Sidamo	Afro-Asiatic	Cushitic	Weak
Spanish	Indo-European	Romance	Strong
Sumatranese	Western Malayo-Polynesian	Sundic	Weak
Sundanese	Western Malayo-Polynesian	Sundic	Weak
Swati	Niger-Congo	Bantoid	Strong
Swedish	Indo-European	Germanic	Weak
Swahili	Niger-Congo	Bantoid	Strong
Swiss French	Indo-European	Romance	Strong
Swiss German	Indo-European	Germanic	Weak
Swiss Italian	Indo-European	Romance	Strong
Tagalog	Western Malayo-Polynesian	Meso-Philippine	Strong
Tamil	Dravidian	Southern Dravidian	Strong
Tenyer	Niger-Congo	Gur	Strong
Thai	Tai-Kadai	Kam-Tai	Strong
Tigrinya	Afro-Asiatic	Semitic	Strong
Tsonga	Niger-Congo	Bantoid	Strong
Tswana	Niger-Congo	Bantoid	Strong
Turkish	Altaic	Turkic	Strong
Ukrainian	Indo-European	Slavic	Strong
Urdu	Indo-European	Indic	Strong
Uzbek	Altaic	Turkic	Strong
Venda	Niger-Congo	Bantoid	Strong
Vietnamese	Austro-Asiatic (Mon-Khmer)	Viet-Muong	Weak
Wolaytta	Afro-Asiatic	North Omotic	Strong
Wolof	Niger-Congo	Northern Atlantic	Strong
Xhosa	Niger-Congo	Bantoid	Strong
Yoruba	Niger-Congo	Defoid	Weak
Zulu	Niger-Congo	Bantoid	Strong