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How Language Shapes Bank Risk Taking

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Abstract

We analyze the impact of language on risk-taking behavior of banks. Our hypothesis is that languages that grammatically distinguish between present and future events lead banks to take more risk. We investigate this hypothesis on a sample of 1,402 banks from 82 countries over the 2010-2017 period. We find that banks from countries with future tense marking take more risk in accordance with our prediction. This finding is robust to the inclusion of alternative culture indicators, to alternative definitions of bank risk and of future time reference.

JEL Codes: G21, Z13.
Keywords: banking, financial stability, language.

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1. Introduction

Languages differ, not only in how they employ sounds, but how they affect their speakers' representations of reality (Gumperz and Levinson, 1991; Boroditsky, 2001). The spoken language can consequently exert an influence on the actions undertaken by individuals, and thus can influence economic behavior (Mavisakalyan and Weber, 2018).

One linguistic feature has been particularly investigated in the literature in economics: the presence of future tense marking. Some languages like English, referred as strong future time reference (FTR) languages, force speakers to grammatically make a distinction between future and present events. Other languages like Chinese, referred as weak-FTR languages, allow speakers to naturally use the present tense to talk about future events as if these events were happening now. This linguistic feature can influence the economic behavior: the use of a strong-FTR language diminishes the importance of the future by dissociating the present and the future. It can therefore lead to a less future-oriented behavior for economic agents.

This hypothesis has been confirmed by a bunch of recent works on individual and corporate decisions. Chen (2013) shows that speakers of strong-FTR languages have a less-future oriented behavior: they save less, invest less in their health, and retire with less wealth than speakers of weak-FTR languages. Mavisakalyan, Tarverdi, and Weber (2018) find that speakers of weak-FTR languages are more willing to address environmental problems than speakers of strong-FTR languages, supporting the hypothesis that they care more for the future. At the corporate level, Liang et al. (2014) show that firms with strong-FTR languages perform worse in corporate social responsibility, a future-oriented activity, than those with weak-FTR languages, while Chen et al. (2017) find that strong-FTR language firms have lower precautionary cash holdings than weak-FTR language firms, in line with the view that the former ones are less future-oriented.

We can question whether this linguistic distinction influences the risk-taking behavior of banks. The risk-taking behavior is influenced by how bank managers and employees consider the future. To view the future as more distant should contribute to increase the risk-taking behavior of banks since it reduces the perception of losses on risky activities. The objective of this paper is to investigate this hypothesis: we examine whether the future tense marking of languages exerts an impact on the risk-taking behavior of banks. We investigate this question on a large cross-country dataset of banks since we need variation in languages

across banks. We use a sample of 1,402 banks based in 82 countries over the 2010-2017 period.

Our results provide evidence for the influence of future tense on bank risk. We find that strong-FTR languages enhance bank risk. This finding is observed when we control for different culture indicators and when we test alternative measures of bank risk and of future time reference. This evidence is consistent with the hypothesis that strong-FTR languages influence banks to take higher risk.

Our paper therefore contributes to two strands of literature. First, we augment the vast literature on the determinants of bank risk-taking. It has identified a large set of factors like governance (Pathan, 2009; De Jonghe, Disli and Schoors, 2012: Körner, 2017), bank competition (Berger, Klapper and Turk-Ariss, 2009), but also political institutions (Ashraf, 2017) and religiosity (Adhikari and Agrawal, 2016). We extend this strand of research with the first study examining how language can shape the risk-taking behavior of banks. Second, we contribute to the literature on the impact of language on economic behavior. While this line of research has until now considered how language shapes the behavior of individuals and firms, we analyze how bank behavior is affected by language.

This work has important implications. From a positive perspective, the finding that strong-FTR language increases bank risk provides support to the view that language would explain cross-country differences in bank risk and in the frequency of banking crises. From a normative perspective, it suggests that bank CEOs with a weak-FTR language should be favored to reduce risk-taking behavior of banks.

The rest of the paper is organized as follows. In Section 2, we discuss the background of our research question. Section 3 describes the data and the empirical method. Section 4 provides estimation results, and section 5 shows the robustness checks. Section 6 concludes the paper.

2. Background

The *Linguistic Relativity Hypothesis*, also known as the Whorf-Sapir hypothesis, holds that the structure of a language has an influence on its speakers' behavior and how they conceptualize the world (Whorf, 1956). The strong version of this hypothesis states that language determines thought and controls the cognitive processes, while the weak version assumes that language exerts some constraints on cognition. Even if the strong version has

been viewed as misguided, several studies support the weak version (e.g., Kay and Kempton, 1984; Slobin, 2003; Regier and Kay, 2009).

In line with the weak version, language would shape behavior without controlling the whole cognitive process. For example, Boroditsky (2001) uses an experimental approach to document that language is a powerful tool in shaping habitual thought, and thought about abstract domains like time. Winawer et al. (2007) have shown that for languages which have specific names for different shades of colors, speakers of such languages tend to recognize different color codes more easily. For example, Russian has specific names for different shades of blue, and as such, Russian speakers find it easier to remember and recognize different shades of blue than English speakers. In documenting the importance of language on influencing thoughts, Edward Sapir, writes:

> *"Human beings...are very much at the mercy of the particular language which has become the medium of expression for their society.... The fact of the matter is that the "real world" is to a large extent unconsciously built up on the language habits of the group."* (Sapir, 1929, p. 209).

Regarding time, languages have different ways of grammatically making reference to future events. Weak-FTR languages like German or Chinese use the present tense to talk about future events. Strong-FTR languages like French or English force their speakers to change the structure of the tense when referring to events in the future, either through the use of an auxiliary verb (like in English[1]) or of a dedicated future tense form (like in French).

We can illustrate these differences across languages with an example. French and English speakers are required to switch from the present tense to the future tense when talking about expectations of the weather tomorrow:

1) English a. It is cold today (PRESENT)
   b. It will/is going to be cold tomorrow (FUTURE)

2) French: a. Il fait soleil aujourd'hui (PRESENT)
   "*It is sunny today"*
   b. Il fera soleil demain (FUTURE)
   "*It will be sunny tomorrow*"

[1] English speakers can sometimes speak about future events with a non-future tense verb (for e.g. "the teacher arrives tomorrow"). However, as documented by Copley (2009), this way of speaking is only used when speakers want to talk about planned/scheduled/habitual events, or events arising from law-like properties of the world.

On the other hand, when German[2] and Chinese speakers expect the weather to be cloudy tomorrow, they would normally talk about it using the present tense:

3) German: a. Heute ist es bewölk (PRESENT)
"Today it is cloudy"

b. Morgen ist es bewölk (FUTURE)
"*Tomorrow it is cloudy"*

4) Chinese: a. Jintian shi duoyun (PRESENT)
"Today is cloudy"

b. Mingtian shi duoyun (FUTURE)
"*Tomorrow is cloudy"*

This linguistic distinction can then influence speaker's behavior and cognition by exerting an impact about the timing of future events. In strong-FTR languages, speakers perceive the future to be more distant when talking about future events. Symmetrically, speakers of weak-FTR languages can perceive the future as more immediate and certain to manifest since they are able to talk about future events in the present tense, i.e. as if the events were happening now.

Since a strong-FTR language makes the future feel more distant from the present, it can alter the importance of the risks associated with banking activities. For instance, a lending decision today is associated with potential loan losses tomorrow. As a consequence, a future perceived as more distant should contribute to reduce the reluctance of banks to grant loans since it diminishes the importance of costs associated with future loan losses. As summarized by Frederick, Loewenstein and O'Donoghue (2002), individuals have a tendency to discount future costs and benefits. It results in the fact that when an outcome is perceived as more distant in the future, individuals tend to discount more its potential costs or benefits.

A strong-FTR language should then be associated with higher risk-taking behavior of banks. Our hypothesis is thus that banks with strong-FTR languages have higher risk than banks with weak-FTR languages. This hypothesis accords with the role of future time reference in shaping intertemporal preferences for individual behavior (e.g. Chen, 2013) and

[2] It is worth noting that Germans can make reference to the future with the future tense marker 'werden'. However, in German like in other weak-FTR languages, speakers are not required to use this future tense marker every time they talk.

corporate behavior (e.g., Chen et al., 2017). We therefore extend these former findings through an analysis of how language can shape intertemporal preferences for bank behavior.

3. Data and methodology

3.1 Data

We extract data from Orbis Bank for all variables related to bank characteristics. We consider the period 2010-2017. We keep only commercial banks to have a homogenous sample in terms of activities and use only consolidated statements for each bank. Data on language FTR is compiled from Chen (2013)'s classification of languages. Data on macroeconomic variables are collected from World Development Indicators and governance variables come from World Governance Indicators database.

We restrict the sample to countries for which Chen (2013) classifies their official language into strong-FTR and weak-FTR categories. We drop all observations with missing necessary accounting information and we eliminate countries with only one bank. We winsorize all bank-level variables at 1% (lowest and highest values) to eliminate the effect of outliers. The final sample includes 1,402 banks from 82 countries with 73.3% of the banks located in strong-FTR countries.

3.2 Variables

We test whether language FTR shapes bank risk-taking. We use the Z-score of each bank to measure bank risk-taking. Z-score measures the insolvency risk and is commonly used in the literature to measure bank risk. Following previous studies (Berger, Klapper and Turk-Ariss, 2009; Houston et al., 2010), we calculate the Z-score as:

$$Z - score = \frac{ROA+CAR}{\delta(ROA)} \quad (1)$$

where ROA is the return on assets, CAR is the capital asset ratio which is measured as the ratio of equity to total assets, and δ(ROA) is the standard deviation of the return on assets calculated over the whole period of the study. Since the Z-score is a highly skewed bank risk measure, we take the natural log of the Z-score following the literature (e.g., Laeven and Levine, 2009). In the rest of the paper, we will refer to the logged Z-score as *Z-score*. The Z-score is inversely related to the probability of insolvency for the bank, hence a higher z-score is associated with lower bank risk.

The explanatory variable of interest in our study is the future time reference of the language. Following Chen (2013)'s classification, we create the dummy variable *Strong-FTR* which is equal to one if a bank's headquarters is located in a country with a strong-FTR language and zero otherwise.

We consider only countries with one FTR language form (i.e., having either a strong-FTR or weak-FTR language) for the official languages to ensure proper identification of the language of the bank with one exception, Switzerland.

Countries with multiple languages with different FTR language forms generate identification problems. We exclude for instance Belgium, a country with approximately half of the population speaking Flemish (a weak-FTR language) and the other half speaking French (a strong-FTR language), since the vast majority of banks in the sample have their headquarters in the same city, Brussels. So we cannot disentangle based on the headquarters of the bank the FTR language form.

The only exception is Switzerland, which combines strong (French, Italian) and weak (German) FTR language forms, because headquarters of Swiss banks are located in various cities in the country (Zurich, Bern, Geneva, and Lausanne) for which we know the dominant language. Countries with multiple languages but with only one FTR language form do not generate problems. For instance, Canada has two official languages (English and French) but they are both strong-FTR languages. So we can associate this form to all Canadian banks.

We consider three bank variables to control for bank-specific characteristics. First, we control for bank size which is measured as the natural logarithm of total assets (*Bank Size*). We also include in our model the ratio of loans to total assets (*Loans to Assets*) to control for the structure of assets. Finally, we make use of the ratio of deposits to total assets (*Deposits to Assets*) to take into account the structure of funding.

We also control for the characteristics of the country with four variables. The level of economic development is controlled with the log of GDP per capita (*log(GDP/capita)*). Inflation is measured as the annual percentage change in consumer prices (*Inflation*). We also take into account the institutional framework with the legal rights index from the World Bank (*Legal Rights*) and for bank concentration with the Herfindahl index (*Herfindahl Index*). Finally, we control for continent fixed effects, as different languages within a continent may share similar components and characteristics.

Definition of all variables is reported in the Appendix. Table 1 presents the cross-country statistics with the number of banks and the average Z-score for each country in the sample. Interestingly we observe that mean Z-score for the banks in strong-FTR countries

(3.530) is lower than those in weak-FTR countries (3.831). It suggests higher risk for banks located in strong-FTR countries in accordance with our hypothesis. Table 2 reports the descriptive statistics of the variables.

3.3 Methodology

In this paper, we examine how languages with future tense marking affect time precision beliefs and lead to differences in bank risk. We therefore formulate our model as:

$$Z\text{-}score_{ikt} = \alpha + \beta\, Strong\text{-}FTR_{kt} + \delta\, Bank\ Controls_{it} + \phi\, Country\ Controls_{kt} + \varepsilon_{ikt} \qquad (2)$$

where *Z-score* is the Z-score for bank i in country k for year t; *Strong-FTR* is the dummy variable equal to one if a country's dominant language is classified as a strong-FTR and zero otherwise; *Bank Controls* is the set of bank-specific control variables (*Bank Size*, *Loans to Assets, Deposits to Assets*); *Country Controls* is the set of country-specific control variables *(log(GDP/capita), Inflation, Legal Rights*, *Herfindahl Index*), and ε is a random error term.

We use panel estimations with random effects. This estimation technique is robust to any first-order autoregressive disturbances within panels and heteroscedasticity across panels. Since language is time invariant, we cannot use fixed effects technique to estimate our model as it would be wiped out in 'within transformation' or 'time-demeaning' process of the variables in fixed effects. Hence, this explains our choice to use the random effects technique.

4. Results

4.1 Main estimations

We analyze whether future tense marking influences risk-taking behavior of banks. We perform four regressions to consider several sets of control variables so that we can test the sensitivity of the results and the results are reported in Table 3. In column (1), we only include the variable *Strong-FTR*. In columns (2) to (4), we respectively add bank-level control variables, country-level control variables, and all control variables.

Our main finding is the negative and significant coefficient for *Strong-FTR* in all estimations. It means that a strong future time reference is associated with lower values for Z-score. Thus, banks from countries with strong future time reference take more risk than those located in countries with weak future time reference. This conclusion is in line with our

hypothesis that to view the future as more distant leads to enhance the risk-taking behavior of banks.

The estimated effect of strong-FTR language is sizeable. Moving from a weak-FTR to a strong-FTR language leads to a reduction of Z-score of -0.301 in the specification with all control variables. This effect is substantial, considering that the average Z-score for weak-FTR language banks is 3.831. In other words, the average strong-FTR language bank has a Z-score about 7.9% (=-0.301/3.831) lower than the average weak-FTR language bank, controlling for bank and country characteristics in the dataset.

With respect to the bank-level control variables, we observe a positive and significant sign for bank size, supporting the view that a large bank size is associated with lower risk. This result is in line with what Berger, Klapper and Turk-Ariss (2009). We also observe significantly positive coefficients for loans to assets and negative for deposits to assets, meaning that higher share of loans and lower share of deposits in total assets contribute to reduce bank risk.

When considering country-level control variables, inflation tends to strengthen risk, as seen with its negative and significant coefficient. It accords with what Houston et al. (2010) have found. Income per capita is associated with lower risk, which corroborates the finding from Laeven and Levine (2009) and Houston et al. (2010). Finally *Legal Rights* and *Herfindahl Index* are not significant.

4.2 Additional culture measures

Our analysis is focused on the impact of language on bank risk. However language is one characteristic of the culture but not the only one. Culture can be defined as "those customary beliefs and values that ethnic, religious, and social groups transmit fairly unchanged from generation to generation" (Guiso, Sapienza and Zingales, 2006). As such it includes language but also religion and trust among many other values. We can then question whether our finding that banks from countries with strong future time reference take more risk is not influenced by another indicator of the culture of a country. We thus aim to rule out this possibility by performing additional estimations in which we control for alternative culture measures. We present these results in Table 4.

4.3.1 *Hofstede Dimensions*

A seminal research in the analysis of culture has been the work from Hofstede (1980, 2001). He has used systematically collected data about a large number of cultures to develop a terminology to characterize cultures through six dimensions. Hofstede classification has been widely adopted to assess the influence of cultural dimensions, e.g. on financial systems (Kwok and Tadesse, 2006), on risk-taking in the insurance industry (Gaganis et al., 2018), and corporate risk-taking (Li et al., 2013).

We focus on two dimensions of national culture identified by Hofstede (1980): *Uncertainty Avoidance* measuring the tolerance of a society for uncertainty and ambiguity, *Long Term Orientation* which indicates the persistence of a society towards achieving future rewards. Both cultural dimensions are the most closely related to the potential influence of future time reference. Chen et al. (2017) similarly consider both these Hofstede dimensions to check the robustness of their findings for the relation between future time reference and corporate cash holdings. Both these indicators come from Hofstede website.

We add both these cultural dimensions in the regression in column 1. We observe that the coefficient of *Strong-FTR* remains significantly negative. Hence the impact of future time reference on bank risk is still observed when Hofstede dimensions are taken into account. In addition, we find that *Uncertainty Avoidance* and *Long Term Orientation* are not significant, suggesting no relation between these dimensions and bank risk.

4.3.2 *Religion*

Religion is a major component of the culture which shapes the norms of societies (Iyer, 2016). A large set of papers have shown how religion can influence financial behavior of economic agents (Hilary and Hui, 2009; Kumar, Page, and Spalt, 2011; Klein, Turk-Ariss, and Weill, 2017). Thus the differences in bank risk we observe across countries can be driven by religion rather than language features.

We control for religion by adding a set of religion indicators at the country level: *Catholic*, *Protestant*, *Muslim*, and *Buddhist*. These variables are all dummy variables equal to one if more than 50% of the inhabitants in a country are respectively Catholics, Muslims, Protestants, and Buddhists. Data come from the CIA World Factbook.

The results in column 2 show that religion does not drive our results. We still find a negative and significant coefficient for *Strong-FTR*. Interestingly, we observe that banks in Catholic countries and in Buddhist countries take less risk while the coefficients for *Muslim* and *Protestant* are not significant. The finding about Catholic countries accords with the finding that Catholics are more risk-averse (Halek and Eisenhauer, 2001).

4.3.3 *Trust and corruption*

Trust and corruption have been shown to influence economic outcomes (Mauro, 1995; Zak and Knack, 2001). In the context of financing decisions, there is evidence that corruption influences loan characteristics (Bae and Goyal, 2009) and bank loan decisions (Fungacova, Kochanova and Weill, 2015) while trust plays a key role in the performance of large organizations (La Porta et al., 1997b) and stock market participation (Guiso, Sapienza and Zingales, 2008).

We take into account trust and corruption in the estimations. *Trust* is measured with the trust index provided by La Porta et al. (1997b). *Corruption* is the corruption perception index from Transparency International with higher values associated with lower corruption.

The results are reported in column 3. We find again that the coefficient of *Strong-FTR* is significantly negative, meaning that the key finding is not affected by the inclusion of trust and corruption. We furthermore find out that higher trust and lower corruption are associated with lower bank risk, in line with the expectation.

5. Robustness Checks

This section presents a battery of robustness tests. We first use alternative measures for bank risk. We continue with results including alternative measures for future time reference and complete with additional robustness checks. We finally check whether future time reference exerts an impact on the occurrence of banking crises.

5.1 Alternative measures of bank risk

First, we use alternative measures for bank risk. We have used Z-score to measure bank risk in our main estimations. Since literature also provides additional indicators for bank risk, we want to check whether our results stand when using these indicators.

To this end, we redo our estimations by using alternatively four measures of bank risk. First, we use the ratio of non-performing loans to gross loans (*NPL*) as our main indicator for credit risk. Second, we utilize the ratio of loan loss reserves to gross loans (*LLR*) as another risk measure. Third, we include the ratio of loan loss provisions to gross loans (*LLP*) as a backward-looking credit risk measure. Finally, we compute the standard deviation of average return on assets ($\delta(ROA)$) on the whole period of the study as an alternative risk measure. It

has to be stressed that higher values represent greater risk for all four alternative bank risk measures. The results are reported in Table 5.

We find that the coefficient of *Strong-FTR* is significantly positive in all estimations aside from a positive but not significant coefficient in the estimation in column (3), which uses *LLP* as the dependent variable. Therefore we observe that our finding that banks located in countries with strong-FTR languages have higher risk-taking is confirmed. Our key finding is thus robust to the use of alternative measures of bank risk.

5.2 Alternative measures for future time reference

We utilize alternative measures of future time reference. Chen (2013) has developed two indicators based on word-frequency analysis of text from the web. The verb ratio measures the number of verbs which are grammatically future marked, divided by the total number of future-referring verbs in a country's online weather forecast. The sentence ratio measures the share of sentences regarding the future which contain a grammatical future marker in a country's online weather forecast. The verb and sentence ratios are highly correlated with the strong-FTR language measure. They are available for a smaller number of observations (7,357 observations vs. 8,424 observations for strong-FTR language measure).

We test the influence of both indicators in Table 6. With each indicator, we first perform regressions without control variables, then with control variables. We find that both verb ratio and sentence ratio are significantly negative. The results with verb ratio and sentence ratio thus align with our main estimations and provide additional support for our finding that strong future time reference increases bank risk.

5.3 Additional robustness checks

Table 7 reports several robustness checks.

First, we use an alternative way to measure Z-score. We change the denominator of the Z-score by computing the standard deviation of ROA on a three-year rolling window rather than on the whole period of the study. We report the results in column (1). We observe again the negative influence of strong-FTR language on Z-score.

Second, we exclude U.S. from the sample. Chen et al. (2017) point out that this country has a specific status as a "melting pot" with large variation in cultures and languages. As such, we can check if the results stand without this country. The regression is displayed in column (2). We find again a significant and negative coefficient for *Strong-FTR*.

Third, we exclude the largest strong-FTR and weak-FTR countries in terms of number of banks from the sample. Both these countries represent a substantial share of the sample and can drive our results. We therefore drop both the largest strong-FTR country (U.S. with 375 banks) and the largest weak-FTR country (China with 116 banks). We report the results in column (3). We still find that the coefficient for *Strong-FTR* is negative and significant.

Fourth, we exclude Switzerland. This country is the only one in our sample combining strong-FTR (French, Italian) and weak-FTR (German) languages. We consider Switzerland in our sample since we were able to carefully check the location of the headquarters of each bank. We can nonetheless check the influence of the exclusion of this country from the sample. The results are reported in column (4). The effect of strong-FTR language on bank risk remains significantly negative.

5.4 The influence on banking crises

We have shown that future tense marking influences risk-taking behavior of banks. Strong-FTR languages contribute to make banks take higher risk. A natural extension of our work is to check whether future tense marking also affects the occurrence of banking crises. Namely the major detrimental effect of high bank risk is to launch a banking crisis. So the support of our hypothesis should be found whether we obtain that countries with strong-FTR languages have higher occurrence of banking crises.

To investigate this question, we perform estimations at the country level explaining the occurrence of banking crises with the language variables. We use information for banking crises from Laeven and Valencia (2018) who provide a dataset of banking crises globally from 1970 till 2017. The dependent variable is a dummy variable that takes the value one if a banking crisis is observed in a particular year or zero otherwise.

When combining information on classification of languages and on banking crises, we obtain a sample of 75 countries. It includes 60 countries with the strong-FTR language form and 15 countries with the weak-FTR language form. Since we perform new estimations at the country level, we must classify both countries of our sample with two languages. We classify Switzerland as having a weak-FTR language form because the most widely spoken language in Switzerland is German. In the case of Canada, we do not have any issue with the FTR language form since both of its official languages are of the strong-FTR language category. However, with regards to the verb and sentence ratio, we use the widely spoken language, which is English.

We consider two country control variables used in the bank-level estimations, *Log(GDP/Capita)* and *Inflation*, in line with previous works on the determinants of banking crises (Demirgüc-Kunt and Detragiache, 2000; Klomp, 2009). We do not include variables *Legal Rights* and *Herfindahl Index* which were adopted in the bank-level estimations because of the availability of data. Namely, the focus on banking crises benefits from the use of long time series starting from 1970 until 2017. However information on *Legal Rights* and *Herfindahl Index* is not available for such a long period for a large number of countries. However, we control for legal environment with variables for legal origin: we include dummy variables for French legal origin, German legal origin, and English legal origin, with the omitted dummy variable being Scandinavian legal origin.

In order to examine whether language FTR affects the occurrence of banking crises across countries, we perform logit estimations and use the following model:

$$Y_{kt} = \alpha + \beta\, Strong\text{-}FTR_{kt} + \delta\, Country\ Controls_{\ kt} + \varepsilon_{kt} \qquad (3)$$

where Y_{kt} is the occurrence of banking crises in country k for year t; *Strong-FTR* is the dummy variable equal to one if a country's dominant language is classified as a strong-FTR and zero otherwise; *Country Controls* is the set of country-specific control variables *(log(GDP/capita), Inflation, French Legal Origin, German Legal Origin, English legal origin*), and ε is a random error term.

We display seven estimations in Table 8 to provide a broad view of the influence of language on the occurrence of banking crises. We first investigate the influence of *Strong-FTR* by considering only two country control variables (*Log GDP/capita* and *Inflation*) in column (1) before adding the three legal origin variables in column (2). In the following estimations, we always use this set of five control variables. We then analyze the impact of *Verb Ratio* in column (3) and of *Sentence Ratio* in column (4). Finally in the three last columns, we study again the influence of *Strong-FTR* by considering the additional culture measures with respectively Hofstede dimensions, religion, and trust and corruption in columns (5) to (7).

We find that *Strong-FTR* is significantly positive in all estimations, except in column (7). This result is observed with all sets of control variables. We also show that *Verb Ratio* and *Sentence Ratio* are significantly positive. Thus we conclude that strong future time reference increases the occurrence of banking crises.

This finding corroborates our major conclusion on the detrimental impact of strong future time reference on bank risk-taking. It has positive implications of prime importance since it suggests that occurrence of banking crises can be related to linguistic factors.

6. Conclusion

In this paper, we analyzed the impact of language on risk-taking behavior of banks. While a large set of determinants of bank risk have been investigated, the influence of language has been ignored until now. Our hypothesis is that strong-FTR languages influence banks to take more risk. It accords with the view that a strong-FTR language makes the future feel more distant than the present and as such, reduces the perception of potential losses associated with risky activities.

Our main finding is that language affects bank risk. Our baseline estimations show a positive relation between strong-FTR language and bank risk. This conclusion stands when we take into account different culture indicators. It is confirmed in a battery of robustness tests considering various measures of bank risk, of future time reference and different samples of countries. We additionally observe that strong-FTR language is associated with greater occurrence of banking crises. This evidence is consistent with our hypothesis and supports the view from Chen (2013) that language exerts an impact on economic behavior for the risk-taking behavior of banks.

The take-away lesson is that language can explain part of the cross-country differences in bank risk. The implications of our conclusion are numerous. At the country level, it suggests that countries with strong-FTR languages should have lower financial stability due to higher risk-taking from banks. Language may therefore contribute to explain the differences in the frequency of banking crises across countries. At the bank level, we should observe a change in risk-taking behavior for a bank when bank managers with a strong-FTR language replace others with a weak-FTR language and reversely. The influence of CEO changes on bank risk should thus be considered through the angle of the CEO language. These implications open avenues for further research.

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Table 1.
Cross-country summary statistics

This table provides the number of banks and the average Z-score for each country in the sample.

Country	Number of Banks	Average Z-score	Country	Number of Banks	Average Z-score
Panel A: *Strong-FTR language countries*					
Albania	2	3.812	Qatar	6	3.610
Australia	19	4.330	Republic of Korea	5	4.008
Azerbaijan	9	2.604	Republic of Moldova	2	3.997
Bahamas	6	3.374	Romania	8	2.296
Bahrain	4	4.207	Russian Federation	58	2.717
Bangladesh	27	3.286	Saudi Arabia	8	4.709
Belarus	4	3.094	Slovakia	4	4.269
Belize	2	2.469	Slovenia	3	2.541
Botswana	5	2.700	Spain	22	3.541
Bulgaria	11	2.958	Thailand	9	3.719
Canada	37	3.783	Trinidad and Tobago	2	4.634
Chile	10	3.763	Tunisia	11	3.264
Colombia	7	3.284	Turkey	18	3.520
Costa Rica	5	3.977	Ukraine	11	3.069
Croatia	5	3.343	United Arab Emirates	14	3.543
Czech Republic	8	3.681	United Kingdom	26	3.066
Dominican Republic	2	4.081	USA	375	3.596
Ecuador	9	3.739	Uruguay	3	3.137
Egypt	4	3.642	Venezuela	2	2.172
France	26	4.04	Vietnam	22	3.616
Gambia	2	3.473	Yemen	2	2.698
Georgia	7	3.716	Zambia	4	3.069
Ghana	8	2.295	Mean		3.530
Greece	5	2.057	Standard Deviation		0.899
Honduras	2	3.997	Panel B: Weak-FTR language countries		
Hungary	12	2.399	Austria	14	3.474
Iraq	2	4.261	Brazil	67	3.443
Italy	19	2.988	China	116	3.911
Jamaica	3	3.146	Denmark	12	2.950
Jordan	12	4.293	Finland	9	3.867
Kuwait	4	3.699	Germany	4	3.785
Latvia	9	2.640	Hong Kong	18	3.935
Lebanon	20	4.358	Iceland	2	3.158
Lithuania	3	2.779	Indonesia	16	3.396
Macedonia	2	3.093	Japan	76	4.308
Mexico	18	3.591	Netherlands	15	3.289
Morocco	8	4.232	Norway	8	3.731
Mozambique	2	3.995	Suriname	3	2.793
Namibia	4	3.764	Sweden	8	3.808
New Zealand	6	4.000	Mean		3.831
Nicaragua	4	3.175	Standard Deviation		0.867
Nigeria	9	2.883			
Panama	22	4.327	Switzerland	10	3.590
Poland	16	3.841			
Portugal	8	2.653			

Table 2.
Descriptive statistics

This table provides descriptive statistics for the variables used in the estimations. Definitions of variables are reported in the Appendix.

Variable	N	Mean	Std Dev.	Min	Max
Strong-FTR	8,424	0.746	0.435	0	1
Z- score	8,424	3.612	0.904	-1.153	7.580
Bank Size	8,424	15.853	1.930	9.203	22.111
Loans to Assets	8,424	58.209	17.646	6.047	89.873
Deposits to Assets	8,424	70.051	18.075	4.476	93.084
Log (GDP/capita)	8,424	10.040	1.045	5.946	11.543
Inflation	8,424	0.026	0.030	-0.038	0.483
Legal Rights	8,424	7.036	0.095	0	12
Herfindahl Index	8,424	0.089	0.095	0.030	0.560
NPL	7,868	4.326	6.833	0	49.143
LLR	8,168	3.189	3.969	0.034	32.888
LLP	8,017	0.920	1.427	-0.816	11.238
δ(ROA)	8,424	0.426	0.398	0.007	3.123
Verb Ratio	7,357	0.605	0.310	0	1
Sentence Ratio	7,357	0.671	0.333	0	1

Table 3.
Main estimations

This table presents the results of random effects regressions examining the relation between strong-FTR language and bank risk. The dependent variable is Z-score. Definitions of variables are provided in the Appendix. Robust standard errors controlling for heteroscedasticity are reported within parentheses.*, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	(1)	(2)	(3)	(4)
Strong-FTR	-0.320***	-0.371***	-0.276***	-0.301***
	(0.054)	(0.069)	(0.065)	(0.069)
Bank Size		-0.135***		-0.158***
		(0.017)		(0.019)
Loans to Total Assets		0.004***		0.003***
		(0.001)		(0.001)
Deposits to Total Assets		-0.004***		-0.004***
		(0.001)		(0.001)
Log (GDP/capita)			0.011	0.095***
			(0.023)	(0.030)
Inflation			-0.743***	-0.868***
			(0.168)	(0.158)
Legal Rights			-0.005	-0.003
			(0.005)	(0.005)
Herfindahl Index			0.117	0.189
			(0.204)	(0.195)
Constant	3.741***	5.503***	3.565***	5.107***
	(0.048)	(0.303)	(0.282)	(0.323)
Observations	8,424	8,424	8,424	8,424
R Squared	0.019	0.035	0.106	0.039
Year FE	Yes	Yes	Yes	Yes
Continent FE	No	Yes	Yes	Yes

Table 4.
Alternative measures of country culture

This table presents the results of random effects regressions examining the relation between strong-FTR language and bank risk. The dependent variable is Z-score. Definitions of variables are provided in the Appendix. Robust standard errors controlling for heteroscedasticity are reported within parentheses.*, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	(1)	(2)	(3)
Strong-FTR	-0.327***	-0.275***	-0.345***
	(0.101)	(0.080)	(0.073)
Uncertainty Avoidance	0.001		
	(0.002)		
Long term Orientation	-0.003		
	(0.002)		
Catholic		0.558***	
		(0.099)	
Muslim		-0.086	
		(0.108)	
Protestant		-0.161	
		(0.198)	
Buddhist		0.286**	
		(0.123)	
Trust			1.247***
			(0.257)
Corruption			0.951***
			(0.254)
Constant	5.407***	5.194***	5.622***
	(0.368)	(0.337)	(0.329)
Observations	7,765	8,424	7,466
R Squared	0.052	0.061	0.012
Bank Controls	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Continent FE	Yes	Yes	Yes

Table 5.
Alternative measures of bank risk

This table presents the results of random effects regressions examining the relation between strong-FTR language and bank risk. The dependent variable is the risk measure at the top of the column. Definitions of variables are provided in the Appendix. Robust standard errors controlling for heteroscedasticity are reported within parentheses.*, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	(1)	(2)	(3)	(4)
	NPL	LLR	LLP	δ(ROA)
Strong-FTR	1.138**	1.11***	0.124	0.059***
	(0.511)	(0.281)	(0.096)	(0.022)
Bank Size	-0.604***	-0.355***	-0.017	-0.045***
	(0.105)	(0.072)	(0.022)	(0.005)
Loans to Total Assets	-0.055***	-0.045***	-0.004*	-0.001**
	(0.010)	(0.007)	(0.003)	(0.001)
Deposits to Total Assets	-0.005	0.001	-0.006***	-0.002***
	(0.010)	(0.006)	(0.002)	(0.001)
Log (GDP/capita)	-2.014***	-1.408***	-0.387***	-0.055***
	(0.280)	(0.168)	(0.050)	(0.013)
Inflation	-6.972	1.057	5.511***	0.677***
	(5.468)	(2.192)	(1.259)	(0.245)
Legal Rights	0.162**	0.125**	0.03*	0.008*
	(0.078)	(0.053)	(0.017)	(0.005)
Herfindahl Index	-6.312***	-2.72***	-0.578	-0.173**
	(1.378)	(0.867)	(0.46)	(0.082)
Constant	36.244***	23.682***	5.901***	1.803***
	(3.121)	(1.935)	(0.662)	(0.138)
Observations	7,868	8,168	8,017	8,424
R Squared	0.257	0.319	0.216	0.143
Year FE	Yes	Yes	Yes	Yes
Continent FE	Yes	Yes	Yes	Yes

Table 6.
Alternative measures for future time reference

This table presents the results of random effects regressions examining the relation between measures for future time reference and bank risk. The dependent variable is Z-score. Definitions of variables are provided in the Appendix. Robust standard errors controlling for heteroscedasticity are reported within parentheses.*, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	(1)	(2)	(3)	(4)
Verb Ratio	-0.551***	-0.521***		
	(0.111)	(0.122)		
Sentence Ratio			-0.547***	-0.511***
			(0.105)	(0.114)
Constant	3.522***	5.341***	3.560***	5.374***
	(0.143)	(0.340)	(0.145)	(0.341)
Observations	7,357	7,357	7,357	7,357
R Squared	0.119	0.052	0.120	0.053
Bank controls	No	Yes	No	Yes
Country controls	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
Continent FE	Yes	Yes	Yes	Yes

Table 7.
Robustness checks

This table presents the results of random effects regressions examining the relation between strong-FTR language and bank risk. The dependent variable is Z-score. Definitions of variables are provided in the Appendix. Robust standard errors controlling for heteroscedasticity are reported within parentheses.*, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	(1)	(2)	(3)	(4)
	3-year rolling window	Excluding U.S.	Excluding largest weak-FTR and strong-FTR countries	Excluding Switzerland
Strong-FTR	-0.128**	-0.292***	-0.181**	-0.297***
	(0.064)	(0.073)	(0.086)	(0.070)
Constant	0.389***	5.170***	4.924***	5.092***
	(.346)	(0.397)	(0.421)	(0.323)
Observations	5,948	5,612	5,018	8,369
R Squared	0.086	0.050	0.050	0.040
Bank controls	Yes	Yes	Yes	Yes
Country controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Continent FE	Yes	Yes	Yes	Yes

Table 8
Language and banking crises

This table presents the results of logit estimations (marginal effects) examining the relation between language variables and the occurrence of banking crises. The dependent variable is the occurrence of banking crisis. Definitions of variables are provided in the Appendix. Robust standard errors clustered at the country level are reported within parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strong-FTR	0.006***	0.008***			0.008***	0.008***	0.003
	(0.002)	(0.002)			(0.002)	(0.002)	(0.003)
Verb Ratio			0.007*				
			(0.004)				
Sentence Ratio				0.008**			
				(0.004)			
Log (GDP/capita)	0.001	0.001	0.002	0.002	0.001	0.001	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
Inflation	0.015***	0.015***	0.016***	0.016***	0.014***	0.015***	0.013***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.005)	(0.003)	(0.003)
English Legal Origin		-0.009**	-0.008*	-0.008**	-0.006	-0.009**	-0.003
		(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
French Legal Origin		-0.007	-0.002	-0.002	-0.006	-0.008	-0.004
		(0.005)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)
German Legal Origin		-0.005*	-0.001	-0.001	-0.003	-0.005*	-0.004
		(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
Uncertainty Avoidance					-0.000		
					(0.000)		
Long-term Orientation					0.000		
					(0.000)		
Catholic						0.002	
						(0.003)	
Muslim						0.006	
						(0.006)	
Protestant						0.003	

						(0.005)	
Buddhist						0.018*	
						(0.01)	
Corruption							-0.000**
							(0.000)
Trust							0.015
							(0.01)
Observations	2,816	2,816	2,504	2,504	2,201	2,816	1,922
Continent FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log-Likelihood	-333.833	-333.444	-288.769	-288.675	-273.006	-327.89	-237.891
Pseudo R-squared	0.035	0.036	0.042	0.043	0.033	0.052	0.047

Appendix

Variable	Definition
	Dependent Variables
Z-score	Measure of bank risk-taking: *Z-score =(ROA+CAR)/* δ(*R*OA), where ROA is the return on assets, CAR is the ratio of equity to total assets, and δ(*R*OA), is the standard deviation of return on assets computed over the whole period of the study. Source: Orbis Bank.
NPL	Ratio of non-performing loans to gross loans. Source: Orbis Bank.
LLR	Ratio of loan loss reserves to gross loans. Source: Orbis Bank.
LLP	Ratio of loan loss provisions to gross loans. Source: Orbis Bank.
δ(ROA)	Standard deviation of the return on assets over the whole period of the study. Source: Orbis Bank.
Occurrence of banking crisis	Dummy variable equal to one if a country has observed a banking crisis in a particular year and zero otherwise. Source: Laeven and Valencia (2018)
	Language Structure Measures
Strong-FTR	Dummy variable equal to one if the dominant language of a region or country is classified as a strong-FTR ("Future Time Reference") language and zero otherwise. Source: Chen (2013).
Verb Ratio	The number of verbs which are grammatically future marked, divided by the total number of future-referring verbs in a country's online weather forecast. Source: Chen (2013).
Sentence Ratio	The share of sentences regarding the future which contain a grammatical future marker in a country's online weather forecast. Source: Chen (2013).
	Bank Level Control Variables
Bank Size	Logarithm of total assets. Source: Orbis bank database.
Loans to Assets	Ratio of loans to total assets. Source: Orbis bank database.
Deposits to Assets	Ratio of deposits to assets. Source: Orbis bank database.
	Country Level Control Variables
Log (GDP/capita)	Log of real Gross Domestic Product per capita. Source: World Development Indicators.
Inflation	Annual percentage change in consumer prices in a country Source: World Development Indicators.
Legal Rights Index	Index to measure the extent to which the laws in a country protect borrowers and lenders. Source: World Governance Indicators.

Herfindahl Index	Index to Measure market Concentration: World Governance Indicators.
Catholic	Dummy variable equal to one if more than 50% of the inhabitants in a country are Catholics. Source: The World Factbook.
Protestant	Dummy variable equal to one if more than 50% of the inhabitants in a country are Protestants. Source: The World Factbook.
Muslim	Dummy variable equal to one if more than 50% of the inhabitants in a country are Muslims. Source: The World Factbook.
Buddhist	Dummy variable equal to one if more than 50% of the inhabitants in a country are Buddhists. Source: The World Factbook.
Uncertainty avoidance	Index to measure how a society feels threatened by uncertain situations. Source: Hofstede Website.
Long-term orientation	Index to measure the long-term orientation of a society. Source: Hofstede Website.
Trust	Index to measure trust. Source : La Porta et al (1997b).
English Legal Origin	Dummy variable equal to one if a bank is from a country with English legal origins. Source: La Porta et al. (2008).
French Legal Origin	Dummy variable equal to one if a bank is from a country with French legal origins. Source: La Porta et al. (2008).
German Legal Origin	Dummy variable equal to one if a bank is from a country with German legal origins. Source: La Porta et al. (2008).
Scandinavian Legal Origin	Dummy variable equal to one if a bank is from a country with Scandinavian legal origins. Source: La Porta et al. (2008).

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