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16/05: LINGUISTIC RELATIVITY AND ECONOMICS

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Bankwest Curtin Economics Centre Working Paper Series

ISSN: 2202-2791

ISBN: 978-1-925083-24-8

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#### Suggested Citation

Astghik Mavisakalyan and Clas Weber 2016 "Linguistic Relativity and Economics", Bankwest Curtin Economics Centre Working Paper 16/05, Perth: Curtin University.

# Linguistic Relativity and Economics\*

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## ABSTRACT:

The theory of linguistic relativity—the idea that our language influences our thinking—has a long history in the humanities. Speakers of different languages may systematically think and behave differently. This phenomenon has only recently attracted attention from economists. This paper provides the first comprehensive review of this nascent literature. First we explain the linguistic relativity thesis. Then we summarise the empirical evidence on the relationship between linguistic structures and economic outcomes. We follow up with a discussion of empirical design and identification. The paper concludes by discussing implications for future research and policy.

*JEL classification:* D83; J24; Z13

*Keywords:* Language; culture; linguistic relativity; economic behaviour.

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\*We thank Nick Evans for valuable comments. Mavisakalyan gratefully acknowledges the hospitality of Norwegian Social Research (NOVA) where a part of this study was completed.

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The theory of linguistic relativity—the idea that our language influences our thinking—has a long history in the humanities. Speakers of different languages may systematically think and behave differently. This phenomenon has only recently attracted attention from economists. This paper provides the first comprehensive review of this nascent literature. First we explain the linguistic relativity thesis. Then we summarise the empirical evidence on the relationship between linguistic structures and economic outcomes. We follow up with a discussion of empirical design and identification. The paper concludes by discussing implications for future research and policy.

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## 1. INTRODUCTION

Why should economists be interested in linguistic structures? The short answer is that the structure of our language influences our thinking and our thinking in turn determines our behaviour. That language has a systematic influence on thought is the central idea behind the so-called *Linguistic Relativity Hypothesis* (LRH). Even though the LRH has been discussed for many decades in linguistics, anthropology, and psychology, it has only recently attracted the attention of economists. There is now a growing body of literature in economics that studies the connection between linguistic structures and economic outcomes. This literature has already significantly increased our understanding of the determinants of a wide range of outcomes including savings, health, education, and gender gaps. In this paper we provide the first comprehensive overview of this exciting new branch of economics.

Put simply, the LRH states that speakers of different languages may differ systematically in how they think about the world. The reason is that different languages encode different aspects of the world and do so in different ways. As a result, their speakers may differ in their cognitive sensitivity to certain features of reality. For instance, when reporting motion events, English typically encodes the manner of motion (e.g. walking vs flying), while Korean typically omits this information. As a result, speakers of English remember the manner of a merely observed motion-event better than Korean speakers (Oh, 2003). Cognitive differences have practical consequences since our thoughts determine how we behave. Hence, language also has a mediate effect on behaviour. Speakers of different languages may not only think but also act differently in regular and predictable ways. The phenomenon therefore deserves the attention of economists.

The effect underlying the LRH is different from the effect of language skills commonly studied in economics. The origins of the economics of language are often linked to the work of Jacob Marschak (1965), who was interested in efficiency of communication. Traditionally, language skills are considered a form of ‘human capital’ since they are embodied in a person, productive in the labour market and obtained at the cost of time, effort and out-of-pocket expenses (e.g., Chiswick and Miller, 2014). Accordingly, there are positive returns to language skills, particularly in the labour market (recent contributions include Di Paolo and Tansel, 2015; Duncan and Mavisakalyan, 2015; Yao and van Ours, 2015, among many others). Economic returns to language proficiency are also observed at the aggregate level: languages foster bilateral trade (e.g., Melitz, 2008; Fidrmuc and Fidrmuc, 2016). However, for each language the reason why its possession has productive value is the same: it enhances efficiency in communication (in the respective context) (Lazear, 1999). In contrast, many languages

differ in interesting ways in their effects on cognition and behavior. For example, speaking English has productive value in an English speaking country, just as speaking German does in a German speaking country. However, the two languages differ in the way they encode reference to the future, and this fact has a substantial effect on its speakers' cognition and many economic outcomes (Chen, 2013). Hence, the insights from the LRH suggest that the influences of language extends far beyond its traditional role, opening up exciting new avenues for economics.

While there are numerous studies on the LRH in linguistics and psychology (for overviews see e.g. Lucy, 1997; Boroditsky, 2003; Casasanto, 2015), the studies in economics differ from these both in the way they are done and in the phenomena they investigate. They typically use much larger sample sizes and they study the connection between language and robust economic outcomes; many previous studies in linguistics and psychology use relatively small sample sizes and concentrate on smaller scale cognitive effects, such as slight differences in reaction times in colour discrimination (e.g., Kay and Regier, 2006).

In this paper we first provide some background on the linguistic relativity thesis and lay out potential ways of conceptualising the effect of language on decision making (section 2). Then, in section 3, we summarise the existing empirical evidence in the economics literature, focusing on the four linguistic features studied so far: *grammatical gender*, *tense*, *personal pronouns*, and *mood*. Following the summary of the literature, section 4 points out methodological challenges the field needs to address: issues of measurement and causality. We consider in detail different proposals of how to deal with the issue of unobserved heterogeneity in studying the economic effects of language structures. We conclude with a discussion of directions for future research and policy implications in section 5.

## 2. CONCEPTUAL BACKGROUND

**The Linguistic Relativity Hypothesis.** The LRH has a long and controversial history. It can be traced back at least to German Romanticism of the 18th/19th century, in particular to Wilhelm von Humboldt.<sup>1</sup> In the 20th century the LRH gained influence in America, culminating in the works of the linguists Edward Sapir (1929) and Benjamin L. Whorf (1956); it is therefore also referred to as the "Sapir-Whorf hypothesis" or simply "Whorfism". Not long after it was explicitly articulated by Whorf, it fell into disrepute, mainly through the rise of cognitive science, and remained unpopular until the early 1990s, both for empirical and conceptual-theoretical reasons (e.g., Pinker, 1994; Lucy, 1996b, 1997; Gleitman and

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<sup>1</sup> For a detailed history see Aarsleff (1988); Koerner (1992).

Papafragou, 2005). However, since the mid 1990s the LRH is experiencing a revival, addressing both lines of criticism. First, there are numerous improved empirical studies in linguistic and psychology supporting its validity; second, there has been conceptual and theoretical progress, leading to more precise formulations of the thesis, and a better understanding of potential underlying mechanisms (e.g., Gumperz and Levinson, 1996; Lucy, 1996a; Slobin, 2003; Boroditsky et al., 2003; Levinson and Wilkins, 2006; Kay and Regier, 2006; Casasanto, 2016).

It is useful to distinguish strong from moderate interpretations of the LRH (Scholz et al., 2016). A strong interpretation states that language *determines* thought; i.e. no thought of a certain kind without corresponding linguistic structures. A more moderate reading merely claims that language *influences* thought in *systematic* and *non-trivial* ways; i.e. speakers of different languages may exhibit interesting and regular cognitive differences. While strong versions of the LRH remain controversial, there is good evidence that the moderate claim is true. It is important to note that moderate interpretations of the LRH are compatible with the influential universalist approach to language, championed by Noam Chomsky (1957) and, more generally, a nativist understanding of the mind (Fodor, 1983).<sup>2</sup> The claim that all humans are biologically endowed with the same linguistic/mental architecture is consistent with the claim that different languages impose different cognitive and developmental constraints on this innate architecture (Kay and Regier, 2006; Scholz et al., 2016). The thought that there is a conflict between nativism and the LRH forms the main conceptual-theoretical motivation behind opposition to the LRH. In light of the above it seems legitimate to assume that there is a plausible and well-supported moderate version of the LRH, compatible with the dominant strands in cognitive science and linguistics.

**The Linguistic Relativity Hypothesis and Behavior.** Our thoughts determine our actions. By influencing thought, language has an indirect effect on behaviour. In this section we sketch how one may understand this influence in a decision-theoretic framework. Decision theory answers *decision problems* of the following form: an *agent* chooses among a set of *actions* which have various *outcomes* depending on different *states* of the world; the agent has varying credences in different states, represented by a *probability function*, and desires different outcomes to varying extent, measured by a *utility function*.<sup>3</sup> We follow Jeffrey (1965)

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<sup>2</sup> These approaches are not uncontested, see e.g. Evans and Levinson (2009) for opposition against the Chomskian paradigm.

<sup>3</sup> The classical formulations of decision theory are due to Leonard Savage (1951) and Richard Jeffrey (1965). Appropriately modelling some of the following phenomena will require extending the standard framework to allow for non-ideal agents; for non-standard version of decision theory see e.g. (Weirich, 2004; Bradley, 2016).

in understanding actions, outcomes, and states as propositions, i.e. subsets of an underlying possibility space  $\Omega$ . The set of actions  $A$ , states  $S$ , and outcomes  $O$  each form partitions of  $\Omega$ .

There are several potential pathways for linguistic factors to influence an agent's decision making. Language might influence:

- (1) the agent's *probability function*;
- (2) the agent's *utility function*;
- (3) the *grain* in which  $A, S, O$  partition  $\Omega$ ;
- (4) the *salience* of elements of  $A, S, O$ .

Looking at concrete examples we seem to find all of these channels being utilised.<sup>4</sup>

(1) *Probability function*: Language may have a systematic effect on the information its speakers possess. For instance, certain Australian languages comprise only absolute spatial terms (e.g. such as *north, south*) and no relative ones (such as *right, left*) (Levinson and Wilkins, 2006). Speakers of these languages constantly keep track of their absolute orientation in space, assigning higher credence to statements like *that tree is to the north* than do speakers of other languages. Further, Chen (2013) makes the case that languages with *future tense* marking influence agents' probability function in that their speakers have more accurate beliefs about the temporal order of events. It has also been shown that our probability judgments are influenced by cognitive *availability*, i.e. "the ease with which instances can be brought to mind" (Tversky and Kahneman, 1975, p. 1127). Availability in turn is influenced by language through its effect on attention, memory, perception, verbalisation, recognition, and other cognitive faculties.

(2) *Utility function*: Language may affect our preferences. For instance, Thibodeau and Boroditsky (2011) show that verbally framing practical questions in terms of different *metaphors*, crime described as a *virus* or *beast*, can change subjects' ranking of preferred options concerning what to do about crime. Similarly, Chen (2013) argues that speakers of languages with *future tense* are more prone to discount future rewards. Further, Givati and Troiano (2012) and Mavisakalyan (2015) find evidence that grammatical *gender* affects preference structure and reinforces discriminatory gender attitudes, e.g. speakers of gendered languages are more likely to support preferential hiring of men. Other linguistic features that seem to fall into this category are *pronoun drop* affecting pro-social preferences (Kashima and Kashima, 1998); *pronoun politeness distinctions* influencing attitudes concerning social hierarchy (Kashima and

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<sup>4</sup> We also find combinations of (1)–(4), e.g. grammatical tense and gender seem to operate through multiple channels.



Kashima, 1998; Davis and Abdurazokzoda, 2016); use of *agentive vs non-agentive verbs* modifying evaluative attitudes about blame and punishment (Fausey and Boroditsky, 2010, 2011); and *subjunctive mood* influencing risk aversion and preferences about immigration (Kovacic et al., 2016; Kovacic and Orso, 2016).

(3) *Grain of partitioning*: How agents represent different states of the world, their options and outcomes depends on what kind of distinctions they are able to draw, i.e. on their conceptual resources. The richer an agent's conceptual repertoire, the more distinctions she can make, the finer she can partition  $\Omega$ . This may affect her decision making, since not all partitionings are equal—appropriate partitionings are sensitive to the agent's utility and probability function (Bradley, 2016, p. 12). For example, in deciding whether to take an umbrella an agent has to consider the probability of rain and the cost of getting wet. Hence, an appropriate partition of  $\Omega$  divides states in a way that distinguishes between rain and absence of rain and outcomes such that they differ between her staying dry and her getting wet. Linguistic features that influence grain of partitioning are related to conceptual structure, i.e. to how we categorise the world. One such example is grammatical *gender*. When choosing between two job candidates, agents that speak a gendered language may often represent their choice accordingly: *Shall I choose him or her?* While speakers of gender-neutral languages may conceptualise the decision in a way that doesn't so distinguish: *Shall I choose this person or that person?* This can matter in case the agent's probability or utility function are sensitive to this contrast, e.g. if she assigns high credence to *men are better at the job than women* (Mavisakalyan, 2015; Perez and Tavits, 2016). Other linguistic features in this category are e.g. *tense, spacial concepts, number words, certain metaphors, and colour terms* (e.g., Levinson and Wilkins, 2006; Frank et al., 2008; Casasanto and Boroditsky, 2008; Regier and Kay, 2009; Casasanto, 2010).<sup>5</sup>

(4) *Saliency*: Language may *highlight* certain actions, outcomes, or states. This effect can potentially be distinct from the ones considered before. First, two languages may divide  $\Omega$  into the same cells (see (3)), but still differ in which cells are made salient. Second, while this may typically influence an agent's probability or utility function (see (1) and (2)), it doesn't need to do so; an agent may choose a certain option over its alternatives not because language has raised its expected utility, but rather because language has placed it at the centre of her attention. This is especially significant for non-ideal, boundedly rational agents, such as ourselves, who cannot consider each and every possible option or consequence but are confined to decide between a limited subclass thereof. Language may affect saliency e.g.

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<sup>5</sup> We're not suggesting that the relevant distinctions are entirely *unavailable* for certain speakers. In practice, it may be enough if language affects the ease or speed in which certain distinctions can be drawn.

by which distinctions are syntactically encoded (e.g. grammatical gender (Mavisakalyan, 2015), tense (Chen, 2013)), which are lexically encoded (e.g. colour terms (Kay and Regier, 2006)), which are emphasised by being regularly used (e.g. agentive vs non-agentive verbs (Fausey and Boroditsky, 2011)), or which are highlighted by common metaphors (e.g. spatial metaphors (Casasanto and Boroditsky, 2008)).<sup>6</sup>

The above is not intended as a comprehensive classification of mechanisms or linguistic features. It is meant to facilitate the understanding and structuring of the influence of linguistic features presented in the next section.

### 3. EXISTING EVIDENCE

There is a small yet rapidly growing literature on the relationship between language structures and economic behaviour. It is based on comparisons both between countries as well as between individuals within linguistically heterogeneous countries. So far, existing studies have focused on evaluating the outcomes of four types of linguistic features: i.) gender, ii.) tense, iii.) personal pronouns, and iv.) mood. The World Atlas of Language Structures (WALS) (Dryer and Haspelmath, 2013) and other cross-linguistic analyses (e.g., Kashima and Kashima, 1998, 2005; Dahl, 2000) have served as the source for data on language structures.

In these studies, the outcome of interest is regressed on a measure of a linguistic marker, as well as a list of controls. In cross-country regressions, a linguistic marker is either assigned to a country's most widely spoken language (e.g., Licht et al., 2007; Santacreu-Vasut et al., 2013; Bhalotra et al., 2015), or, to reflect the heterogeneity in multilingual countries, it is taken as a weighted measure with weights given by the share of the population speaking each language (e.g., Tabellini, 2008; Chen, 2013; Mavisakalyan, 2015). At the individual level, linguistic markers are linked to the language spoken at home.<sup>7</sup>

The majority of studies focuses on the economic effects of language structures themselves (e.g., Chen, 2013; Mavisakalyan, 2015). Other studies (e.g., Licht et al., 2007; Tabellini, 2008) estimate the causal effect of cultures on economic outcomes, using language structures in the first stage for identification. In what follows, we summarise the existing evidence on the economic effects of linguistic features resulting from this literature.

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<sup>6</sup> Under this category, one might also subsume influences through *habituation* (Majid, 2002) and other effects on reasoning processes, i.e. certain linguistic features may simplify cognitive processes relevant for practical deliberation.

<sup>7</sup> In the absence of corresponding data, studies have employed proxies for primary language, such as the interview language (e.g., Chen, 2013), or the dominant language of the country of ancestry (e.g., Hicks et al., 2015).

**Impact of gender.** Languages differ in whether or not they require speakers to grammatically mark gender. As Corbett (2013a) notes, gender systems ‘pervade some languages, are of some importance in others, and are missing in yet others’. The need to make reference to gender in language may influence individuals’ credences, their preferences, the distinctions they draw and their salience (see §2). In particular, it appears to raise the significance of traditional gender roles in the mind of the speaker. This impacts on gender role distinctions and gender bias in societies. For this reason, feminists have criticised the use of grammatical gender marking as contributing to gender inequalities (see Saul (2012) for an overview of this literature). A number of recent studies investigate the implications of variation in grammatical gender marking for women’s outcomes.

For a linguist “gender” does not simply refer to the colloquial distinction between men and women. Formally, a language possesses a gender system if it has classes of nouns which require inflectional agreement with other elements in the sentence (e.g., Corbett, 1991). Some languages, like Finnish, make no distinctions between noun classes, others, like Thai, distinguish between almost 20 different ones. The contrast between grammatical and natural/semantic gender can be illustrated by the German construction “das Fräulein” (*the Miss*). Grammatically, the noun “Fräulein” is of *neuter* gender, requiring agreement with the neutral article “das”, while its natural/semantic gender is female, as it refers to a woman.

The contrast between grammatical and natural gender gives rise to a challenge. So far, there are two approaches to address this challenge. The first acknowledges that grammatical gender doesn’t always track underlying differences in biological sex; indeed, less than half of the 112 language in the WALS base their assignment of nouns into genders on semantic distinctions (Corbett, 2013b). A promising proposal is to focus on personal pronouns systems (e.g. *he* vs *she* in English), where gender assignment does indeed track underlying biological distinctions (e.g., Givati and Troiano, 2012; Mavisakalyan, 2015). The second approach is to simply utilise all available measures of grammatical gender from cross-linguistic sources such as WALS, remaining largely ambiguous on their relevance to the study of sex-based socio-economic inequalities (e.g., Santacreu-Vasut et al., 2013; Hicks et al., 2015). These include i.) the number of genders, i.e. the number of noun types requiring agreement; ii.) whether the gender system is sex-based; iii.) systems of gender assignment (semantic vs formal), and iv.) gender distinctions in personal pronouns, used independently or in various combinations.

There is growing evidence that grammatical gender is associated with gender inequalities at work and in the household. It is linked to lower female labour force participation and

hours worked across countries and individuals (e.g., [Gay et al., 2015](#); [Mavisakalyan, 2015](#)). Further, grammatical gender appears to have negative implications specifically for female participation on corporate boards and senior management positions ([Santacreu-Vasut et al., 2014](#)). It is not surprising then that having a gendered language is associated with larger estimates of gender wage gaps across countries ([van der Velde et al., 2015](#)). There are also consequences for gender inequalities inside the household, leading to gendered division of labor in household tasks ([Hicks et al., 2015](#)).

How does grammatical gender influence women's outcomes? One plausible mechanism is investment in human capital. [Davis and Reynolds \(2016\)](#) give evidence that speaking a gendered language increases the educational gender gap within countries. Furthermore, recent evidence suggests that it is correlated with gender inequalities in health. [Bhalotra et al. \(2015\)](#) show increases in maternal mortality rates and reductions in the female advantage in life expectancy across countries. Another channel may be its effect on institutions. The literature suggests a connection between gendered languages and an absence of institutions promoting gender equality. [Givati and Troiano \(2012\)](#) show that speaking a gendered language is negatively correlated with the length of maternity leave across countries. [Santacreu-Vasut et al. \(2013\)](#) present evidence that it is negatively associated with the adoption of political gender quotas, and also affects the efficacy of such quotas ([Santacreu-Vasut et al., 2013](#); [Hicks et al., 2016](#)). Most significantly perhaps, grammatical gender has an influence on gender-discriminatory attitudes. [Givati and Troiano \(2012\)](#) and [Mavisakalyan \(2015\)](#), for example, show that speakers of gendered languages are more likely to express support for giving men preferential access to jobs; [Perez and Tavits \(2016\)](#) document a negative effect on support for policies to combat gender imbalances.

**Impact of tense.** Another linguistic feature that has received significant attention from economists is *future tense*. Languages encode reference to future events in different ways. Some, such as German, use the present tense to talk about future events. Others, such as English, make use of auxiliary verbs (shall/will), or, like French, use a dedicated future tense form.

German: *Ich fahre morgen nach Paris* — (I drive<sub>present</sub> tomorrow to Paris).

English: *I will<sub>aux</sub> drive to Paris tomorrow*.

French: *Je conduirai à Paris demain* — (I drive<sub>future</sub> to Paris tomorrow).

We can then distinguish languages that don't require future tense marking, i.e. *weak FTR languages* such as German, from languages that necessitate some form of future tense marking, i.e. *strong FTR languages* such as English and French (Chen, 2013).<sup>8</sup>

Future tense marking seems to have an influence on speakers' intertemporal choices. In a seminal paper, Chen (2013) formulates a 'linguistic-savings hypothesis': being required to speak in a distinct way about future events leads speakers to take fewer future-oriented actions. The explanation proposed by Chen (2013) is that future tense marking projects future events further away from the speaker's present time. As a result, speakers of such languages have a stronger tendency to discount future rewards. Several variations of this hypothesis have been formulated and tested in recent studies.

In his study Chen (2013) shows that speakers of weak-FTR languages save more, retire with more wealth, smoke less, practice safer sex, and are less obese. This evidence holds across countries as well as within linguistically heterogeneous countries. The linguistic-savings hypothesis is confirmed in studies of household saving behaviour by Guin (2015) and Paule-Paludkiewicz et al. (2016). Tense marking can also affect educational attainment; Figlio et al. (2016) show that speakers of weak-FTR languages perform better in third grade reading and math tests, have larger test score gains over time and fewer absences and disciplinary incidents, are less likely to repeat grades and more likely to graduate from high school within four years. Furthermore, they are more likely to attend college (Galor et al., 2016).

These effects also carry over to behaviour at the corporate level. Recent evidence suggests that firms in weak-FTR language locations perform better at corporate social responsibility practices (Liang et al., 2014), have higher precautionary cash holdings (Chen et al., 2015), engage less in earnings management (Fasan et al., 2016), and invest more in research and development (Su et al., 2016). Interestingly, a study by Liang et al. (2014) finds that the link between linguistic FTR and a firm's future-oriented activities is weaker for firms with greater exposure to diverse global languages through being headquartered in countries with higher degree of globalization, having a higher degree of internationalization, and having a CEO with more international experience.

Further studies document that intertemporal preferences might indeed be an important mechanism mediating the effect of future tense. Sutter et al. (2015) demonstrate strong differences in the intertemporal choices of children speaking strong- and weak-FTR languages

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<sup>8</sup> Some studies have additionally considered two alternative continuous measures of language FTR: verb ratio and sentence ratio, defined as the frequency of verbs and sentences respectively that are grammatically future-marked in weather forecasts (e.g., Chen, 2013; Paule-Paludkiewicz et al., 2016; Su et al., 2016).

in a controlled experiment. [Hübner and Vannoorenberghe \(2015a,b\)](#) exploit differences in future tense marking across countries to identify the effect of different time preference measures on macroeconomic outcomes, such as income per worker, total factor productivity, the capital stock and inflation. Moreover, in a recent globally representative assessment of distribution and nature of behaviourally validated survey measures of preferences, [Becker et al. \(2015\)](#) show that the predictive power of FTR is not limited to time preference. As this study demonstrates, weak FTR is also associated with higher levels of prosocial traits such as positive reciprocity, altruism, and trust across countries. Although not explored in the study, these preferences should have influence over a range of important aggregate outcomes.

**Impact of pronoun use.** Grammatical rules governing personal pronouns have also recently been investigated in economics, largely building on the social psychology study by [Kashima and Kashima \(1998\)](#). Two aspects of pronoun use are considered: *pronoun drop* and *politeness distinctions* in pronouns.

In some languages pronouns can be omitted in their position as grammatical subject. For instance, Spanish permits both “Yo estoy cantando” and simply “Estoy cantando” for the English *I am singing*. In the second sentence the pronoun “Yo” has been dropped. This distinction seems to have implications for the contrast between cultural individualism vs collectivism. As [Kashima and Kashima \(1998\)](#) note, “An explicit use of ‘I’ signals that the person is highlighted as a figure against the speech context that constitutes the ground; its absence reduces the prominence of the speaker’s person, thus reducing figure-ground differentiation” (p. 465). Nonpronoun drop languages are expected to be associated with more individualist cultures, while pronoun drop languages are expected to be associated with more collectivist cultures.

A different aspect of personal interactions is linked to politeness distinctions in 2<sup>nd</sup>-person pronouns (you). In some languages (e.g. German, Spanish) there are two different singular 2<sup>nd</sup>-person pronouns (e.g. du, Sie) to index social distance in interactions. In other languages (e.g. English) no such distinction exists and only single 2<sup>nd</sup>-person pronoun singular is used regardless of the social distance between speakers. According to [Kashima and Kashima \(1998\)](#), speakers of languages with multiple *yous* are more conscious of status or social distances than the speakers of other languages. Therefore, the politeness distinction in personal pronouns is expected to bear implications for cultural norms associated with hierarchy and egalitarianism.

Existing studies on the effects of grammatical rules of personal pronouns use have been largely based on the data from [Kashima and Kashima \(1998, 2005\)](#). Accordingly, variables



for pronoun drop and the number of 2<sup>nd</sup>-person singular pronouns available in a language have been employed. A recent study by [Davis and Abdurazokzoda \(2016\)](#) provides new data on these variables based on more refined linguistic information. The studies document a significant relationship between pronoun drop and individualism across societies, however the relationship between politeness distinctions and indicators of culture is less robust ([Kashima and Kashima, 1998](#); [Davis and Abdurazokzoda, 2016](#)).

The work by [Kashima and Kashima \(1998, 2005\)](#) has motivated using personal pronouns as instruments for key dimensions of culture such as individualism vs collectivism and egalitarianism vs hierarchy in studies of their effects on economic outcomes. Cross-country studies by [Licht et al. \(2007\)](#) and [Tabellini \(2008\)](#) provide the initial contributions to this literature, using linguistic variables to identify the causal relationship between culture and institutions. Using pronoun drop as an instrument for cultural emphasis on ‘autonomy’ vs ‘embeddedness’, [Licht et al. \(2007\)](#) find a significant influence of culture on the rule of law, corruption, and democratic accountability. They do not consider politeness distinctions in pronouns in their identification approach. Taking a similar approach to identification, [Alesina and Giuliano \(2007\)](#) study the effect of cultural attitudes towards the family on a range of economic and social outcomes across countries. A study by [Tabellini \(2008\)](#) exploits a composite linguistic variable incorporating both pronoun drop and politeness form differentiation as an instrument to study the link between the culture of ‘generalized’ vs ‘limited’ morality in a society (whether norms of good conduct apply towards everybody or just in a narrow group with which the individual identify) and the quality of government. [Davis and Abdurazokzoda \(2016\)](#) replicate the results in [Licht et al. \(2007\)](#) and [Tabellini \(2008\)](#) using new linguistic data on personal pronoun use. Another recent study by [Davis and Williamson \(2016\)](#) uses pronoun drop rule as an instrument to demonstrate a causal link between individualistic cultures and a country’s propensity to regulate the entry of new firms.

**Impact of moods.** Lastly, economists have studied the grammatical feature of *mood*. There are two general classes of mood: realis and irrealis. Roughly, the mood of a verb differentiates factual from hypothetical statements. For example, “John is taking<sub>ind</sub> an aspirin” is in the *indicative mood*, signalling that it is a statement about what is actually the case. On the other hand, in “He suggested that John take<sub>subj</sub> an aspirin”, the complement sentence is in the *subjunctive mood*, as it describes a *hypothetical* situation in which John takes an aspirin, rather than an actual one. Colloquial English typically uses the indicative mood for both types of statements; other languages are stricter in grammatically marking this distinction and do so across a wide range of linguistic constructions.

Kovacic et al. (2016) propose that speakers of languages where irrealis mood, encoding non-factuality, is more pervasive perceive the world as more uncertain. They show a correlation between the intensity of use of irrealis mood in a language and risk perceptions of speakers of the language. Furthermore, they use mood as an instrument to study the effect of risk aversion on the probability of holding risky financial assets. In a further study, Kovacic and Orso (2016) demonstrate significantly higher intolerance towards immigration among individuals who speak a language where irrealis mood is used more frequently.

#### 4. ISSUES OF EMPIRICAL DESIGN AND METHOD

The existing studies on linguistic features and economic outcomes establish fascinating patterns that, if real, could have important implications for research and policy. Nevertheless, there are at least three important issues that need to be addressed in assessing the reliability of the existing evidence.

First, there are difficulties involving *measurement*: what is to be measured and how best to do it? In the previous section we alluded to the issue of complexity in measuring linguistic features. Existing studies have often simply used existing measures from large linguistic databases such as WALS without thoroughly engaging with their relevance (e.g., Santacreu-Vasut et al., 2013; Hicks et al., 2015). Furthermore, existing categorisation of complex linguistic systems into broad groupings might conceal information about different relevant aspects of languages. Further, many differences between languages are also likely to be non-linear. Our impression is that more effort needs to go into both providing a careful account of the heterogeneity of languages across categories as well as generating valid aggregate measures based on individual linguistic features (including issues of functional form, technique, etc.). Lastly, there is the issue of assigning linguistic measures to units of analysis. This involves the need to account for the presence of multiple significant language groups at the country level and to justify the use of proxy measures in cases where the primary language is not known (for a good example of careful engagement with both tasks see Chen, 2013). Furthermore, the structure of the language in which information is elicited (e.g. in the survey) may matter in addition to the structure of the primary spoken language (Mavisakalyan, 2015).

Second, the issue of *reverse causality* needs to be explicitly addressed. It is not completely implausible that certain economic outcomes may themselves causally affect linguistic structures in some cases. Some promising arguments to exclude this possibility have been made; most notably, Tabellini (2008) points out: ‘As a classic example of network externalities, language evolves slowly over time. Linguistic innovations are costly because until they are



widely adopted communications is more difficult.’ (p. 273). In support of this, [Roberts et al. \(2015\)](#) show that future-time reference variable, in particular, is very stable over time. This suggests that causation is more likely to flow from language to contemporary values and outcomes than vice-versa. Nevertheless, similar arguments adapted to the context of study may support the drawing of causal inferences.

Third, there is the issue of *omitted variables*. The reasons why certain countries and individuals possess languages with specific features are not random: both linguistic features and economic outcomes may be the product of deeper, unobserved factors. In the extreme, this would mean that the estimated effects in the existing studies are entirely spurious. To highlight this, [Roberts and Winters \(2013\)](#) demonstrate that the failure to deal with unobservables may yield implausible links between traits such as linguistic diversity and traffic accidents. Hence, it is crucial to establish whether the observed outcomes are a genuine consequence of languages rather than the effect of unobserved factors merely correlated with languages. Existing studies have thoroughly engaged with this task. The rest of this section focuses on proposals to address the omitted variable bias.

**Cross-country comparisons.** A number of studies have investigated the association between grammatical structures and economic outcomes across countries. Here, the dominant approach to mitigate the influence of unobserved heterogeneity has been to control for a comprehensive list of relevant observables. These studies include several important controls, in addition to controlling for standard characteristics of countries that have established relationships with the outcome of interest.

First, an important question is whether language acts as a mere marker of cultural values influencing economic outcomes, or whether language itself has a direct effect. To answer this question, some studies have included measures such as religious shares (e.g., [Santacreu-Vasut et al., 2013](#); [Gay et al., 2015](#)) and controls for cultural attitudes and beliefs (e.g., [Chen, 2013](#); [Chen et al., 2015](#)). The results confirm that there is a significant effect of language after inclusion of such controls. Other studies have ran placebo regressions with a different linguistic feature theoretically irrelevant to the outcome of study as an additional control (e.g., [Mavisakalyan, 2015](#)).

It is important to note that the above does not preclude the possibility that language may be linked to economic outcomes through influencing elements of culture themselves — a possibility underlying the use of language as an instrument for culture in studies of economic effects of cultures (e.g., [Licht et al., 2007](#); [Tabellini, 2008](#)). On the other hand, the fact that language does have a direct effect on economic outcomes after controlling for measures

of culture throws into doubt the validity of such identification approaches and needs to be carefully considered in future research.

Existing attempts to isolate the economic effect of linguistic measures have also taken into account the relevance of historic origins of countries. These may potentially confound the relevant linguistic effects, as they may influence linguistic and cultural evolution. Indeed, as Galor et al. (2016) demonstrate, differences in pre-industrial geographical characteristics that were conducive to higher return to agricultural investment, larger gender gap in agricultural productivity, and more hierarchical society, have significant explanatory power over differences in the presence of the future tense, grammatical gender, and politeness distinctions across languages. However, they are likely to also affect economic outcomes directly or via other mechanisms. To mitigate the effect of associated bias, cross-country studies have introduced some controls for confounding historical factors such as legal origins, colonization history, historical agricultural practices, language families (e.g., Chen et al., 2015; Gay et al., 2015; Roberts et al., 2015).

Finally, it is possible that the linguistic features of countries are spatially correlated, i.e. that there is a concentration of linguistic features in certain areas. If so, the effects attributed to language may be due to correlated geographical and climatic factors. To address this concern, cross-country studies have included continent fixed effects, and various other location and climatic controls such as the distance from the equator, the share of tropical population, the average number of frost days per unit of population, the share of coastal population, landlocked country status, etc. (e.g., Chen, 2013; Bhalotra et al., 2015; Mavisakalyan, 2015). To accurately address the issue of historical cultural transmissions across countries, Roberts et al. (2015) control for linguistic areas where linguistic contact is known to have historically occurred.

In most cross-country studies, language effects persist once proxies for unobserved heterogeneity are included.<sup>9</sup> Still, unobserved heterogeneity can never be exhaustively controlled for. In cross-country analysis there are several important challenges concerning (i.) unavailability of information on many relevant omitted variables; (ii.) lack of independent variation in linguistic measures and its correlates that may also affect the outcome of interest; and (iii.) exhaustion of the available degrees of freedom in regressions where countries are observations. A conventional way to directly address the problem of endogeneity is to

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<sup>9</sup> One exception is the study by Roberts et al. (2015), based on mixed-method modelling approaches, which shows that cross-country effects of languages are not always robust once historical and geographic relatedness of languages is accounted for.

use an instrumental variable. In practice, however, finding a persuasive instrument for linguistic markers can be extremely hard. Two main attempts to establish a causal effect of linguistic structures through the use of instrumental variables have emerged in the cross-country literature. [Davis and Abdurazokzoda \(2016\)](#) use the grammatical rules of related languages to establish a causal link from the linguistic structures of a country's dominant language to its culture.<sup>10</sup> [Mavisakalyan \(2015\)](#) presents another attempt to identify the effect of language by using language families as instruments for linguistic structures. These approaches assume that the horizontal or vertical relatedness of languages is not correlated with unobserved determinants of outcomes studied. [Mavisakalyan \(2015\)](#) acknowledges the limitations of the identification strategy in her study by noting that '... the linguistic trees may be related to pre-historic migration movements, which may have taken place due to particular economic reasons affecting gender differences in labour force participation' (p. 410), i.e. the outcome variable of interest.

In summary, cross-country studies have undoubtedly been informative in illustrating aggregate patterns between linguistic markers and economic outcomes. But short of including an exhaustive list of controls for unobserved heterogeneity or exploiting truly exogenous shocks to linguistic markers, the estimated effects of linguistic markers in cross-country regressions inevitably capture, at least to some extent, the effect of unobservables. Adding an analysis of individuals living in the same country helps to mitigate some of the bias inherent in cross-country studies.

**Within-country comparisons.** So far, the economics literature on linguistic structures contains two main approaches to studying individuals in the same country. The first directly builds on the design used in cross-country comparisons and estimates country fixed effects models exploiting the presence of multilingual countries with sufficient linguistic diversity to allow for within-country comparisons, in addition to cross-country comparisons (based on the World Values Surveys, for example) (e.g., [Chen, 2013](#); [Mavisakalyan, 2015](#)).<sup>11</sup> These approaches effectively compare the outcomes of observationally identical individuals (controlling for wide range of characteristics capturing individuals' demographic and socio-economic standing but also values and beliefs) living in the same country that speak languages with different linguistic features. By fully accounting for unobserved heterogeneity

<sup>10</sup> For each language, they compute a weighted average of the linguistic rules of all of the other languages in the sample where the weights are proportional to the linguistic proximity of the languages.

<sup>11</sup> Studies based on cases of single multilingual countries such as Belgium ([Su et al., 2016](#)), Canada ([Chen et al., 2015](#)) and Switzerland ([Chen et al., 2015](#); [Guin, 2015](#)) have also recently emerged in the literature. By estimating language effects at smaller geographic scope, these approaches potentially allow to control more extensively for unobserved heterogeneity.

at the country level, this approach is better suited to identify the causal effect of languages than cross-country studies.

Typically, immigrants are excluded from these analyses ‘... so as to avoid conflating differences in a household’s primary language with differences between natives and immigrants’ (Chen, 2013, p. 700). In practice, however, it is likely that a lot of the within-country variation in spoken languages comes from second- or higher-generation immigrants. If so, not only does the approach of excluding first-generation immigrants not entirely deal with this difficulty, it is also problematic due to its failure to identify differences in the type of ancestry (different higher-order immigrants, indigenous populations, etc.), generation of residence (some may have been in the country for many generations whereas other may be second generation), etc. which may have important implications for the study of the effects of linguistic structures.

The second approach to within-country comparisons, on the other hand, specifically targets the behaviour of first- (e.g., Gay et al., 2015; Hicks et al., 2015) or second-generation (e.g., Galor et al., 2016) immigrants, and applies an epidemiological approach to separate the effect of language from country-level unobserved heterogeneity. This approach rests on ‘exploiting the differential portability of culture relative to markets and institutions’ (Fernandez, 2007, p. 310) and was first introduced for studying the effect of culture on economic outcomes (see e.g. Fernandez, 2008 for an overview). Gay et al. (2016) provide a discussion on the relevance of studying immigrant populations for gaining insights into the relationship between linguistic structures and economic outcomes.

Like the approach of none-immigrants studies discussed above, the epidemiological approach is based on the comparison of outcomes of observationally identical individuals in the same country who speak languages with different linguistic features. In contrast to traditional epidemiological approaches, however, the version adopted by studies of linguistic structures also accounts for individuals’ countries-of-ancestry (e.g., Gay et al., 2015; Galor et al., 2016). Hence, in effect, the analysis is based on exploiting variations of languages spoken by individuals with similar characteristics, living in the same place and sharing the same ancestry. This approach helps to overcome potential biases generated by omitted ancestral characteristics not fully accounted for in previous studies.

Nevertheless, the epidemiological approach to within-country comparisons of linguistic structures has its own potential drawbacks. Recent immigrants may face shocks (e.g. on language, culture) which can affect their usual behaviours. Further, recent immigrants are

unlikely to be a representative sample of home-country populations; in particular, their linguistic and cultural profile is likely to be different from home country averages. Finally, the issue of why we observe variation across languages within countries and ancestries and whether such variation is random remains to be comprehensively accounted for.<sup>12</sup>

Overall, the results of within-country analyses are consistent with those obtained in cross-country comparisons. They suggest robust differences in outcomes associated with linguistic structures for otherwise very similar individuals residing in the same country and, in some case, with the same ancestry. These studies are superior, compared to cross-country analyses, in establishing a causal relationship between linguistic structures and behaviour, and in particular in disentangling the effect of language from that of culture. However, making a convincing case for entirely random variation in linguistic measures in observational studies is a tall task. A recent response to these methodological difficulties has been the introduction of experimental approaches.

**Experiments.** A promising way to identify the effects of linguistic structures is to study natural experiments involving changes of languages with different structures or changes within a language. An exogenous change from a language with one grammatical structure to a language with another structure within a country has recently been exploited for the study of *tense*. [Chen et al. \(2015\)](#) and [Su et al. \(2016\)](#) provide difference-in-differences analyses based on the case of Hong Kong, where a weak-FTR language (Chinese) relative to a strong-FTR language (English) became increasingly important after the 1997 transfer of sovereignty from the U.K. to China. They use this natural experiment to examine the effect of an increased significance of a weak-FTR language on cash holdings ([Chen et al., 2015](#)) and investment in research and development ([Su et al., 2016](#)) in Hong Kong firms, compared to several control groups. Similar evidence for other contexts would be useful.

In addition, the effect of languages has been studied in a controlled laboratory experimental setting. A study by [Sutter et al. \(2015\)](#) presents the pioneering contribution to this strand by providing evidence on intertemporal choices of strong-FTR (Italian) and weak-FTR (German) speaking children in a bilingual city in northern Italian. The study is based on a controlled and incentivised experiment in which the authors directly elicit intertemporal preferences, thus keeping the environment as identical as possible for members of the two language groups. While this approach potentially allows for causal interpretation, a

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<sup>12</sup> For example, it is possible that within-country-of-ancestry variation reflects ethnic heritage (e.g. Russian-speaking immigrants from the UK) or socio-economic status (e.g. Russian-speaking immigrants from Kazakhstan). Some of these concerns can be eliminated by inclusion of controls, e.g. [Galor et al. \(2016\)](#) control for parents' human capital.

major drawback is the loss of external validity (for an insightful discussion on the generalizability of findings from laboratory experiments see [Levitt and List, 2007](#)).

## 5. CONCLUSION

Language structures are emerging as an important determinant of a wide range of economic behaviours and outcomes. The nascent economics literature surveyed in this article has uncovered fascinating effects of linguistic structures. Nonetheless, there is work to be done.

We need to pay careful attention to the measurement of linguistic structures that are theoretically relevant and accurately reflect the complexity in which grammars differ. This may also assist in uncovering the mechanism by which given effects are mediated. Collaborations with linguists can help to achieve higher accuracy in measurement tasks.

Further, we need to improve our understanding of the causal relationship between language structures and economic outcomes. There is a growing body of experimental evidence on this issue, which is, however, weak on external validity. Natural experiments of language changes within a country offer promising opportunities for causal identification. Also, investigating changes within a language (e.g. loss of the distinction between the formal and informal ‘you’ in the Scandinavian languages and English) are another promising area of future research aimed at establishing causality.

While the existing studies provide initial evidence on the economic effects of four linguistic structures (i.e. gender, tense, pronouns, mood), there are numerous linguistic features yet to be considered that may likely also reveal differences in outcomes. Some promising candidates are, for instance, the potential effect of *word order*, *possessive constructions*, *metaphors* and *use of agentive vs non-agentive verbs*. Future research may also explore new areas where the linguistic features already considered may have additional effects.

The results of the literature may play an important role in policy-making. As this survey indicates, linguistic structures have both costs and benefits. When they are advantageous for certain desired outcomes (e.g. absence of future tense promoting pro-saving behavior), this should add to the economic benefits of language learning, in addition to its direct labour market value. On the other hand, the economic costs of linguistic features (e.g. gender marking affecting women’s employment) should also be considered in policy-making.

Indeed, the fact that language structures may have important socio-economic consequences has been at the core of several language reform proposals. In the case of gender, for example, the promotion of new gender-neutral terms and ways of communicating has been pursued



by the Swedish Language Council (Milles, 2011). There have even been proposals by some feminists to introduce a new genderless language as a path towards gender equality (e.g., Elgin, 1985). Such reforms, if executed, are very costly. The results from the new literature on linguistic relativity and economics can form a vital source of evidence for such interventions.

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The Centre's research and engagement activities are designed to influence economic and social policy debates in state and Federal Parliament, regional and national media, and the wider Australian community. Through high quality, evidence-based research and analysis, our research outcomes inform policy makers and commentators of the economic challenges to achieving sustainable and equitable growth and prosperity both in Western Australia and nationally.

The Centre capitalises on Curtin University's reputation for excellence in economic modelling, forecasting, public policy research, trade and industrial economics and spatial sciences. Centre researchers have specific expertise in economic forecasting, quantitative modelling, microdata analysis and economic and social policy evaluation.

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