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Rational Conversions

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Abstract: This paper examines the conversion of Bayesian individuals of various types. We show that conversion involves moderately distant religions and that limited access to information for whatever reason leads to dogmatism. We also show that a variety of agnosticism and dogmatism can flourish in the religious sector of the society. Testable predictions include difference in the conversion behaviour of the followers of a religion in societies differentiated by degree of religious pluralism and/or technology, difference in the incidence of agnosticism in societies differentiated by degree of religious pluralism, and conversion to and from atheism involves neither too conservative nor very liberal religions.

JEL Classification: C44, D81, Z12

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1.0 Introduction

If religion is a poorly understood subject then religious conversion is more so. The issue of conversion has been hotly debated in a number of countries some of which, mostly Islamic countries, have banned conversion whereas others, like USA, celebrate the free market in religion. But even in USA conversion to cults was not quite acceptable till recently. Even without explicit sanctions states can alter the dynamics of conversion simply by establishing one or more religions. Similarly, civil society can put in place sanctions, which can influence the process of conversion. But all this is just the super-structure. At a more elementary level a conversion can be characterized by dichotomies like intrinsic vs. extrinsic, voluntary vs. involuntary, and instrumental vs. non-instrumental. The distinction between different types of conversion, however, has remained ambiguous and the related debates are as old as religion itself.

The thin line separating different types of conversions is indeed more often than not elusive. Consider, for instance, the re-conversion of Henri IV of France (b. 1553 – r. 1589 – d. 1610) from Protestantism to Catholicism (Wolfe, 1993), the conversion of Dr. Bhimrao R. Ambedkar (b. 1891 – d. 1956), one of the founding fathers of independent India, from Hinduism to his own interpretation of Buddhism (Zelliot, 2005), and the re-conversion of the Bandaranaikes, the first family of independent Sri Lanka, from god-knows-what to Theravada Buddhism (Gooneratne, 1986). In each of these cases for every person who believed in the authenticity of conversion there was one who flatly rejected the same. Incidentally, the first two conversions stretched over years. At a more mundane level one can think of a Kurdish Muslim who still worships tree-spirits or a Sub-Saharan Protestant who visits shamans. One is also reminded of newly Christianized peasants of medieval Northern Europe who expected the king to bring rains and heal through royal touch (Oakley, 2006). In fact, certain pre-Christian practices survived among the Catholic and Orthodox people of Europe as late as the early 20th Century (Weber, 1978).

In all these cases of conversion three things remain unclear. What are the termini linked by the process of conversion? When does one declare the process of conversion complete? What is the

rationale for conversion? Each of these questions has been debated heavily for at least two millennia. We cannot, and therefore will not, even pretend to make an attempt to summarize these debates.¹ We will just note that both intrinsic and extrinsic rationales suggest themselves in all the above cases and that it is indeed difficult to disentangle the two in a satisfactory manner so as to be able to accord primacy to one of them.

This paper has a very modest aim, namely, to understand non-instrumental, intrinsic conversion. We will use the word “instrumental” in the narrow material sense. Instrumental conversions are rational in the sense that one has some material objectives and conversion is undertaken to meet those objectives subject to constraints. However, the same is not necessarily true about non-instrumental conversions. We will concern ourselves only with non-instrumental, yet rational conversions. Individuals want to follow the “true” religion and convert whenever they learn that their own religion is not the “true” one. Even though religion has a material dimension, material gain from conversion is only incidental to the problem of choice in our analysis. To keep things simple we will further narrow down our scope by focussing on intrinsic conversion so that we can work within a decision-theoretic framework. It bears noting that intrinsic conversion, whether mass or individual, is a process involving just one individual, in particular his beliefs and preferences. We intend to model the process of non-instrumental conversion at this level. We assume stable preferences and restrict our focus to beliefs. Even without this assumption we can confine our analysis to beliefs because elsewhere we have argued that beliefs enjoy primacy over preferences in religious matters (Kumar, 2008).

The key insights of this paper are as follows. (a) It has been argued that people are dogmatic because they have a taste for irrationality (Caplan, 2001). We argue that people become dogmatic due to limited access to information. (b) Club-theoretic models of religious groups rationalize restrictions on interaction with “others” as a means to limit free-riding (Iannaccone, 1992). We, however, argue that restriction on interaction might be imposed to maintain high levels of faith. (c) Supply side theorists have long argued that plausibility of any religion in

¹ Kumar (2008) engages with the relevant debates *within* Economics of Religion and allied disciplines.

particular and religion in general is not affected by the multiplicity of religions in the society and that the vitality of the market for religion is increasing in religious pluralism (Kumar, 2008; Iannaccone, 1998). We show that diversity negatively affects plausibility leading to different types of agnosticisms in a completely or partly religious society. (d) We provide a foundation for Ferrero's assumption that individuals cannot distinguish between closely located religions, which implies that conversion takes place between sufficiently different religions (Ferrero, 2008). In fact, we show that conversion takes place between moderately distant religions, neither too distant nor too close. Further, if religions prescribe different standards for judging themselves (minimize Type I error) and other religions (minimize Type II error) then distance requirement becomes more stringent. This conclusion goes against the human capital models of religion (Iannaccone, 1990), which suggest that chances of conversion between religions are higher when the two are closer.

Last but not the least our discussion highlights the ways in which cognitive constraints (e.g., weightage given to others in one's surroundings while updating beliefs, ability to handle large datasets, ability to distinguish between fine differences, level of confidence desired for making a decision, and uncertainty aversion) shape religious choices. Since these cognitive constraints can be inherent or induced it is not unlikely that religions could try to manipulate them to manage their flocks. Our discussion also suggests that religious groups might try to misrepresent demographic statistics to improve their standing.

Rest of the paper is organized as follows. In the next section we will motivate the need to study conversion within Economics and also provide a brief overview of the existing literature. In the first part of Section 3 we will deal with conversion of individuals who know Bayes' Theorem whereas the second part deals with individuals who know elementary Bayesian econometrics. In both cases we work within a decision-theoretic setting. The last section contains concluding remarks. Throughout this paper we talk in terms of religious beliefs. The discussion, however, applies to other kinds of beliefs, say, political beliefs, as well.

2.0 Background

Over the last few decades economists have gradually become aware of the impact of religion on the economic sphere. Elsewhere we have extensively reviewed the growing body of literature known as *Economics of Religion*, henceforth EoR, see (Kumar, 2008). The issue of religious conversion has received some attention in this literature but mostly in connection with the role of habit in religious sphere, inter-generational transmission of religious affiliation, impact of inter-religious marriage on religious affiliation, and related issues. We will advance two additional reasons why economists *qua* economists should be interested in religious conversions.

Firstly, following Max Weber it has been debated whether some religions are particularly conducive to economic growth. So far the evidence is not unambiguous partly because of problems with historical data and partly because of the difficulty in isolating the causal channels through which religion affects other social phenomena. But suppose in future we obtain conclusive evidence suggesting that religion x is most conducive to growth. What next? Call for conversions? History suggests that this question is not purely rhetorical. Consider, for instance, the belief in certain principles of Protestantism being particularly supportive of socio-economic development, which predates Max Weber, certainly its most celebrated proponent. This widespread belief seems to be a consequence of *socialization*, 'the idea that actors imitate the successful policies and strategies of other actors' (Arreguin-Toft, 2005). Starting from the early 18th Century, the elite of a number of countries outside Western Europe held their traditional religions responsible for their country's material backwardness and introduced religious reforms inspired by the West European Protestant cultures.²

² The long list, arguably, begins with Peter the Great (b. 1672 - r. 1682 - d. 1725), the founder of modern Russia, in the 18th Century (Hughes, 2002). Other prominent figures include the early 19th Century British Indian leader Raja Ram Mohan Roy (1772 - 1833), the founder of modern India (Dinkar, 2002 [1954]; Tagore, 1973). Incidentally, both predate Max Weber and belonged to states in conflict with Western Europe. Neither of them converted to Protestantism, though. Petrine reforms were largely confined to the rationalization of rituals and organization of church activities whereas Raja Roy's reforms also dealt with ethics and theology.

Even for those of us who do not believe that religion influences economic activities there is a reason to study religious conversions. We have been interested in brand loyalty in markets for search, experience, and credence goods. However, the core product of religion, salvation, defies this neat, tripartite classification current in Economics and is traded in an inscrutable market (Kumar, 2008). The very low rates of conversion make world religions one of the most durable brands in human history. How about studying brand loyalty in the market for religion where the underlying product is inscrutable? In fact, in recent years it has been argued that at times it pays to see firms, especially the firms dealing in lifestyle, etc products, in secular markets as “religious-like” (Gomez & Moore, 2006) or “spiritual” (Fogel, 1999). There are a few contributions in EoR that deal with religious brands without directly addressing the inscrutability of the market (Goff & Trawick, 2008; Miller, 2002; Lipford, 1992).

Further, within EoR there is a small body of literature that addresses the issue of religious conversion. On an earlier occasion we have discussed this literature very thoroughly (Kumar, 2008). Here it suffices to note that none of these contributions deals squarely with the issue of doctrinal conversion, the focus of this paper. As of now we know a lot why people do not change beliefs most of the times but little if anything about why they change beliefs sometimes. The present contribution tries to fill this gap in a small way by examining intrinsic, non-instrumental conversions. By restricting ourselves to intrinsic conversions we are abstracting from the market for religion.

3.0 Non-instrumental, intrinsic conversion

We will deal with conversion within a decision-theoretic setting assuming a world where all relevant information, including religious demography, is common knowledge and beliefs are updated with the help of Bayes’ Theorem (Bayes, 1958).³ Since we intend to build a rational

³ The theorem is not explicitly stated in Bayes’ original paper. We use the statement of the theorem currently in use (Iversen, 1984, p. 12).

choice model of conversion it bears noting that the very possibility of rational analysis of religion has been questioned. We have defended rational choice analysis of religion elsewhere (Kumar, 2008; Kumar, 2009a). We will begin with a discussion on the inter-relationship between economic and religious spheres. First of all assume that all individuals who believe in some god or the other also believe that there is no afterlife and that depending on religious practice god dispenses rewards/punishments entirely during one's life, in fact, in the current period itself.⁴ Further economic output depends on secular effort, assumed to be identical across individuals, *and* religious practice, which varies across individuals. People believe that right practice, which in turn depends on religious affiliation, accentuates output and vice versa.⁵ We assume that all individuals put in optimal religious effort in accordance with their religion since god is believed to be omniscient. We will, therefore, not concern ourselves with the issue of free-riding.⁶ Every period individuals form expectations about aggregate output based on their religious belief. At the end of the period individuals adjust their beliefs after observing actual output, which is believed to contain information about the true state of the world. Note that the set of religions can include atheism, belief that output is not influenced by god-like agencies. At this stage three issues bear elaboration, namely, the nature of our explanation of conversion, the objective of individuals in religious sphere, and the relationship between the states of world and religion in our model.

Remark 1. We are not following the Marxist approach to religion under which changes in the religious sphere are treated as manifestations of deeper material changes (Kumar, 2008). In this paper output depends on the true state of the world which in turn is governed by the true

⁴ We will not deal with religions with positive belief in afterlife since we do not have a credible solution to the problems posed in Kumar (2008), who provides an extensive discussion on the difficulties involved in bringing afterlife within the ambit of rational choice analysis. Elsewhere we provide a justification for modeling religion sans afterlife (Kumar, 2009a; Kumar, 2009b).

⁵ Traditionally, material setbacks were attributed to divine punishment for transgressions and victories were treated as rewards for righteousness. More recently religious extremists and fundamentalists across the world have held human "sins" responsible for natural disasters ranging from Gujarat earthquake (2001) to Hurricane Katrina (2005). In short, there is longstanding tradition, which is still strong, of interpreting (in fact, *reducing*) religious developments in (to) materialistic terms. For more on defence of materialistic treatment of religious phenomena see Kumar (2008, 2009a, 2009b) where we argue among other things that religions interpret spatio-temporal variations in material well-being as signals from the divine realm.

⁶ Side-stepping free-riding in this manner is not uncommon in EoR literature (Kumar, 2008). However, there is a growing literature on free-riding in the religious sector (Iannaccone, 1992; Kumar, 2008).

religion. So, when individuals change religion by observing output they are not switching to a new brand of opium due to “deeper” material changes. Rather they are correcting their beliefs in accordance with “revelation”, which is conveyed in material terms.

Remark 2. Our individuals are not after optimal decision *a la* Knightian or Bayesian decision-makers driven by cost-benefit analysis. An instrumentalist is interested in minimizing expected loss (Greene, 2003, p. 434) or in trade-off between the cost of data collection and loss from not knowing the “truth” (Cyert & De Groot, 1987; Iversen, 1984). Our individuals are not instrumentalist because they do not convert to achieve material gains rather they want to ascertain the truth content of various beliefs and switch to the right one. In other words, the inferences about the true state of the world are an end in themselves and material gains or losses are incidental side-effects of the quest for truth.

Remark 3. Application of the states of world approach for normative purposes requires that the states should be a) mutually exclusive, b) exhaustive, and c) should represent “*nature’s* exogenous uncertainty” that cannot be affected by individual’s choice of action. However, whether the states actually exist or are conjured up is irrelevant for the purpose of normative use (Machina, 2002). In this paper the states of nature are assumed to be mutually exclusive and exhaustive and the society is assumed to be sufficiently large so that given the choices of all others’ the choice of an individual has an insignificant affect on output, the alleged medium of revelation. Further, since we are not interested in the validity of claims of existing religions, we can proceed with our discussion even if none of the existing religions corresponds to the true state of the world.

In rest of this section we will analyze the conversion decision of individuals. Individuals in Sections 3.1 and 3.2, respectively, use Bayes’ Theorem and elementary Bayesian econometrics to make decisions. We assume for simplicity that individuals update beliefs every period. However, all our results would go through even if individuals update beliefs once in $T > 1$

periods, with T being restricted by the limitations of memory or fixed by religious doctrine.⁷ Also assume that in case of indifference between two beliefs status quo is preferred. This is just a tie-breaking rule sans any utilitarian content. A utilitarian interpretation would not be inconsistent though.

3.1 When does a Bayesian convert?

We will begin with an introduction to the typology of individuals who populate our world and then discuss the initial condition before we model the actual process of conversion. But before all this consider the following stylized summary of religious doctrine. Religions present a tripartite dogma (\mathcal{D}):

- $\mathcal{D}1$. There is a true god with certain attributes,
- $\mathcal{D}2$. with verifiable manifestations reserved for true believers, and
- $\mathcal{D}3$. contrary manifestations, if any, are either temptations (by a testing god or a satan) or false perceptions due to the lack of faith.⁸

It is not difficult to see that no amount of contrary empirical evidence can shake the belief of an individual who adheres to $\mathcal{D}1$ - $\mathcal{D}3$ because observing either X or $\neg X$ leads to affirmation of such an individual's prior belief. We will refer to such individuals as \mathcal{D} -type, henceforth \mathcal{D} .⁹ However, an individual who adheres to $\mathcal{D}1$ - $\mathcal{D}2$ can entertain the possibility that a contrary manifestation might be due to the fact that the true state of the world corresponds to the description/explanation provided by some other religion.¹⁰ We will refer to such individuals as $\mathcal{D} \setminus \mathcal{D}3$ individuals. It is not at all clear how individuals can relax $\mathcal{D}3$. Here we assume that the

⁷ For instance, some religions ask believers to suspend judgement till the god incarnates or sends a prophet, which in turn is very vaguely timed, while others ask believers to wait till the judgment regarding afterlife is delivered.

⁸ Mythology and theology of all religions are replete with graphic details of $\mathcal{D}3$ simply because contrary manifestations dominate the experience of the believers (Kumar, 2008).

⁹ These individuals hold the following type of beliefs: *If a book contains something that is not in The Book it is dangerous and if it contains all that is in The Book it is unnecessary. In either case The Book is sufficient.*

¹⁰ It bears noting that even without $\mathcal{D}3$ religious conversion might not be forthcoming. In fact, Jainism, an Indic religion that does not restrict self-doubt has not seen any major exodus over the last few centuries. Towards the end of their argument Jain scholars exclaim in self-doubt: *syat yeh theek ho* or perhaps it is right (Dinkar, 2002 [1954]).

types are exogenously fixed. In other words, a $\mathcal{D} \setminus \mathcal{D}3$ individual cannot transform into a \mathcal{D} individual and vice versa. We will further differentiate $\mathcal{D} \setminus \mathcal{D}3$ individuals depending on the weightage, $\lambda \in [0,1]$, they attach to others around them while updating priors. For a fully Bayesian individual $\lambda = 1$ (full Bayesian rationality) whereas $\lambda = 0$ (complete naiveté) for a fully non-Bayesian individual.¹¹ Accordingly, we will refer to $\mathcal{D} \setminus \mathcal{D}3$ type Bayesian individuals as λ -Bayesian individuals. $\text{prob}(Y|R_k)$ denotes the likelihood that output is Y if religion R_k is “true”. Y can be point-valued or set-valued. Without loss of generality we assume the former to simplify expressions.

Now consider a multi-religious society consisting of the individuals described above. Prior belief of \mathcal{D} individuals who belong to the k th religion, R_k , that the doctrine of religion k ($\neg k$) reflects the true state of the world is given by 1 (0). Such an individual’s prior belief about his own religion is invariant to new information because zero priors for truthfulness of other religions necessarily lead to zero posteriors (cf. Iversen 1984, 63).¹² For $\mathcal{D} \setminus \mathcal{D}3$ individuals the prior belief that religion k relates to the true state of the world is given by $\text{prob}(R_k = \text{true})$, or $\text{prob}(R_k)$, which is equal to the population share of k th religion, r_k . So, irrespective of their religion $\mathcal{D} \setminus \mathcal{D}3$ individuals start with a common set of priors in the initial period, which corresponds to the religious demography. Note that even $\mathcal{D} \setminus \mathcal{D}3$ individuals will be impervious to new information if their priors are very strong. However, the imperviousness of $\mathcal{D} \setminus \mathcal{D}3$ individuals is structurally different from that of \mathcal{D} individuals because the latter hold logically unfalsifiable beliefs.

Now consider a Bayesian individual who initially belongs to religion R_k . His subjective belief that the true state of world corresponds to religion R_j given output Y can be expressed as follows, where $\sum_i \text{prob}(Y|R_i) = \text{prob}(Y)$.

$$\text{prob}(R_j|Y) = \frac{\text{prob}(R_j) \cdot \text{prob}(Y|R_j)}{\text{prob}(R_k) \cdot \text{prob}(Y|R_k) + \lambda_k \cdot \sum_{k' \neq k} \text{prob}(R_{k'}) \cdot \text{prob}(Y|R_{k'})} \quad (1)$$

¹¹ Others have differentiated among different shades of Bayesian rationality similarly (Benabou & Tirole, 2006).

¹² In the literature one finds suggestions for going from zero prior to non-zero posterior (Hajek, 1998). But the mechanisms suggested lie outside the Bayesian framework.

Now the response function, which captures the change in religious affiliation in response to new information regarding output, can be expressed as follows, where ω_k captures the degree of certainty an individual belonging to religion k desires:

$$\begin{aligned} R_{\Lambda\text{-bayesian}}^{t+1} &= R_j \text{ if } \operatorname{argmax}_v(\operatorname{prob}(R_v|Y)) = j \text{ and } \operatorname{prob}(R_v|Y)|_{v=j} > \omega_k \\ &= R_{\Lambda\text{-bayesian}}^t \text{ else} \end{aligned} \quad (2)$$

According to Condition (2), a $\mathcal{D} \setminus \mathcal{D}^3$ individual converts from religion R_k to religion R_j iff the posterior probability that the latter is the true religion is not only highest but also exceeds some pre-specified threshold. In words, a Bayesian's decision to convert depends on five things: (a) observed output (Y), (b) weightage given to beliefs of others (Λ_k), (c) prior beliefs $\{\operatorname{prob}(R_j)\}$, (d) belief about the magnitude of output in various possible true states of the world, each related to a particular religion, $\operatorname{prob}(Y|R_j)$, and (e) decision rule (ω_k). *Simple plausibility* (a new belief is acceptable only if it is more likely than not associated with the true state of the world) requires $\omega_k \in (0.5, 1.0]$. We will refer to religious community j that fulfils Condition (2) and *simple plausibility* for another religious community k as " x_{kj} -majority", where x_{kj} is the minimum population share of religion R_j for it to fulfil the conditions with respect to religion k .

We can now make the following claim regarding conversion.

Proposition 1. Conversion decision rule varies with the type of individual as follows:

- a. \mathcal{D} individuals always remain in their initial religion.
- b. $\mathcal{D} \setminus \mathcal{D}^3$ individuals belonging to religion k convert to the religion corresponding to the true state of nature in accordance with Condition (2) that also meets the requirement of *simple plausibility*, i.e., individuals convert to the religion of x_{kj} -majority, if any.

Note that the set of x_{kj} -majorities can be empty and that in a bi-religious society religions cannot simultaneously serve as x_{kj} -majorities for each other. Now the above proposition leads

to the following observations, where $\mathcal{F} = 1 - \sum_k r_k^2$ denotes unadjusted fractionalization index,¹³ $r_k \in [0,1]$ is the population share of k th religious community, and $\mathcal{P}_{ij} = \frac{\text{prob}(Y|R_i)}{\text{prob}(Y|R_j)}$.

Corollary 1. Conversion does not take place in a sufficiently fractionalized society.

For instance, in a two religion society conversion does not take place if $\mathcal{F} = 1 - \sum_k r_k^2 \geq \underline{\mathcal{F}} = 2(1 - x_{kj}) \cdot x_{kj}$, where $x_{kj} = \omega_k \cdot \sum_{k'} \mathcal{P}_{k'j} \cdot \Lambda_{kk'} \cdot \text{prob}(R_{k'})$, $\Lambda_{kk'} = 1$ for $k' = k$, and $k' \in \{j, k\}$.

Corollary 2. Conversion of higher order Bayesian individuals (characterized by larger values of Λ) is relatively less likely. ($\because \partial x_{kk'} / \partial \Lambda_{kk'} > 0$)

Following the above we can say that the educated should be less likely to convert if Bayesian rationality is increasing in education.

Corollary 3. The existence of other religions affects the relative plausibility of two religions, say, R_k and R_j , and, therefore, conversion between the two. Holding the population share of religion j fixed if the population weighted mean of likelihood of $n - 2$ other religions is sufficiently larger than that of religion R_k , $\text{prob}(R_k) \cdot \text{prob}(Y|R_k) \cdot \Lambda_k^{-1} < \sum_{k' \neq j, k} \text{prob}(R_{k'}) \cdot \text{prob}(Y|R_{k'})$, then the possibility of conversion of a non-naive individual ($\Lambda_k > 0$) from religion R_k to religion R_j will be less than if R_k and R_j were the only religions in the society.

Corollary 4. Conversion can be triggered by exogenous shocks to priors (change in demography due to migration, population transfers, etc) and/or parameters (ω - standard of proof, Λ - weight attached to claims made by competing religions).

¹³ Unadjusted fractionalization index is widely used in EoR to capture religious pluralism of a society. It measures the probability that two individuals picked at random belong to different communities but does not take into account inter-community normative distance (Kumar, 2009a). $\mathcal{F} \geq 0.5$ if no community enjoys a majority status in the society, i.e., $r_k \leq 0.5 \forall k$.

So far we have confined the analysis to a single period. Now we will take up a simple case to illustrate how things work out in a multi-period setting. Assume that once the entire society is converted to one religion there are no more changes in religious affiliations. We know that in pre-modern societies output and population (and, hence, per capita income) remained largely unchanged for centuries in a row (Maddison, 2003). In the following analysis we will, therefore, assume for the sake of simplicity that output is fixed and same across periods, which given our assumption that history is known to all implies $prob(Y) = 1$. If the same level of output is observed every period and all individuals are fully Bayesian rational ($\Lambda = 1$) then in a bi-religious society (religions R_j and R_k) in period n the posterior belief that R_j is the true religion is given by $prob(R_j) \cdot (prob(Y|R_j))^n$, where $prob(R_j)$ is the initial population share of religion i . The following proposition summarizes the conditions under which this initial demographic distribution is stable, where use has been made of the fact that in a bi-religious society a religion that satisfies one part of Condition (2) satisfies the other part as well. (Analogous results can be obtained for $prob(Y) < 1$ and $\Lambda < 1$.)

Proposition 2. If the same level of output is observed every period then an initially bi-religious society consisting of fully Bayesian rational ($\Lambda = 1$) individuals turns mono-religious at the end of first period iff $prob(R_k) \notin [1 - \omega_k/prob(Y|R_j), \omega_j/prob(Y|R_k)]$ otherwise it remains bi-religious. (See Figure 1)

Figure 1 about here

3.2 When does a Bayesian econometrician convert?

Individuals in Section 3.1 were assumed to be equipped with Bayes' Theorem. In this section we will assume that individuals are fully Bayesian rational ($\Lambda = 1$) and familiar with elementary Bayesian Econometrics. We noted above that the true state of the world is deciphered by observing output. Assume that in period $t = t'$ a Bayesian individual who follows k th religion

believes that output follows a normal distribution with mean $\mu_k^{t=t'}$ and variance $\sigma_k^{2t=t'}$, the priors corresponding to his religious belief, R_k . For a given religious demography followers of every religion form expectation about economic output of the society as a whole according to their religious beliefs. Individuals have access to information from n comparable societies, where output is believed to be generated by an identical process. Actual output in these societies is found to be normally distributed as per mean y and variance σ^2/n . Posterior mean and variance can be expressed as follows:

$$\mu_k^{t=t'+1} = \left(\frac{1}{\sigma_k^{2t=t'}} \mu_k^{t=t'} + \frac{1}{\sigma^2/n} y \right) \cdot \sigma_k^{2t=t'+1} \quad (3)$$

$$\sigma_k^{2t=t'+1} = \left(\frac{1}{\sigma_k^{2t=t'}} + \frac{1}{\sigma^2/n} \right)^{-1} \quad (4)$$

because normal priors with normally distributed data lead to normal posteriors (Iversen, 1984, pp. 36-38; Cyert & De Groot, 1987, pp. 16-19). It is easy to see that posterior mean is a weighted average of prior and observed means. The individual constructs a confidence interval $\mu_k^{t=t'+1} \pm Z_k \cdot \sqrt{\sigma_k^{2t=t'+1}}$, where Z_k depends on the level of confidence desired and can be seen as a cognitive constraint and/or part of religious teaching.¹⁴ See Figure 2 for an illustrated example where posterior mean lies midway between prior and observed means and both prior and observed means fall outside the confidence interval.

Figure 2 about here

Now the individual decision to convert can be summarized in the following proposition. We assume that individual belonging to religion R_k does not change affiliation if $C_k = \emptyset$ or $k \in C_k$, where C_k denotes the set of religions whose prior falls within the posterior confidence interval of religion k . This assumption captures status quo bias.

$$C_k = \left\{ k' \mid \mu_{k'}^{t=t'} \in \left[\mu_k^{t=t'+1} - Z_k \cdot \sqrt{\sigma_k^{2t=t'+1}}, \mu_k^{t=t'+1} + Z_k \cdot \sqrt{\sigma_k^{2t=t'+1}} \right] \right\} \quad (5)$$

¹⁴ The interpretation of Bayesian confidence intervals is different from that of classical ones. "Bayesian interval founded on probability as a measure of uncertainty, expresses our uncertainty about the population parameter by stating" that with specified probability it lies in the interval constructed (Iversen, 1984, p. 38).

Proposition 3. A Bayesian econometrician switches affiliation from religion R_k to

- A. If $|C_k| = 0$: Religion R_k .
- B. If $|C_k| \geq 1$ and $k \in C_k$: Religion R_k .
- C. If $|C_k| > 1$ and $k \notin C_k$:
 - a. Type I Agnosticism¹⁵ (impossibility of differentiating among religions as well as between religion and non-religion): C_k includes atheism *and* more than one religion.
 - b. Type II Agnosticism (impossibility of differentiating between religion and non-religion): C_k includes atheism *and* one religion.
 - c. Type III Agnosticism (impossibility of differentiating among religions): C_k includes more than one religion but not atheism.
- D. If $|C_k| = 1$ and $k' \in C_k$: Religion $R_{k'}$.

Note two points here. One, $C_k = \emptyset$ or $|C_k| = 0$ does not imply acceptance of atheism because in this case the prior of atheists does not fall in the posterior confidence interval. Two, if we introduce sectarian divisions within religions another type of agnosticism, namely, impossibility of differentiating among sects of a religion is possible, which roughly corresponds to the *ecumenist's* claim. So, there can be four kinds of *Type II* Buridan's Asses¹⁶ in the religious sphere.^{17, 18} Further, if to begin with an individual is assumed to be some kind of agnostic

¹⁵ Even though there is no work on agnosticism in EoR we are not the first to deal with agnosticism within the Bayesian framework (Hajek, 1998; Monton, 1998; van Fraassen, 1998). The recent literature actually begins with van Fraassen's (1989) *Laws and Symmetry* (Hajek, 1998). van Fraassen had originally proposed that being agnostic about some proposition involves having a belief that can be represented by a non-singleton set containing zero. Since then this idea has come under serious attack and, in fact, lost acceptability (Hajek, 1998). The key insights of this literature are as follows: a) agnosticism is not necessarily associated with low probability, b) vagueness is not a necessary element of agnosticism, c) agnosticism has nothing to do with stability of beliefs, and d) belief and commitment are not interchangeable. Our notion of agnosticism is a shade different from that of Hajek. Our agnostics know that the true value lies within a specified interval with a certain probability but within that interval they are unable to isolate the true value of the variable under consideration. But to every possible interval they assign a sharp probability.

¹⁶ Type II Buridan's Problems relate to choice between items that are different "in some crucial respect which is not apparent" (Gambetta, 1994).

¹⁷ Agnostics, it has been argued, can be divided into two broad categories (Duncan, 2003). The first believe that questions about god are impossible to resolve whereas the second do not believe in the impossibility even though they think that evidence alone is insufficient in this regard. Our agnostics compare with the latter.

(characterized by rectangular priors) we can find the conditions under which the individual will convert to some religion, another type of agnosticism, or atheism. The above proposition leads to the following observations, where it is assumed that atheism is included in the set of religions and there is sufficient religious diversity in the society. The latter amounts to assuming that for each religion R_k there exists another religion R_j such that $(\mu_j^{t=t'} - \mu_k^{t=t'}) \cdot (\mu_k^{t=t'+1} - \mu_k^{t=t'}) > 0$, which in turn is equivalent to $\exists R_j$ such that $\mu_j^{t=t'} \in \begin{cases} (-\infty, \mu_k^{t=t'}) & y < \mu_k^{t=t'} \\ (\mu_k^{t=t'}, \infty) & y > \mu_k^{t=t'} \end{cases}$; otherwise there is no question of conversion because whenever the preceding condition is not satisfied $R_k \notin C_k \xRightarrow{\Rightarrow} R_j \notin C_k$, i.e., status quo is stable in case of religion R_k .

Corollary 5. Inter-religious conversion ($|C_k| = 1$ and $k \notin C_k$) involves two moderately distant religions, say, k and j . $d_{kj} \in \left[d_0 - Z_k \cdot \sqrt{\sigma_k^{2t=t'+1}}, d_0 + Z_k \cdot \sqrt{\sigma_k^{2t=t'+1}} \right]$, where $d_{kj} = |\mu_j^{t=t'} - \mu_k^{t=t'}|$ is the 'distance' between religions k and j , $d_0 = |\mu_k^{t=t'+1} - \mu_k^{t=t'}|$, and $k \notin C_k \Rightarrow d_0 = |\mu_k^{t=t'+1} - \mu_k^{t=t'}| > Z_k \cdot \sqrt{\sigma_k^{2t=t'+1}}$ (See Figure 3).

Figure 3 about here

Following the above corollary we can say that that conversion to and from atheism involves neither too conservative nor very liberal religions.

Corollary 6. Individuals with access to information from fewer comparable societies, i.e., small n , are less likely to convert and hence more likely to come across as dogmatic. (See Figure 4)

Figure 4 about here

¹⁸ Agnosticism can also emerge in Section 3.1 if Y is set-valued, i.e., religions supply beliefs about a range rather than precise values of outputs.

The idea behind the above claim is as follows. As long as $y \neq \mu_k^{t=t'}$ (a) $|\mu_k^{t=t'+1} - \mu_k^{t=t'}|_{n=0} = 0$ while $Z_k \cdot \sqrt[2]{\sigma_k^{2t=t'+1}} \Big|_{n=0} > 0$, where $n = 0$ relates to the situation of complete lack of access to new information, (b) $\partial |\mu_k^{t=t'+1} - \mu_k^{t=t'}| / \partial n > 0$ and $\partial \left(Z_k \cdot \sqrt[2]{\sigma_k^{2t=t'+1}} \right) / \partial n < 0 \forall n$, and (c) $|\mu_k^{t=t'+1} - \mu_k^{t=t'}|_{n \rightarrow \infty} > Z_k \cdot \sqrt[2]{\sigma_k^{2t=t'+1}} \Big|_{n \rightarrow \infty}$. Together (a) - (c) imply the existence of n^* such that access to $n \leq n^*$ sources of information rules out conversion because $k \in C_k \forall n \leq n^*$, which as per our assumption supports status quo. Uniqueness of n^* follows from the monotonicity of the slopes.

Now we can say that followers of the same religion in technologically different societies will reveal different conversion behaviour due to different degrees of access to information, assuming access varies directly with the level of technological development.

Corollary 7. Agnosticism is more likely in more plural or fractionalized societies.

Fractionalization, which is a measure of pluralism, is non-decreasing in the number of religions (Kumar, 2009a). We will refer to the degree of pluralism based simply on the number of religions as *count-pluralism*. Fractionalization is increasing in *count-pluralism*. Other things equal higher the degree of *count-pluralism* (and by implication fractionalization) the more likely it is that the posterior confidence interval is non-empty as well as non-singleton, which together favour agnosticism against status quo or conversion to another religion. Figure 5 illustrates the various possibilities regarding agnosticism in a four-religion, including atheism, society.

Figure 5 about here

Corollary 8. To prevent conversion of its members to other religions a religion should be dogmatic (very strong priors, i.e., small values of $\sigma_k^{2t=t'}$), discourage interaction between its members and others at least on doctrinal issues (small n), and prescribe Type I error-aversion

for self-evaluation (large Z_k) and Type-II error-aversion for evaluation of claims of other religions (small Z_k).

Actually sufficiently strong empirical evidence can force Bayesian individuals with widely different priors to converge, or at least come reasonably close to each other (Iversen, 1984, p. 70). No wonder religions stress primacy of *faith* when confronted with contrary evidence.

4.0 Concluding remarks

This paper models religious conversions within a decision theoretic framework. First we deal with an individual who knows only Bayes' Theorem and then with one who knows elementary Bayesian econometrics. We show that conversion takes place between moderately distant religions and that different types of agnosticism can emerge in a society exhaustively divided among a number of religions, which may include atheism, to begin with.¹⁹ Our analysis also suggests that religions will play with the parameters of decision problem faced by believers to retain members. In fact, it is for this purpose that religions also "discuss" other religions, which ensures that when judging other religions the believers will use parameters values favourable to their own religion. Also, religious groups that face intense existential pressures should ask believers to wait till a distant future date before updating their beliefs. One way in which religions manage to push the aforesaid date beyond death is by arousing afterlife considerations. Rest of this section is divided into three parts. First we will discuss how various implications of our analysis compare with existing literature. We will then summarize the testable predictions of our analysis. Finally, we will discuss some extensions.

¹⁹ Note carefully that explaining the emergence of agnosticism is not same as explaining the emergence of a new religion. Unlike atheism, agnosticism is not a religion. The emergence of agnosticism marks the redefinition, in the mind of an individual, of the relationships among *known* religions. Agnosticism is a state of undecidability when faced with a set of religious choices.

Cognitive limitations In a recent spatial model of religious competition (Ferrero, 2008) “firm” locations were assumed to be constrained by a *minimum critical distance* firms need to maintain among themselves. This distance in turn was assumed to be governed by the inability of laity to distinguish between sufficiently close doctrinal positions. We have provided a rigorous foundation for this assumption by showing that limited access to data or constraints on acceptable standards of proof can limit individual capacity to distinguish between nearby options (see Figure 3-5). New firms in Ferrero’s framework will not open shops in *no conversion* zones in the aforesaid figures.

Religious capital-based explanations of conversion According to religious capital models closer the religions are higher the possibility of conversion between them because in such cases the convert does not completely forfeit religious capital (Iannaccone, 1990). It is not difficult to see that the idea of loss aversion drives the result. An extreme example illustrates this point. A pious Muslim or Jew who accumulated a lot of religious capital by abstaining from prohibited foods forfeits the entire capital when converting to Christianity. But the reasonable assumption of cognitive limitations (Ferrero, 2008) goes against the religious capital argument. Further our results suggest that conversion involves religions that are neither very close nor too distant (Corollary 5). If religions prescribe different standards for judging themselves (minimize Type I error) and other religions (minimize Type II error) then the “difference” requirement becomes even more stringent.

Why are religious people dogmatic? It has been argued that religious beliefs belong to the class of low information, high certitude beliefs, which can be modelled as rational irrationality (Caplan, 2001). Caplan assumes that people are endowed with a taste for irrationality. He *presumes* that all religious people are $\mathcal{D}\backslash\mathcal{D}3$ -type individuals. He argues that most religious beliefs, howsoever, irrational can be held with high certitude because they do not affect ones material well-being, e.g., believing in the reality of flying prophets does not affect ones salary unless one is into aircraft designing. Individuals discard irrational beliefs when faced with sufficiently high cost of continued adherence. But the limitation of Caplan’s model becomes

clear when we consider the case of those who sacrifice their lives for otherwise innocuous religious myths, e.g., the place of Ali in the (Islamic) prophetic hierarchy, etc.

Two broad kinds of dogmatisms, extrinsic and intrinsic, emerge from our analysis. We show that lack of information (small n) can lead rational $\mathcal{D} \setminus \mathcal{D}^3$ individuals to tenaciously hold on to religious beliefs. However, we cannot distinguish between dogmatism due to a) genuine lack of information and b) rationing of information (self- or externally-imposed)). These are sources of what we call *extrinsic* dogmatism. But individuals can be dogmatic even in face of abundant information due to intrinsic factors. For instance, \mathcal{D} individuals are absolutely dogmatic simply due to the structure of their belief, which is not falsifiable. In fact, even $\mathcal{D} \setminus \mathcal{D}^3$ individuals can behave like \mathcal{D} individuals: a) if they are endowed with very strong priors (in our framework this requirement translates as sufficiently small $\sigma_k^{2t=t'}$, i.e., high confidence in priors), b) if they are completely naive ($\Lambda = 0$), c) if they employ very demanding and/or biased evaluation criteria, and d) if they are unable to handle large datasets due to cognitive limitation. It is not difficult to see that the *intrinsic* dogmatisms of \mathcal{D} and $\mathcal{D} \setminus \mathcal{D}^3$ individuals are different because the former hold beliefs that are *logically unfalsifiable* whereas the latter might hold beliefs that are *empirically unassailable* (for the time being).

Before we end this discussion it is worth noting that dogmatism has been explained elsewhere in Economics by invoking ideas like home team bias (Wittman, 2008). In this literature agents are endowed with preference for beliefs and often there is an element of group pressure. We differ from this literature in two crucial respects. First of all our agents derive no utility from clinging to their past beliefs. Secondly, our agents are stand alone decision makers, i.e., we do not invoke group pressure. Our individuals are not subject to herd behaviour when choosing to convert. So, in our case individuals might be dogmatic even in absence of utilitarian status quo bias (arising out of uncertainty aversion) and peer pressure. It bears noting that the status quo biases introduced immediately before Section 3.1 and also before Proposition 2 are tie-breaking rules. The substance of the following analysis remains unaffected even if we discard the aforesaid rules. In the former we can as well resort to toss of a coin to resolve ties. In the latter

case discarding the tie-breaking rule will lead to the following minor change: Case B of Proposition 3 will be subsumed under Case C of the same proposition.

Behavioural or doctrinal strictness Club-theoretic models of religious organization suggest that sects (roughly speaking, stricter churches) restrict secular options of members, which includes interaction between believers and non-believers, to limit free-riding. This is referred to as behavioural strictness. Those who continue as members derive more satisfaction from higher intensity of involvement of other participants and in turn increase their own level of participation (Iannaccone, 1992). Our discussion suggests that restrictions on interaction between believers and non-believers can also be justified based on the need to reduce n and promote intensity of belief (Corollary 6). So, we could as well interpret restriction on interaction with “others” as a consequence of doctrinal rather than behavioural strictness. Elsewhere we have discussed other issues related to the neglect of doctrinal strictness in club-theoretic models (Kumar, 2008).

Religious pluralism and religious vitality Supply side theorists argue that as religious pluralism increases so does competition among religions, which in turn enhances religious vitality because suppliers exert themselves and offer better quality products. People respond by enhancing their engagement with religion of their choice (Iannaccone, 1998). Our discussion suggests that sufficiently high degree of pluralism can lead to agnosticism of various hues (Corollary 7), which is not suggestive of the religious vitality of the society. Incidentally, this condition is very weak as well as general in the sense that it does not depend upon an extreme or for that matter any particular demographic distribution.

Another interesting insight that can be drawn from our discussion is as follows. We can interpret the possibility that the followers of religion i could convert to religion j as a measure of doctrinal competition offered by religion j to religion i . Holding the population share of religion j fixed if we alter the shares of other religions then the effect of doctrinal competition to religion i due to religion j decreases as the population-weighted plausibility of $n - 2$ religions other than i and j

increases and vice versa (Corollary 3). Similarly, holding the number and population shares of religions fixed if we alter the set of religions other than i and j then the doctrinal competition to religion i due to religion j decreases as the population-weighted plausibility of $n - 2$ religions other than i and j increases and vice versa (Corollary 3). Assuming a straightforward relation between pluralism (as long as it is defined demographically) and religious vitality, fairly common in the 1990s, is, therefore, quite simplistic and bound to lead to misleading results. In the 1990s simplistic characterizations of pluralism wrought havoc in EoR and Sociology of Religion (Kumar, 2008; Kumar, 2009a).

Attitudes towards religious identity of immigrants Consider a demographically stable (in the sense of Proposition 2) bi-religious society. Now suppose it starts attracting immigrants from a variety of religions and countries at a rate that does not overwhelm the host society. For simplicity further assume the absence of religious persecution in all societies. In other words, we are dealing with economic migrants. By virtue of Corollary 3 the immigrants who make the position of relatively vulnerable of the two original religions stronger will weaken the position of the relatively stronger one and vice versa. In short, the two original religious communities have opposed preferences over the religious composition of immigrants. Further, ex ante the conversion propensity of immigrants in the host country relative to their home countries is ambiguous since conversion rates are higher in advanced countries (Corollary 6) and educated are less likely to convert (Corollary 2). Here we are assuming not without justification that migration takes place from backward to advanced countries and that the migrants to advanced countries are on an average more educated than the home population.

Error aversion Religious discourse, particularly Middle Eastern, is obsessed with *false* and *erroneous* beliefs. In our discussion Z_k captures Type I error aversion. Higher values of Z_k relate to higher Type I error aversion. Since the likelihood of Type II errors increases as the likelihood of Type I error decreases we can roughly say that Z_k captures both aversion to Type I and II errors. It is not difficult to see that religions should prescribe different standards for judging themselves (minimize Type I error) and other religions (minimize Type II error) (Corollary 5, 6, 8).

When do religions need afterlife? The traditional view in this regard suggests that afterlife is an integral part of religion. More recently, EoR scholars have linked the stress or lack of it on afterlife to the society's need for contract enforcement, etc (Richardson & McBride, 2008; Hull & Bold, 1994; Hull & Bold, 1989; Hull, 1989). Others in EoR view afterlife as a useful conning device (Ekelund, Hébert, & Tollison, 2006; Ekelund, Hébert, Tollison, Anderson, & Davidson, 1996). Our discussion suggests that whenever a religion faces stiff competition, particularly from close competitors, secular pressures, or intense questioning (may or may not be related to the first two) it should stress afterlife to alter the frequency of revisions of beliefs. Roughly speaking a related reasoning has been used to explain the genesis of the idea of Apocalypse in Early Christianity (Smith, 1999). To be more precise Smith argues that this idea wrought on the imagination capital of believers and altered their time preferences. This in turn made the believers wait for longer before giving in to the pagan pressures. Our and Smith's arguments share a common element, namely, altering the time horizon of decision-making. It bears noting that we are not suggesting that a cornered religion will necessarily stress afterlife; only that afterlife doctrine could serve as a safety valve.

Testable predictions of our analysis can be summarized as follows: a) difference in the conversion behaviour of the followers of a religion in societies differentiated by degree of fractionalization (possibility of conversion being lesser in more fractionalized society), b) difference in the conversion behaviour of the followers of a religion in societies differentiated by technological development (possibility of conversion being lesser in technologically backward societies), c) difference in the conversion behaviour of the followers of a religion in societies with non-identical set of religions (possibility of conversion being lesser in a society where non-target religions are relatively more plausible than the target religion), d) difference in incidence of agnosticism in societies differentiated by degree of pluralism (agnosticism being more likely in more plural societies), e) conversion to and from atheism involves neither too conservative nor very liberal religions, and f) education is inversely proportional to the propensity to convert.

Before we end a few words on possible extensions of this paper are in order. The rational choice model presented here can be extended in four complementary directions. So far we implicitly assumed that individuals get free access to information, which is not true. We can think of extending the model to a market setting, which includes sellers of information (*aka* priests) apart from laity (individual decision makers). In such a setting individuals will be required to form beliefs about priests as well as the truth of religious claims. Individuals might have to choose among (a) honest priests espousing plausible religions (honest, plausible), e.g., Rev. Martin Luther supporting Christianity, (b) (honest, implausible), (c) (dishonest, plausible), and (d) (dishonest, implausible). It is easy to see that $(a) \succ \neg(a)$, $(b) \succ (d)$, and $(c) \succ (d)$. But whenever the choice is restricted to $\{(b), (c)\}$ then the individual faces Type III Buridan's Problem. Likewise, whenever there is more than one option under any particular category (a) through (d), i.e., say $\{a_i\}$, then individual faces Type II Buridan's Problem.²⁰

Secondly, we can extend the model to a multi-period setting and check if an initially heterogeneous society converges to some stable demographic distribution in response to material shocks or if an initially internally heterogeneous religious community survives intact over time. (At the end of Section 3.1 we provided an illustration of conversion in a simple multi-period setting assuming time-invariant level of output. Extensions should work with random output.) Thirdly, the model could be extended to include afterlife. Finally, we can extend the model so as to account for societies where people are not sure if the known religions mutually exhaust the set of states of the world. One last point before we close our discussion. Looking at Figure 2, which underlies Figures 3 - 5, we can say that that a Hotelling-style linear spatial representation of doctrinal competition, including actual doctrinal claims as well as the standards of proof, among suppliers is plausible.²¹

²⁰ Type I Buridan's Problem relates to choice between items that "are of the same quality". Type II Buridan's Problems relate to choice between items that are different "in some crucial respect which is not apparent". Type III Buridan's Problem relates to more than one evaluation criteria that are in conflict (Gambetta, 1994, pp. 353-354).

²¹ Also see Kumar (2009b) where we arrive at a linear spatial representation of a religious problem, namely, choice of state religion.

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Figures

Figure 1: Conversion in a fully Bayesian rational, bi-religious society

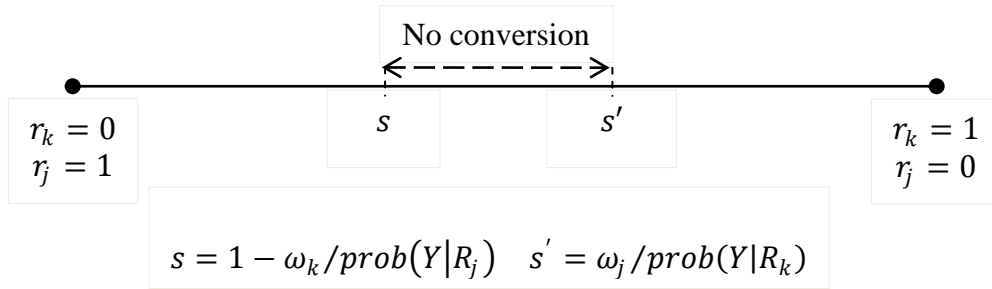


Figure 2: Confidence Interval

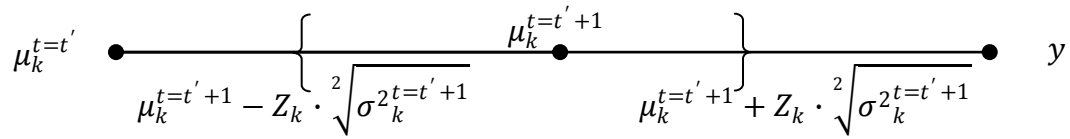
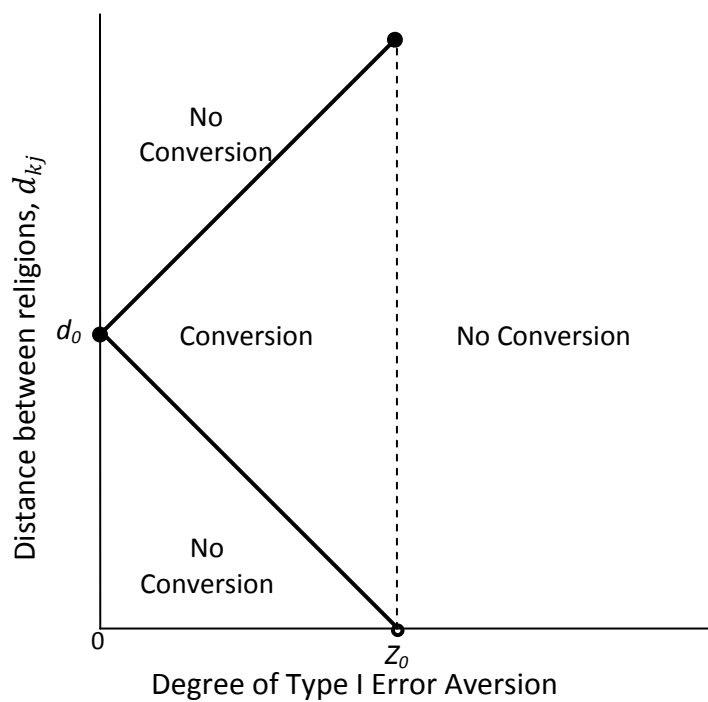


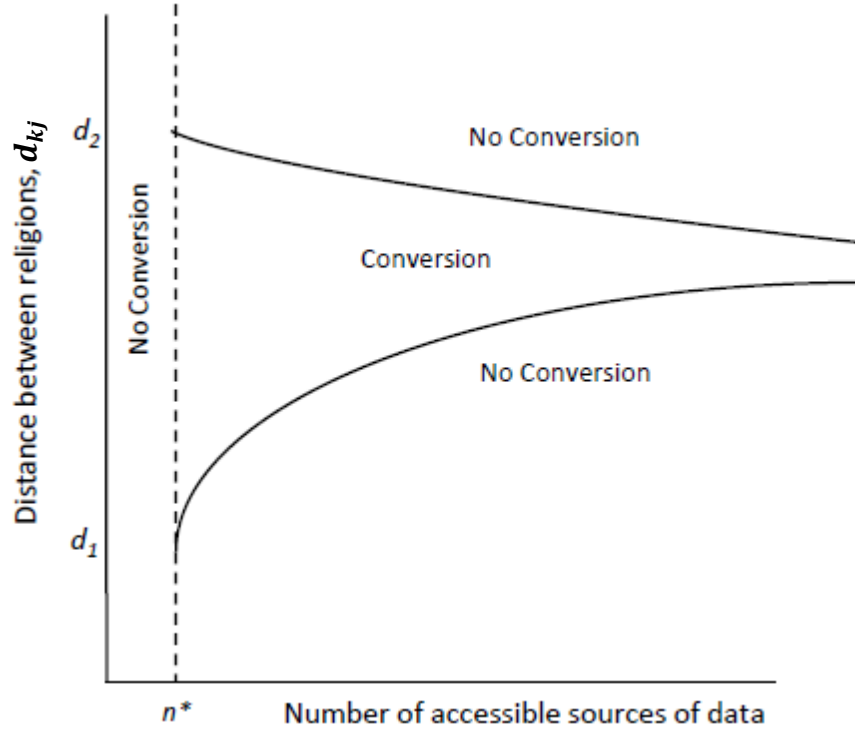
Figure 3: Type I Error Aversion and Conversion



$$d_0 = |\mu_k^{t=t'+1} - \mu_k^{t=t'}|$$

$$z_0 = d_0 / \left(\sqrt{\sigma_k^{2t=t'+1}} \right)$$

Figure 4: Access to data and Conversion

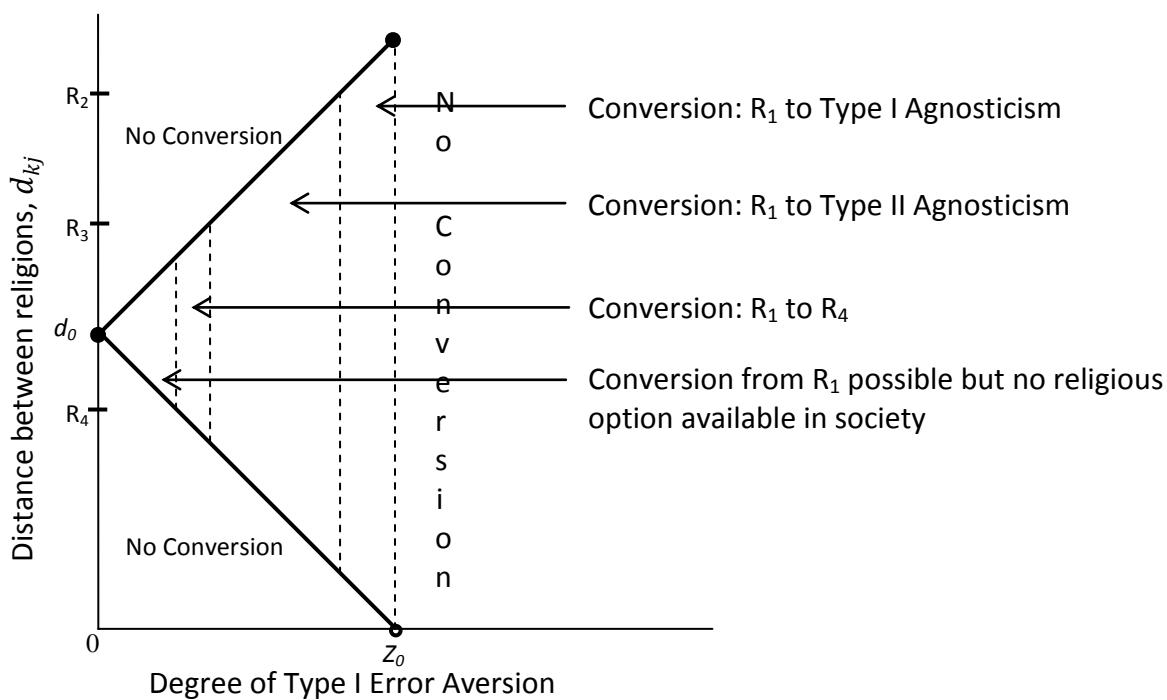


$$d_0 \leq Z_k \cdot \sqrt[2]{\sigma_k^{2^{t=t'+1}}(n^*)} \quad \forall n < n^*$$

$$d_1 = d_0 - Z_k \cdot \sqrt[2]{\sigma_k^{2^{t=t'+1}}(n^*)}$$

$$d_2 = d_0 + Z_k \cdot \sqrt[2]{\sigma_k^{2^{t=t'+1}}(n^*)}$$

Figure 5: Various types of Agnosticisms²²



- R₁: Parent religion
- R₂: A *theistic* religion
- R₃: An *atheistic* religion
- R₄: Another *theistic* religion

²² The number of sources of information, n , is fixed. In absence of R_3 Type I Agnosticism in the figure transforms to Type III Agnosticism. In absence of R_2 and R_3 , a less plural society, the set of agnosticisms is empty. In the present case with four religions, more plural society, two types of agnosticism are possible. (Likewise we can construct a figure holding Z fixed and allowing n to vary.)

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