Learning and the Prevalence of Religion

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Abstract

This paper explores the conditions necessary for religion to persist even if it is economically and genetically costly. In a simple growth model, agents choose their level of religion. More religion reduces the time available for labor, but also reduces the perceived likelihood of hell. A genetic learning algorithm then selects agents' discount factors based on their wealth. A higher discount factor has two effects on wealth. First, as in most growth models, it increases the savings rate and induces wealth accumulation. Second, it increases the discounted expected disutility of eternal damnation, and thus induces more religion, which reduces wealth. If the average discount factor is too low, then the net effects of a higher discount factor on wealth are positive and the genetic algorithm selects more patient, and more religious, agents. Likewise, if the initial discount factor is too high, then the genetic algorithm will select less patient, and less religious, agents. The genetic process does not, however, select on religion. Instead, it selects agents' level of patience and the impact on religion is a side effect. As a result, religion exists in a long-run macroeconomic equilibrium, even though it reduces wealth and genetic fitness.

JEL Classification: religion, genetic algorithm, learning.

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1 Introduction

In 1670, the French philosopher Blaise Pascal published his famous argument in support of a religious lifestyle.[1] Pascal's Wager posits that if one is uncertain about the existence of an afterlife, then it is rational for her to choose to be religious. If she chooses to be religious and is wrong, then she faces no negative consequences after her death. If she chooses to be non-religious and is mistaken, however, then she forgoes salvation and instead faces eternal damnation. Although interesting criticisms have been made against Pascal's Wager[2], the general idea is sensible from the perspective of a rational expected utility maximizing framework.[3] From a macroeconomic perspective, however, there is one noticeable flaw: the idea that eternal damnation at the expense of salvation results in an infinite welfare loss. Continuity of preferences suggests that any rational agent would surely be willing to swim in a lake of molten hellfire, provided that it cause no lasting damage, for a very small but positive amount of time in exchange for some earthly pleasure. The instantaneous welfare loss of hell is thus finite.[4] Analogously, the instantaneous welfare gain of heaven is finite.[5] If agents use a discount factor less than one, then hell is an infinite geometric series that converges to a finite level of disutility that is increasing in the discount factor.[6]

This paper adds Pascal's Wager to a very long run growth model where time allocated to religion reduces the time that is available for production, and agents' preferences evolve based on a genetic learning algorithm.[7] I then examine the joint determination of religion, wealth, and agents' discount factors. The main result is that that agents choose a level of religion greater than the amount which maximize their evolutionary fitness. Furthermore, the resulting discount factor is less than the value that maximizes evolutionary fitness in a model without religion.

[1] The concept was published after his death in the text *Pensees*.

[2] Notable criticisms include the argument that God does not care about the specific belief, only that it be sincerely held, that religion is not a choice, and that the probability of God existing is zero. See Hajek (2003).

[3] Berman and Iannaccone (2006) represent an example of economists arguing in support of the reasonableness of Pascal's Wager.

[4] This concept is evident in Dante's *The Divine Comedy*, arguably the most famous depiction of hell. Dante's Inferno includes nine, increasingly unpleasant, circles of hell, which requires that at least the first eight result in finite disutility.

[5] Pascal himself focused on the infinite utility gain from heaven rather than the infinite disutility of hell. The remainder of the paper focuses on the disutility of hell which hereafter includes the opportunity cost of heaven.

[6] Hajek (2003) discusses other arguments that the disutility of hell is finite. I am unaware of any prior work, however, that bases this argument on discounting.

[7] Cavalcanti, Parente, and Zhao (2007) is the only other paper that I am aware of to explicitly include the disutility of hell in a growth model. In their paper, Catholics and Protestants have different beliefs about how work affects the probability of salvation. The disutility of hell is exogenous and does not depend on the discount factor. Azzi and Ehrenberg (1975) include the utility from an afterlife in a microeconomic setting.

Standard theory suggests that evolution favors the prosperous.[8] Religion, however, poses many obvious economic costs. Time devoted to worship, prayer, preaching, etc. could be used to produce and thus increase one's genetic fitness. Churches could be converted into farms or factories, and animals could be bred or consumed instead of being used for sacrifice. Why evolution has not therefore selected less religious agents is a puzzle that has attracted the interest of the public, biologists, and economists. A major literature proposes that evolution does directly select more religious agents and seeks to identify subtle evolutionary benefits of religion that trump the obvious costs. Much of this literature in in evolutionary biology. Hamer (2005) suggests that the evolutionary benefits of religion may include reduced stress, increased optimism, and the ability to overcome setbacks.[9] His work resulted in a *Time Magazine* cover story titled "the God Gene."[10] Hill and Pargament (2003) argue that religion may improve both physical and mental health. Other arguments consider group selection, where religion increases social cohesiveness or deters disruptive behavior.[11] Stark (1997), for example, proposes that religion may act as a method of community risk sharing.

Economics has also proposed scenarios where religion may yield net economic benefits. Barro (2004) writes that religion may be seen as "spiritual capital," which encourages attributes "such as honesty, work ethic, thrift, and openness to strangers." Berman (2000) develops a model where high levels of religion "signals commitment to the community, which provides mutual insurance to members." Iannaccone (1992) models religion as a "club good" where seemingly irrational rituals and behavior serve to prevent individuals from joining who then choose minimal involvement. Berman and Iannaccone (2006) suggest that religious sects may efficiently provide social services when governments fail. In his survey of the economics of religion, Iannaccone (1998) notes that many religions prohibit unhealthy behaviors such as drinking, smoking, and the use of illicit drugs. In an empirical study, MacCulloch and Pezzeini (2010) find that religion may reduce the propensity for revolutionary tastes.

Theories that suggest an evolutionary advantage to religion are compatible with the mech-

[8]There has been much speculation, however, that modern society has changed the conditions of evolution so that the less wealthy are more likely to reproduce. Nettle and Pollet (2008), however, show that while more education reduces the number of offspring, increased wealth continues to result in more offspring. Nevertheless, the model of this paper is best suited to a pre-industrial society where the traditional link between wealth and fertility is stronger.

[9]See Hamer, D. 2005. "The God Gene : How Faith is Hardwired into Our Genes." *Doubleday Press.* Hamer also reported to have found a single gene responsible for much of variation in religiosity, but he has since backed off of this claim.

[10]*Time Magazine*, 10/25/04.

[11]See Wade, N. 11/14/09, "The Evolution of the God Gene." *The New York Times.* The plausibility of group selection under evolution remains controversial.

anism developed in this paper.[12] This paper, however, takes a different approach by assuming that evolution directly selects only on economic factors, and that religion imposes a net economic cost. It then examines the conditions that are needed for agents to choose high levels of religion despite its economic costs. In other words, can religion emerge in a macroeconomic equilibrium despite the lack of a God Gene?

I rely on a genetic learning algorithm that determines only one parameter, the discount factor, and does not directly consider religion. The wealthier the agent, the more likely that she successfully reproduces. I use a simple growth model where agents maximize their utility, not their evolutionary fitness. In addition to choosing their labor supply and savings rate, agents also choose how much of their time to devote to religious activities. More religion reduces the time that an agent may spend producing and therefore reduces their wealth and probability of reproducing. More religion also reduces the perceived probability of eternal damnation, but this has no effect on reproduction.

As in most growth models, a higher discount factor induces a higher savings rate that, all else equal, increases wealth. If the average discount factor is initially very low, then the discounted value of everlasting hellfire is also low and the population will choose a low level of religion. Low discount factors deter savings and wealth accumulation, and the net economic benefits of a higher discount factor are positive. Through reproduction, mutation and other operators, the genetic algorithm selects agents with higher discount factors and more wealth. As the average discount factor increases, however, so does the discounted cost of hell. Agents thus choose more religion even though, all else equal, religion reduces evolutionary fitness. Crucially, the genetic learning algorithm is not selecting more religion, it is selecting a higher discount factor. Increased religion is a side effect.[13]

The dynamics of the model also work in the opposite direction. Suppose that all agents have discount factors just below one. The cost of hell is therefore exceptionally large. Agents rationally choose to devote most of their time to religion, and their wealth and genetic fitness suffer. In this case, the genetic learning algorithm selects a lower discount factor.

A society's religious fervor depends both on the strength of its convictions and the consequences of disbelief. Increasing either parameter increases the equilibrium level of religion, and reduces the average level of wealth. The genetic algorithm thus selects a lower average discount factor, which mitigates the economic costs of heightened religiosity. The model thus

[12]As discussed in Section 4, the paper's main results are still locally valid if religion may improve productivity. The equilibrium value of religion is still greater than the value that maximizes fitness, although imposing religion equal to zero no longer necessarily improves fitness.

[13]Gould and Lewontin (1979) refer to this type of result as a "spandrel." A spandrel is a byproduct of evolution rather than a direct result of it.

predicts that more religious societies exhibit less patience and less wealth once convergence has occurred.

The paper is organized as follows. Section 2 develops a simple growth model. Section 3 develops the genetic learning algorithm. Section 4 discusses simulations that demonstrate the model's dynamics, and briefly discusses extensions to more general models. Section 5 concludes.

2 A Simple Growth Model

To make the paper's main mechanism clear, I rely on a very simple growth model that includes religion. Agents live for two periods, but solve an infinite horizon problem that accounts for the possibility of an afterlife. In the first period, agents choose their savings, and allocate their time among labor, leisure, and religion. In the second period, agents live off their savings and do not choose how they allocate their time.[14] I define κ as the perceived probability that an afterlife exists, and Ω as the per-period instantaneous disutility of being in hell.[15] The expected present discounted value of damnation thus equals $\frac{\kappa\Omega\beta_{i,t}^2}{1-\beta_{i,t}}$. The i^{th} household solves the following optimization problem:

$$Max_{C_{i,t},L_{i,t},R_{i,t}} \quad \frac{C_{i,t}^{1-\sigma}}{1-\sigma} + \gamma\frac{L_{i,t}^{1-\nu}}{1-\nu} + \beta_{i,t}\frac{C_{i,t+1}^{1-\sigma}}{1-\sigma} + \tau(R_{i,t})\frac{\kappa\Omega\beta_{i,t}^2}{1-\beta_{i,t}} \tag{1}$$

$$N_{i,t} + L_{i,t} + R_{i,t} = 1 \tag{2}$$

$$W_{i,t+1} = (1+r)(N_{i,t} - C_{i,t}) \tag{3}$$

$$W_{i,t+1} = C_{i,t+1} \tag{4}$$

The household allocates one unit of time among labor ($N_{i,t}$), leisure ($L_{i,t}$), and religion ($R_{i,t}$). Unlike leisure, religion does not directly provide utility (beyond avoiding hell).[16] Time spent

[14]Equivalently, agents spend all of their time on leisure in the second period of life. The model may also include a leisure-religion allocation problem in the second period of life. As long as the opportunity to be religious in the second period does not completely eliminate the incentive to be religious in the first period (e.g. a deathbed conversion ensures entrance to heaven), the paper's mechanism and conclusions are unaffected. The existence of such a tradeoff does result in old people being more religious than young people both because agents do not supply labor in the second period of life and because the possibility of damnation draws near.

[15]For simplicity, I normalize the utility of heaven to zero. More generally, Ω may be the difference in utility between heaven and hell.

[16]It can, of course, be argued that for many people religion is a type of leisure. Because selection depends on

on religion reduces the time that may be spent on labor and thus imposes an economic cost. Agents' return to saving, r, is exogenous and constant. The function $\tau(R_{i,t})$ represents agents' perceived beliefs about how religion affects the probability of eternal damnation. I assume that $\tau(0) = -1$ (certain hell), $\tau^{'}(0) = \infty$, and $\tau(1) = 0$ (certain heaven). The parameter σ is the inverse of the intertemporal elasticity of substitution and ν is the inverse of the Frisch elasticity of labor supply. Notably, agents' discount factors are heterogeneous. Section 3 develops the genetic learning algorithm that determines their evolution.

For any $\beta_{i,t}$, optimization yields the following three first order conditions:

$$C_{i,t}^{-\sigma} = \beta_{i,t}(1+r)C_{i,t+1}^{-\sigma} \tag{5}$$

$$C_{i,t}^{-\sigma} = \gamma L_{i,t}^{-\nu} \tag{6}$$

$$C_{i,t}^{-\sigma} = \tau^{'}(R_{i,t})\frac{\kappa\Omega\beta_{i,t}^{2}}{1-\beta_{i,t}} \tag{7}$$

Equations (2)-(7) fully characterize the equilibrium for a given discount factor.

3 Selection and the Genetic Learning Algorithm

At the end of period 1, reproduction occurs. For simplicity, I treat reproduction as exogenous; agents obtain no utility from successfully having children.[17] Macroeconomic models typically hold preferences fixed in the short-run. As discussed in Rogers (1994), however, natural selection is the most sensible source for preferences in the long-run.[18] I thus assume that a genetic learning algorithm determines elements of agents' preferences. Specifically, the genetic algorithm only determines $\beta_{i,t}$, and selects based solely on W_{t+1}.[19] The population consists of Z households. Each household's discount factor is determined by a X digit binary string, denoted Q_i. For example, $Q_i = [0, 1, 0, 0, 1, ...1]$. I use the following process to determine agents'

wealth and not utility, however, the paper's main mechanism is present in both cases.

[17]An alternate, more complex, approach is to assume that agents also choose how much time to devote to fertility, child rearing, courtship, etc. More time increases the probability of having children who provide utility. In this case, time dedicated to religion reduces the time available for reproductive activities and the paper's main mechanism is again present. Additionally, if children provide utility only later in life, then the model includes an additional mechanism where selection favors higher discount factors.

[18]Other papers that advance this idea include Becker (1976), Hirshleifer (1977), Coase (1978), and Hansson and Stuart (1990).

[19]For further discussion of genetic algorithms and other examples of their use in macroeconomics, see Arifovic (2000), and Arifovic and Gencay (2000).

discount factors:

$$\beta_{i,t} = \left(0.001 + Q_i * \begin{bmatrix} 2^{X-1} \\ 2^{X-2} \\ . \\ . \\ 4 \\ 2 \\ 1 \end{bmatrix} \right) (0.002 + 2^X - 1)^{-1} \tag{8}$$

Including 0.001 and 0.002 in (8) ensures that the discount factor never equals zero or one for any household. The maximum discount factor, just below one, occurs in conjunction with a string of X ones. A string of X zeros results in a discount factor just above zero. Selection occurs through a three step process that closely follows Arifovic, Bullard, and Duffy (1997):

1. Reproduction

$2Z$ pairs of strings are drawn, with replacement. The string with the higher value of W_{t+1} is selected and replicates by entering the population for period $t + 1$.[20]

2. Mutation

I define the probability of mutation as $p^m > 0$. For each digit in the population, a random number is drawn from a uniform distribution between zero and one. If this number is less than p^m, then the digit mutates by changing from zero to one or vice-versa. If the random number is greater than p^m, then the digit is unchanged.

3. Crossover

Crossover is another genetic operator. The strings, having been subjected to mutation, are next randomly grouped into $\frac{Z}{2}$ pairs. For each pair, crossover occurs with probability $p^c > 0$. If crossover occurs, an integer, F, is drawn from a discrete uniform distribution between 1 and $X - 1$. The first F digits of string 1 are then combined with the last $X - F$ digits of string 2. The first F digits of string 2 are then combined with the last $X - F$ digits of string 2. Crossover thus yields two new strings.

The genetic algorithm thus determines a single characteristic, patience, based on a single criterion, wealth. The effects on religion are entirely indirect.

[20] Alternatively, the string with the higher value of W_{t+1} may be selected with probability greater than one-half. This change reduces the rate of convergence.

The crucial assumption of this section is that the genetic algorithm determines agents' preferences, but not their specific religious beliefs. The compound parameter, $\kappa\Omega$ is thus treated as exogenous.[21] Were the genetic algorithm to also determine $\kappa\Omega$, then it would generally select values close to zero, and agents would choose very little religion. Although natural selection surely influences belief formation, it likely determines the process of expectations formation rather than a specific belief. As an example, consider expectations of inflation. There surely is no gene that directly determines that expected inflation equals 3%. Instead, the evolutionary process results in some type of process (*e.g.* rational expectations or econometric learning) that maps from the data to a precise expectation. By the same reasoning, there is surely no gene that directly sets the probability of a religion being true equal to a specific value. $\kappa\Omega$ is thus best interpreted as some type of boundedly rational expectation of the likelihood and nature of an afterlife.[22] It is easy to imagine an evolutionary process selecting boundedly rational agents if the obvious economic benefits outweigh the associated costs, which surely include increased computational costs, and in this model, more religion.

4 Simulations

To simulate the model, I specify the following functional form for $\tau(R_{i,t})$:

$$\tau(R_{i,t}) = \frac{ln(R_t)}{1 - ln(R_t)} \tag{9}$$

Following Arifovic, Bullard, and Duffy (1997), and Grefenstette (1986), I set $p^m = 0.0022$, and $p^c = 0.95$, a common calibration in the literature.[23] I assume that utility is logarithmic in both consumption and leisure by setting $\nu = \sigma = 1$, and that agents value leisure and consumption equally by setting $\gamma = 1$. I set $\kappa\Omega = 1$.[24] I discuss the effects of changing these last two parameters later in this section. Notably, the individual values of κ and Ω do not matter, only their product affects the model. Finally, I set $X = 10$, and $Z = 1000$. These two values are large enough so that, once convergence has occurred, aggregate volatility is low.[25]

[21] The argument of this paragraph may also apply to τ.

[22] Another approach is to model a supply side where religious leaders are able to influence $\kappa\Omega$, and τ. A more relaxed religion will set $\kappa\Omega$ low and will choose $\frac{\partial \tau}{\partial R_t}$ close to zero. Such a religion will yield wealthy followers who spent relatively little time on religion. A more stringent religion, however, will yield poorer, but more devout, followers. Such an approach has interesting implications for competition among religions. This is left for future research.

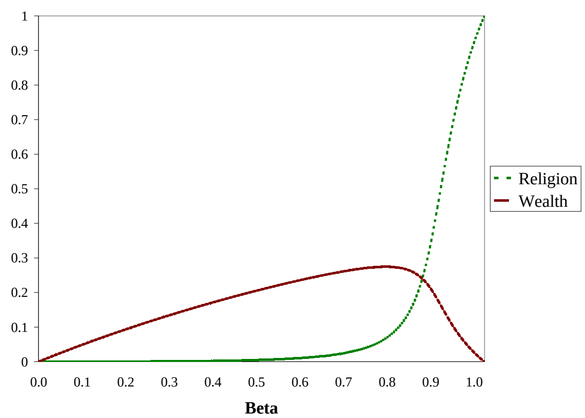
[23] Convergence of the discount factor to the neighborhood of the value that maximizes wealth occurs as long as p^m is not too large. Higher values of p^m and p^c locally increase the rate of convergence.

[24] Correctly calibrating the disutility of hell is challenging. It seems like it should be high.

[25] Random mutations are responsible for this volatility.

I have deliberately chosen a model where there is no interaction among households. As a result, the model's control variables depend only on the household discount factor. Figure 1 plots religion and wealth as a function of $\beta_{i,t}$ for this parameterization:[26]

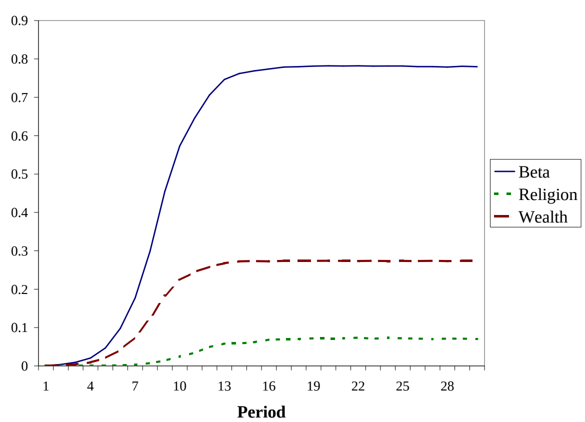
Figure 1: Wealth and Religion as a Function of β



Simulation #1

For this simulation, I set all agents' initial discount factors close to zero. As seen in Figure 1, this initial condition results in poor fitness. Figure 2 demonstrates a typical simulation:[27]

Figure 2: Convergence from Low Initial Average Discount Factor ($\kappa\Omega = 1$)



At the initial conditions, the average agent is very impatient. She thus chooses very little savings, which harms his both her wealth at the end of period t, and her reproductive fitness.

[26] If utility is Inada-convex in both consumption and leisure, then religion will always be increasing in the discount factor and wealth will be maximized for an interior value of the discount factor. Different functional forms and calibrations may, however, cause wealth as a function of the discount factor to no longer be single peaked.

[27] All of this paper's simulations were repeated several times. In all cases, the results are qualitatively identical and quantitatively similar.

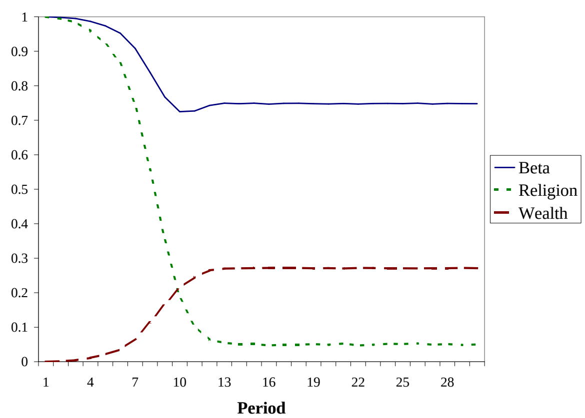
Because she is impatient, she does not care much about the afterlife and therefore chooses a low level of religion. The genetic algorithm then selects agents with higher discount factors who accumulate more wealth. The model quickly converges to an average discount factor near the optimal value from Figure 1.[28] As a side effect, the agent becomes more religious. More religion reduces fitness, but this effect is trumped by the effect of an increased savings rate.

There is thus a genetic source for religion. If looked at atheoretically, Figure 2 could mistakenly suggest that the genetic algorithm does select based on religion. In this model, however, there is no God Gene. The genetic algorithm determines only an economic factor, the discount factor, and increased religiosity is a side effect. Restricting religion to a lower level would increase evolutionary fitness (while reducing expected utility). Nevertheless, religion persists in the long-run.

Simulation #2

I repeat the previous simulation with different initial conditions. I now impose the maximum discount factor for all agents (by setting all digits in all strings equal to one). All variables still converge to the same neighborhood as in Simulation #1. Consider the model at these initial conditions. Because agents are exceptionally patient, they care a great deal about the afterlife. They thus choose a high level of religion which reduces their labor and wealth. Their genetic fitness is poor. The genetic algorithm then selects agents with lower discount factors, who supply more labor and accumulate more wealth. Figure 3 reports the results:

Figure 3: Convergence from High Initial Average Discount Factor ($\kappa\Omega = 1$)



The question that this paper attempts to answer may also be reversed: Why have agents not evolved discount factors arbitrarily close to one when doing so would increase their ge-

[28] If the initial conditions include more heterogeneity than in this simulation, then the genetic operators are more efficient and convergence occurs more rapidly.

netic fitness?[29] Simulation #2 provides an explanation. Ultra-patient agents would be overly concerned about the afterlife and would thus choose an excessively high amount of religion.

Simulation #3

So far, the analysis has focused on a constant value of $\kappa\Omega = 1$. This compound parameter may be interpreted as the fervor of religious beliefs, encompassing both the certitude of believers and the consequences of apostasy. This simulation is identical to Simulation #1 except that it considers the alternate parameterizations $\kappa\Omega = 10$ and $\kappa\Omega = 0.1$. Figures 4 and 5 report the results.

Figure 4: Convergence from Low Initial Average Discount Factor ($\kappa\Omega = 10$)

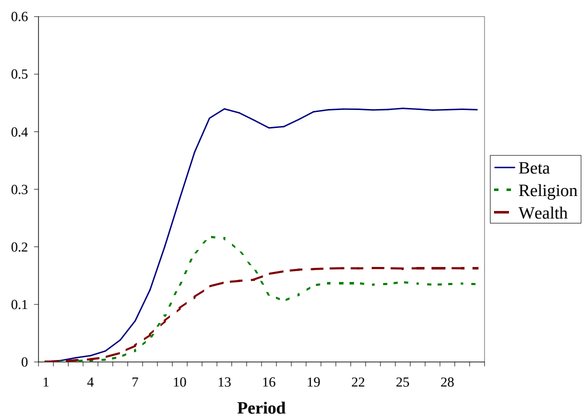
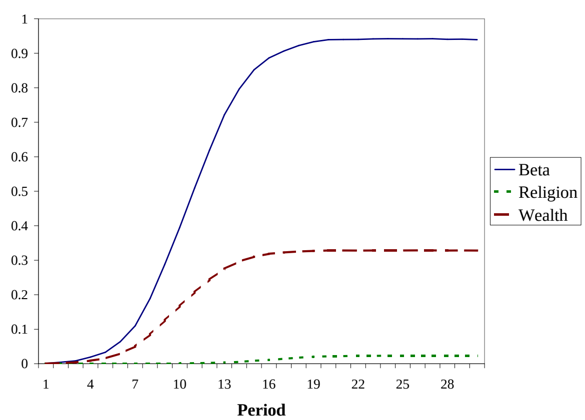


Figure 5: Convergence from Low Initial Average Discount Factor ($\kappa\Omega = 0.1$)



All else equal, a higher value of $\kappa\Omega$ results in more religion and hence less wealth. To prevent too many resources from being devoted to religion, the genetic algorithm selects agents with

[29]One sensible reason for discount factors less than one is the possibility of death. Because this uncertainty is suppressed in the model, the equilibrium value of $\beta_{i,t}$ should be interpreted as the discount factor independent of the probability of death.

lower discount factors. Although lower discount factors reduce the savings rate, the larger effect on wealth comes from a lower value of religion. Figure 4 also demonstrates a secondary result of interest. Religion begins near zero, but then increases above its eventual value before finally converging. At the initial conditions and after convergence, there is little heterogeneity. During convergence, however, there is more heterogeneity. Some mutations result in high discount factors and high levels of religion. Until the genetic operators are able to eliminate these strings, they skew the average level of religion above its long run value. Simulation #3 suggests that more religious societies are less patient and less wealthy than less religious societies.[30]

I now discuss three limitations of the model. First, I assume that selection depends only on wealth. For most of human history, this appears to be a reasonable assumption. Innovations of the past few centuries, including the reduction of childhood disease and malnutrition, and the creation of the welfare state render this assumption questionable in much of the developed world. This model is thus best suited as a pre-industrial model of behavior. Second, the growth model is, by design, very simple. Most notably, it includes no strategic interaction among households, and it fails to endogenize fertility. The mechanism behind the main results, however, is straightforward. In an alternative model, if the benefits of a higher discount factor to fertility outweigh the economic costs associated with more religion, then the genetic algorithm will select a higher discount factor and more religion. Otherwise, the algorithm will select less religion. Finally, the paper makes no connection between welfare and religion. In the model, all agents are fully optimizing conditional on their beliefs about the afterlife. Any policy that imposes an alternate value of religion is welfare reducing.

This paper has demonstrated that religion may exist in equilibrium even if, all else equal, evolutionary fitness is maximized when religion equals zero. Before concluding, I briefly discuss how the paper's mechanism would affect models where religion may improve fitness. As discussed in the introduction, a long literature has proposed that religion may provide subtle economic benefits. Such a premise could be added to the model by assuming that productivity is increasing in religion. Likewise, it is clear that many religions command their followers to reproduce. The advent of family planning has enabled agents to better choose their number of offspring. In a modern society, more religious agents may therefore enjoy an added evolutionary advantage over less religious agents. This premise may be added to the model by assuming

[30] Barro and McCleary (2003) write that "empirical research on the determinants of economic growth typically neglects the influence of religion." Their paper finds that belief in heaven and hell increases growth but that church attendance reduces growth. Guiso, Sapienza, and Zingales (2003) find that religious intensity is positively correlated with attitudes that are favorable for growth. Using microeconomic data on church membership, Azzi and Ehrenberg (1975) find that religiosity is generally increasing with statewide income but decreasing with household income.

that fitness depends on both wealth and religion. With these two modifications, the level of religion that maximizes fitness will now generally be positive but less than one: an agent who spends 100% of their resources on religion will still exhibit poor fitness. In such a model, the mechanism of this paper would still exist. Agents will continue to choose a level of religion above the value (no longer zero) that maximizes fitness. In equilibrium, decreasing religion (locally) will continue, all else equal, to improve evolutionary fitness.

5 Conclusion

It is difficult to reconcile the apparent economic costs of religion with an evolutionary process that selects a high level of religion. Many efforts attempt to identify less obvious economic benefits of religion that dominate the more obvious costs. This paper does not argue that this approach is invalid. Instead, it attempts to explain relatively high levels of religion in an environment where religion is costly and selection depends only on economic factors. The genetic learning algorithm encounters a tradeoff. If the initial average discount factor is too high, then the genetic algorithm will choose lower discount factors that result in less religion despite a lower savings rate. If the initial average discount factor is too low, however, then the genetic algorithm will select higher discount factors. What appears to be selection on religion is actually a side effect of selection based on only economic factors. Religion thus exists in equilibrium despite the fact that, all else equal, it reduces reproductive fitness.

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