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Believe or not believe:

generalising Azzi-Ehrember model

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Abstract

This paper presents an economic model of consumer behaviour within a religious framework. The individual is defined as being religious, for whom God exists with absolute certainty. We distinguish between two separate targets facing the individual: human welfare and spiritual welfare. Joint maximisation of these two targets subject to time and budgetary constraints yields a solution in which the optimal values of consumption and religiosity are obtained. Allowance is also given to the compulsory payment of a religious tax. We show that the shape of the interchange curve between these two optimal values depends upon the relative shapes of the human welfare and spiritual welfare functions.

Keywords: Religion; consumer behaviour; religious utility

JEL Classification: D00, D11

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Despite references by Adam Smith (1776) to the possible importance of economic incentives in motivating the activities of the clergy and churches, it has only been in recent years that economists have shown an interest in providing a more analytical examination of religion. This paucity in the economics literature is in contrast to that of sociology and psychology, where the study of religion has grown apace since the seminal works of Durkheim (1912) and Weber (1922) and has focussed on, *inter alia*, how beliefs and norms are formed and how these affect economic attitudes.[1] The substantial pause in research interest amongst economists since Adam Smith arguably reflects the conventional view that religious activity is essentially a 'non-market' and 'irrational' activity and, thus, outside the traditional ambit of economic analysis with its central focus on rational choice *a là* Becker (1976).[2] As vigorously argued by Iannaccone (1997, 1998), however, the continuing worldwide importance of religion runs counter to 'irrationality' arguments. Moreover, this stylised fact provides a rationale for examining religious behaviour within the conventional framework of maximising behaviour at either the individual, group or market level of aggregation.[3]

The contribution of this paper is positioned at the former level of aggregation. More specifically, we develop a model of consumer behaviour within a religious framework in which the choice of religion is done. The individual is defined as religious and the only choice confronting him is between the level of material consumption and the level of spiritual consumption. In this simple model we attempt to analyse the individual consumer's behaviour within an institutional framework that is religious. In addition, all individuals are assumed to be religious and believe God exists with absolute certainty[4]. Our model represents an extension over the previous work of Azzi and Ehrenberg (1975) and Neuman (1986) because we relax the assumption that religion is simply 'done' in the individual's utility function. In contrast, we focus on the individual consumer's problem of maximising both human welfare and spiritual welfare jointly, given a set of budgetary and time constraints *and*, more importantly, the individual's spiritual level represented by a parameter γ. This innovation in the modelling of religious behaviour allows for a spectrum of religiosity, from an extreme

[1] See, for example, Wilson (1982) for a literature review.
[2] Such a conventional view may have its origins in nineteenth-century philosophy [see, for example, Stark *et al* (1993) and Stark (1997)].
[3] The contribution of economists to the study of religion is has, however, been criticised by both sociologists and economists. See Montgomery (1996) and Neitz and Mueser (1997) for an expose.

of non-involvement in religious activity (i.e. an 'atheist') to an individual who devotes all his income to religious activity. In our view, this approach represents an improvement on previous models of religious behaviour.

1. Theoretical Perspectives[5]

It is widely recognised that the contemporary economic analysis of religion started with the seminal paper of Azzi and Ehrenberg (1975). Their model is essentially an extension of the household time allocation model of Becker (1976) to allow for involvement (by both wife and husband) in "church-related" activity.[6] For Azzi and Ehrenberg, participation in church-related activity brings three main benefits: afterlife consumption (the "salvation motive"); the network benefits or social benefits of being a member of a human organisation; and third, the social pressure benefits where members of an organised religion enjoy access to wider career opportunities. Azzi and Ehrenberg focus on the former of these benefits to the exclusion of the latter two. Crucial to their model is the specification of the household utility function. The household is assumed to have two members (husband and wife), and obtain utility from lifetime consumption and the expected value of afterlife consumption. In turn, afterlife consumption is assumed to be a function of time spent in church-related activities. The model predicts that individuals substitute between time and money devoted to religion. This, they argue, explains differences in church attendance between male and females. Their model may, however, be criticised on several points. First, their model assumes that consumption and afterlife consumption are perfect substitutes. Secondly, there is no role for inheritance or religious donations.

Neuman (1986) follows a similar methodology as Azzi and Ehrenberg, but focuses on the behaviour of the individual consumer rather than the household. Neuman specifies a 'religiosity production function', whose inputs are money spent on the purchase and use of religious goods and time devoted to religious activity. Religiosity

[4] If the society is religious it is because there is certainty that God exists (certainty in the methodological sense). See Rodero *et al* (1999) for more discussion on this point.

[5] According to Iannaccone (1998) there are three major lines of inquiry by economists into religion: first, the study of religion from an economic perspective using conventional microeconomic techniques; second, the economic consequences of religion; and third, the use of theology and scriptures to provide a critique of economic policy. Our paper lies firmly in the first of these fields.

is assumed to be an increasing function of money spent on religious good and time devoted to religious activity. The model does, however, suffer from the same criticisms as the Azzi and Ehrenberg model.

2. A Model of Religious Behaviour

2.1. An Overview

In conventional microeconomic analysis of consumer choice [see, for example, Kreps (1990) and Mas-Colell *et al* (1995)] an individual decision-maker maximises his utility subject to a budget constraint. We introduce a religious dimension to the consumer's maximisation problem, who is assumed to retain income for consumption. The specification by Azzi and Ehrenberg (1975) of a utility function defined with both the arguments of consumption, C, and religiosity, R, $U(C, R)$, can be objected to because it implicitly assumes perfect substitution between C and R[7]. We avoid this restrictive assumption in our model by separating both these dimensions in the individuals utility function.

2.2. The Formal Model

Let k_0 denote the initial individual endowment of capital, and T represents the individuals endowment of time. The problem facing the individual is then to choose between devoting his time to labour (work) to obtain an income; or spending time in religious activities[8] for his salvation. The choice between consumption and leisure is not explicitly considered in our model, because this choice lies outside the focus of our work. We define only two alternatives for individual i to allocate his time: activity that earns income (including resting) denoted by L_i, and time dedication to religious activities, denoted by A_i. Thus, the time constraint facing the individual is given by:

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[6] Church related activity is restricted to church attendance.

[7] Moreover, optimising criteria for the religious decisions, although looks like a simple generalisation of the altruistic behaviour, are frequently criticised because of their mechanistic approach.

[8] Religious activity can encompass, for example, church attendance as in the model of Azzi and Ehrenberg (1975), and/or religious education of children and other church related activities as assumed in the model of Neuman (1986).

$$T = L_i + A_i \qquad \forall i \qquad [1]$$

There is nothing remarkable about the time constraint in [1] and is quite consistent with the earlier model of Neuman (1986). The only two other restrictions are that a household cannot pray whilst working, and also that religious activity cannot earn any wage. Consequently, our model excludes the possibility of an individual being a priest.[9]

The next stage of our analysis is related to the investment and saving behaviour of the individual. We assume that investment opportunities are done for each individual, and that the returns are known with certainly, being entirely public information.

Following a conventional neo-classical modelling framework, the different savings rates are related to the consumption preferences of the individual and to the yields on other assets. These choices pertain to purely material choices (i.e. are not celestial in nature), so are therefore unrelated with the analysis contained in this paper. The only other relevant question is the inheritance of the individual to be left at the end of his life (following an altruistic behaviour) for his son or daughter. Moreover, the inheritance that an individual bequeaths to his children is an important dimension of the majority of mainstream religions.

We can now distinguish two different individual targets facing the individual. First, we define human welfare by:

$$U(C_1,...,C_N) = \sum_{i=1}^{N} \beta^{i-1} u(C_i) \qquad [2]$$

where C_i is the consumption for the period i of the numerarie commodity, which can also be interpreted as money (with unitary price); β is the discount factor of consumption, defined in the range $1 > \beta > 0$; N is the number of periods that the individual lives; and $u(.)$ is an increasing function.

As is conventional microeconomic analysis the only relevant factor is the maximum limit of an individual's life, which is assumed to be finite. Because our focus is to explain the individual choices about God, inter-generational aspects are left to one side.

[9] For an applied approach to modelling the behaviour of priests see Sawkins and Paterson (1996).

The second target is spiritual welfare. This is much more complicated to define from a methodological perspective. We define such a function as the following:

$$V = V(Z_1, .., Z_N, A_1, .., A_N, K_N) \qquad [3]$$

where Z_i is the amount of church giving given to external persons[10], and may or may not be compulsory. Other donations are not considered because these would be too difficult to distinguish from altruist reasons. The variable A_i is the time devoted to prayer, and K_N the amount of inheritance (as an example of religiosity) left after death. This money is shared according to the particular details of religious law.

The function $V(.)$ is an increasing function in all its arguments. Morever, the second partial derivatives of $V(.)$ with respect to all of its arguments are assumed to be negative[11]. This function cannot be interpreted as exchange between "heaven portions" and "human sacrifice" and is, thus, cannot be interpreted as a demand function. The only way to interpret $V(.)$ is the amount of utility that the consumer obtains by practising his religion.

Next, we formalise the joint maximisation of [2] and [3], through the next function:

$$H = \text{Max}\left[\gamma U(C_1, .., C_N) + (1-\gamma)V(Z_1, .., Z_N, A_1, .., A_N, K_N)\right], \quad \gamma \in [0,1] \qquad [4]$$

The relationship contained in [4] is a linear combination of individual objectives. The parameter γ is not solely a representation of the individual spiritual level. It also represents the possibility of exchange between religious and materialistic consumption, but importantly enters the utility function separately. The utility function is invariable to monotonic transformations, so the effect of different scales will not be relevant. In

[10] In our microeconomic framework, we include here resources given to other agents so that the recipient of consumption does not have a direct relation with the (altruistic) utility function of the donor. In this way, we want to exclude household or close family transfers, from which is difficult to separate spiritual and egoistic motivations.

[11] We don't require mathematical concavity for $V(.)$, although, we will stop for a moment to consider what the concavity assumption implies. Ultimately concavity will reflect some Christian parables (for example, the one relative to the "lost sheep''), meaning that a bigger (relative) reward for those that commence (or return) in that faith compared to those who remain faithful. As there is uncertainty about what happens at the end of life, however, it does not imply opportunistic behaviour of the individual; individuals with different risk aversion will have a different optimising solution. Besides, concavity arguments are often criticised in the modelling of religious behaviour.

addition, γ could also incorporate the necessary transformation to obtain a homogeneous scale function, because it does not have to be interpreted in absolute value terms.

We have chosen the specific form in [4] because the trade-off between materialistic and religious behaviour is so evident; however, it is only one particular development of the formalisation of $H(.)$ that could have been chosen.

Frequently models of religious behaviour [see, for example, Iannaccone (1998)] make an implicit frugality hypothesis (i.e. 'too much' consumption is 'bad' for men), reflecting that increasing consumption – after a determined level - is not yielding any addition to consumer utility. We reject such a hypothesis on normative grounds.[12] In any case, such a hypothesis could also be represented by the conditions:

$$\frac{dU(.)}{dC} \to 0 \;\forall\; \mathbf{C}>>\mathbf{C}^* \text{ and } \frac{\partial V(.)}{\partial \mathrm{Z}} > 0, \frac{\partial V(.)}{\partial \mathrm{A}} > 0 \forall \text{ Z, A} \qquad [5]$$

where $\mathbf{C} = (C_1, .., C_N)$; $\mathbf{Z} = (Z_1, .., Z_N)$, and $\mathbf{A} = (A_1, .., A_N)$.

The following represents the constraints associated with the maximisation problem:

$$\begin{aligned} & C_i + S_i + Z_i = w_i L_i + R(I_{i-1}) \\ & I_i = I_{i-1} + S_i \\ & I_i \geq 0 \qquad\qquad\qquad\qquad \forall i \end{aligned}$$

where S_i is the level of savings in the *i*th period, and w_i is the exogenously determined salary per unit of time.[13] The above budget constraints are commonly employed in intertemporal choice models [see, for example, Mas-Collel *et al* (1995)]. The investment yields function denoted by $R(.)$ must be increasing.

Religious tax, or compulsory donation, is defined as[14]:

[12] Moreover, there is no empirical support for the frugality hypothesis.

[13] Although the empirical evidence provided by Grossbard-Schechtman and Neuman (1986) and Tomes (1996) suggest significant feedback effects between religious activity and the level of earnings, we ignore these in the model. These concerns lie outside the focus of our model and their inclusion would arguably add little to the main focus of our analysis.

[14] Such taxes are quite common in mainstream religions. We employ a linear tax function (of income) because of ease of computation. Our function implies that donations increase with income. Such a stylised fact is supported by empirical evidence contained in Neuman (1986), and Iannaccone (1998) for the case of church contributions.

$Z_i = Z[w_i L_i + R(I_{t-1})]$, so that $Z' > 0$; $Z(x) < 0$ *if* $x < Y$, and [6]

$$Z(x) > 0 \text{ if } x > Y$$

where Y is the minimum level of subsistence, or income limit that changes the household from being a net taxpayer to a net receiver of the tax, and $x = w_i + R(I_{i-1})$.

Specifically, we will consider the linear case, which has the following form:

$$Z(x) = t(x - t') \equiv tx - t_0 \quad [7]$$

where t' is the subsistence level Y and, $t_0 = t't$.

At this stage the problem facing the individual is too abstract to offer definite conclusions, but given the value of γ it is possible to determine the optimum values of consumption (c*) and religiosity (v*). These can be represented in diagrammatic form illustrated in Figure 1 below.

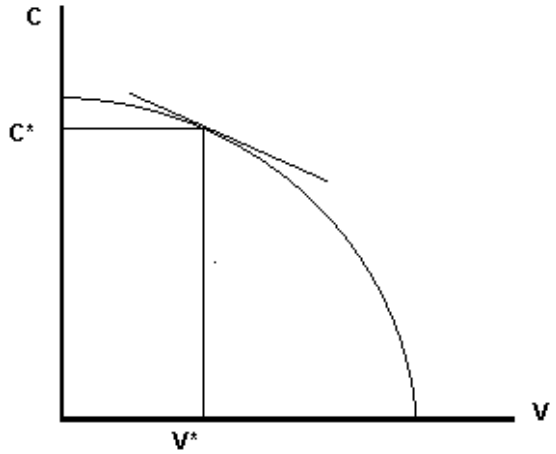


Fig1.- The interchange curve

The exact shape of this interchange curve evidently depends on its slope. The slope of the interchange curve can be interpreted as the relative increase in consumption relative to the religiosity of the individual. The concavity or convexity of the curve will ultimately depend of the relative shapes of $U(.)$ and $V(.)$. Such a trade-off between religiosity and consumption is similar (in essence at least) to that derived by Azzi and

Ehrenberg (1975), except that Azzi and Ehrenberg perceive the substitution being between time and money devoted to religion.[15]

Easier is the next example built on the model contained in equations [2, 3, and 4]. If we consider only one time period, we can eliminate savings as a variable, so the levels of taxes depend exclusively on the level of wages. Ignoring subscripts, the maximisation problem for the individual is:

$$\underset{L}{\text{Max}}\, H = \gamma U(C) + (1-\gamma)V(Z, A) \qquad [8]$$

subject to:

$U(C) = C$

$T = A + L$

$W = wL$

$Z = twL - t_0$

The total wage is the product of the quantity offered by the salary per unit of time. As there is only one independent variable, we can simplify our problem (we suppose a non-negative solution in all variables), leaving it as a function only of L:

$$\underset{L}{\text{Max}}\, \{[wL(1-t) + t_0] + [(1-\gamma)V(wLt - t_0, T - L)]\} \qquad [9]$$

The fist order condition is an optimal if $V(.)$ is concave. Clearly, this implies that at the optimum the following must hold:

$$V_1(.)wt - V_2(.) = \frac{\gamma w(1-t)}{1-\gamma} \qquad [10]$$

The particular form of the interchange curve in this case can be written down as:

$$\frac{dC}{dV} = -\frac{1-\gamma}{\gamma} \qquad [11]$$

[15] Hence the hypothesis that wives and husbands will devote different amounts of time to religious activity given their wage profiles.

Equation [11] infers that the relationship is negative and increasing in γ. Given any value of γ (i.e. mundane preference of the individual) we can deduct the quantity of c he must leave to increase by one unit the consumption of v.

4. Conclusions

In this paper we have developed a model of religious behaviour for an individual with determinate religious beliefs. Our model differs from previous work in that we do not assume that religion is simply done in the individual's utility function. Moreover, we break with the idea of 'clubs' in religious behaviour. In contrast to previous work, we assume that religious aptitude is a personal choice, which is not related with either the spouses or children's behaviour. In our model the religious factor is related with personal giving, attendance and inheritance. The element of all allowing the individual to leave an inheritance is certainly an innovation in the modelling of religious behaviour. In addition, we relax the assumption of substitution between giving and attendance made in the model of Neuman (1986), because this stylised fact is only supported by empirical evidence for the case of Jews.

The utility function we specify is a combination between human and celestial consumption. The value of γ gives us the degree of religiosity of the individual, so that an optimal combination will depend on morality attitudes. Moreover, this allows the individual to choose from a spectrum of religiosity.

Offering a preliminary approach to this question, we obtain the result that different levels of religiosity and selfish attitude depend upon the extent to which an individual values the next life. This relationship will define a convex boundary of (optimal) combinations of religiosity and consumption. We have shown that the shape of this boundary depends on the shape of the human welfare and spiritual welfare functions.

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