THE DEVIL MADE HER DO IT?:

EVALUATING RISK PREFERENCE AS AN EXPLANATION OF SEX DIFFERENCES IN RELIGIOUSNESS

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ABSTRACT

Risk preference theory posits that females are more religious than males because they are more risk averse and thus more motivated by the threat of afterlife punishment. We evaluate the theory formally and empirically. Formally, we show that the rational choice reasoning implied by the theory leads to unexpected conclusions if one considers belief in eternal rewards as well as eternal punishment. Empirically, we examine cross-cultural data and find that, across many populations, sex differences in religiosity are no smaller among those who do not believe in hell. We conclude by arguing that psychological characteristics are almost certainly crucial to understanding the difference, just not risk preference.

Females tend to be more religious than males, both in the United States and elsewhere (see reviews in Francis 1997; Walter and Davie 1998; Stark 2002). For example, females are more likely to express certainty about the existence of God, more likely to assess themselves as being "religious" or "extremely religious" persons, and more often attend church, pray, and participate in other religious activities (Stark 2002). Given increasing recognition of the importance of religion for, among other things, social participation, political orientation, psychological well-being, and health, understanding causes of social cleavages in religiosity may contribute to understanding better some of the reasons for cleavages in its apparent consequences. As importantly, debates about the causes of the difference provide an intriguing example of the more general question about the extent to which differences in male and female behavior are the result of males and females facing different choice problems with similar psychology (whether between of sex differences in circumstances or the implications of the choices provided to them), versus facing similar choice problems with different psychology (regardless of how those psychological differences happen to be caused). Although we have reason to expect individual differences in religiousness to be the result of a complex array of psychological and social factors, which among these are specifically responsible for the observed sex difference?[1]

[1] We use "sex" instead of "gender" in the main text because some literature on this topic draws much on this distinction (e.g., Thompson 1991), and following language there, the observed difference to be explained would seem better characterized as respondent's "sex." Our usage is not intended to engage any other or larger debates about the meaning of "sex" and "gender" and the propriety of using one or the other in a particular context. For the same reason, we use "male" and "female" instead of "men" and "women" throughout.

A recent, creative line of reasoning in the sociology of religion proposes that the sex difference in religiousness is largely the result of sex differences in risk preference (Miller and Hoffman 1995; Stark 2002; Miller and Stark 2002). The reasoning is consonant with a larger movement toward explanations that present decisions regarding religion in rational-choice or quasi-rational-choice terms. Adopting a decision-theoretic perspective, Miller and Hoffman (1995) posit irreligiousness to be a form of subjectively risky behavior insofar as it exposes the individual to the risk of eternal punishment. Given psychological and economic evidence suggesting that females are more risk-averse than males, then it would seem to follow that if being religious is the less risky choice, females should be more religious than males.

Going further, Miller and Stark (2002; see also Stark 2002) suggest that the sex difference in risk preference is "physiological," and they counterpose the theory that risk preference explains the sex difference in religiosity against the long held, if amorphous, idea that "differential socialization" is responsible for the difference. Evolutionary psychology has already provided scenarios under which psychological differences in risk preference between males and females would have been selected for in the environments of our ancestral past (Wilson and Daly 1985; Kanazawa and Still 2000). The difference in the conceptual level at which the "risk preference" and "socialization" proposals are pitched, however, must be kept clear. Even though Miller and Stark often pose "risk" and "gender socialization" as if they are naturally opposing possibilities (e.g., p. 1415), risk preference could explain the sex difference in religiosity, but yet the difference in preferences could be the result of differential socialization. Conversely, an innate psychological (or "physiological") difference between males and females could explain the difference in religiousness, and yet reflect something other than risk preference. In either case, such proposals would stand opposed to explanations that imagine the

difference as pertaining entirely to differences in immediate circumstances, as in theories that have focused on sex differences in work or other time obligations that have found little empirical support (e.g., Iannaccone 1990). They would also be opposed to explanations that attribute the difference to females disproportionately occupying social roles in which incumbents are expected to exhibit more religiousness, or that females's subordinate position leads to the escapist or otherwise therapeutic benefits of religion to be greater on average for females than males (see reviews in Francis 1997; Miller and Stark 2002).

As an explanation based on psychological differences, subsequent work has revealed the distinct fronts on which the risk preference thesis can be engaged. Sullins (forthcoming) offers evidence he interprets as undermining claims about the "universality" of greater female religiosity upon which the putative need for an innatist explanation is based. Roth and Kroll (ms) do not dispute a tendency for females to be more religious, but they present evidence that beliefs about hell seem unable to explain this sex difference, regardless of the developmental origins of the difference. Freese (2004) shows also that the empirical measure of risk preference used elsewhere by Miller (2002) fails to account for the observed sex difference in religiosity. Lizardo and Collett (ms), on the other hand, seem willing to grant the possible importance of risk preference for explaining sex differences in religiosity, but offer evidence they regard as indicating that the relevant sex differences in risk preference may be more the result of socialization than any innate differences.

We set aside the enticement of debates that pit "biology" against "the social" in determining human behavior. Instead, our purpose here is to provide more formal and detailed scrutiny of the logically prior proposal that risk preferences—whatever their etiology—provide the appropriate focus for understanding sex differences in religiousness. In attempting to

engage the theory, one runs immediately into the problem that "risk" is a vernacular word that has been appropriated by different literatures in different ways; indeed, the concept has not been used consistently by those who see risk are central to sex differences in religion. However, in its reasoning and its employment of phrases like "risk preference" and "risk aversion," Miller and Stark (2002) seem to be seeking to incorporate the well-developed tools of orthodox economics for discussing and deriving predictions regarding risk.

Given this orientation, we begin by attempting to specify the risk preference theory in more formal terms familiar to economists. Doing so leads to a somewhat different set of conclusions than those presented by Miller and Stark. We then seek to address matters empirically in analyses of the World Value Surveys (WVS) and the International Social Survey Program (ISSP) surveys. Our approach is similar to that taken by Roth and Kroll (ms), and our more formal arguments are bolstered by the findings of their empirical analyses, which use the WVS and the General Social Survey and arrive at empirical conclusions broadly consistent with ours. We subsequently conduct further analyses that anticipate some objections to our initial formulation. Taken together, these analyses lead us to doubt that risk preference figures importantly as a cause of the observed sex differences in religiousness. We conclude with a discussion about what might be more productive avenues to explore in trying to resolve this standing puzzle in the sociology of religion.

RELIGIOUS BEHAVIOR AS CHOICE UNDER UNCERTAINTY

In this section, we formally consider the predictions that orthodox economic reasoning might seem to imply about the relationship between afterlife beliefs and religious behavior. In brief, the conclusion of this effort is that the proposition that being irreligious is more risky than being religious is not as straightforward as it may seem. Given an *exclusive emphasis on*

afterlife punishment, religious behavior might correctly be viewed as a form of insurance against hell, and we might expect risk-averse individuals (disproportionately females) to be more likely to engage in such behavior. However, traditional Christian teaching, for example, emphasizes the existence of both extreme afterlife punishment for the faithless (i.e., hell) and extreme afterlife reward for the faithful (i.e., heaven). If one emphasized only the possibility of an afterlife *reward*, religious behavior might be seen as more akin to buying a lottery ticket – a sure cost borne now for a chance at a large prize to be claimed later – that risk-takers (disproportionately males) would find more appealing. Among those who believe in both heaven and hell, then, the predicted implications of an individual's risk attitudes for the choice between religiousness and irreligiousness is indeed ambiguous.

Making this argument formally requires us first to review briefly the standard economic perspective on choice under uncertainty (see Pindyck and Rubinfeld 2001 for further discussion; Kreps 1990 and Hirschleifer and Riley 1992 offer more advanced treatments). Given a set of possible actions, an individual chooses the action that provides the highest expected utility. More formally, for each possible action, the individual first computes the expected utility

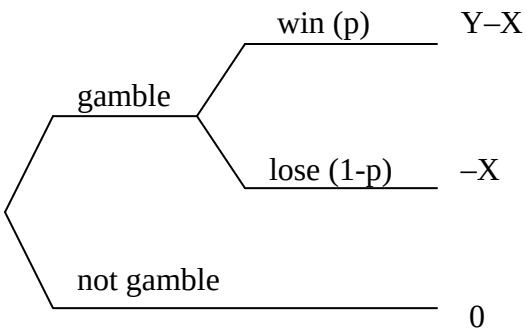
$$(1) \qquad E\text{U(action)} = \sum_{i \in I} p_i \, U(v_i)$$

where E is the expectation operator, I is the set of possible (mutually exclusive) outcomes, p_i is the probability that outcome i occurs given the action, v_i is the payoff associated with outcome i, and $U(v_i)$ is the subjective level of utility generated by this payoff. Having determined the expected utility for each possible action, the individual then prefers action A to action B if

$$(2) \qquad E\text{U(action A)} \geq E\text{U(action B)}.$$

Within this framework, risk preferences are reflected by the shape of the utility function. The individual is risk-averse if utility is a concave function of payoffs, risk-neutral if the utility function is linear, and risk-loving if the utility function is convex.

More concretely, suppose that an individual is given a choice to gamble or not gamble as depicted by the decision-tree diagram below:



If the individual does not gamble, she receives payoff 0 for sure. If the individual does gamble, she pays the amount X (for, say, a lottery ticket). The individual then wins the prize Y with probability p. Thus, the expected utility of each action is

(3) $EU(\text{gamble}) = pU(Y-X) + (1-p)U(-X)$,
$EU(\text{not gamble}) = U(0)$,

and the individual prefers to gamble if

(4) $pU(Y-X) + (1-p)U(-X) \geq U(0)$.

Obviously, gambling becomes more attractive (increasing the left-hand side of this inequality relative to the right-hand side) as the probability p rises, the prize Y rises, or the cost X falls.

However, holding these variables constant, the decision to gamble also depends on the individual's risk preferences—that is, on the shape of the utility function.

To illustrate the role of risk preferences, suppose that p = 1/2 and Y = 2X. Note that this gamble is "fair" in the sense that expected winnings are equal to the cost of the gamble (pY = (1/2)(2X) = X). Further normalizing the utility function so that U(0) = 0, inequality (4) now implies that the individual will gamble if

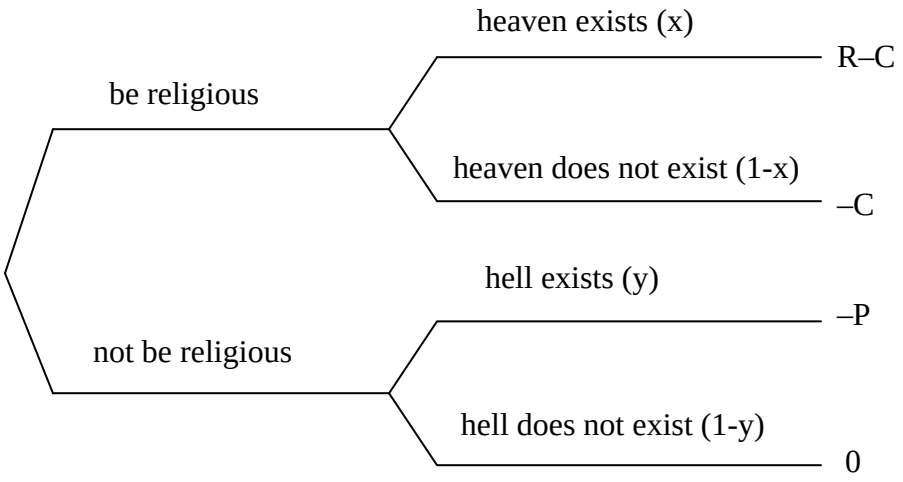
(5) $U(X) \geq -U(-X)$.

In words, the individual chooses to gamble if the subjective pleasure associated with winning X exceeds the subjective pain associated with losing X. Comparing the utility functions in Figure 1, it is obvious that this condition will be satisfied for risk-loving individuals (with convex utility functions) but not satisfied for risk-averse individuals (with concave utility functions).[2]

FIGURE 1 ABOUT HERE

[2] More generally, the rejection of fair bets by risk-averse individuals and the acceptance of fair bets by risk-loving individuals follows from Jensen's inequality (see Hirschleifer and Riley 1992). This result states that, given a random variable v and utility function U, the utility of the expected payoff U(*E*v) is greater than the expected utility *E*U(v) if U is concave, while U(*E*v) is less than *E*U(v) if U is convex. In the present example, given any fair bet such that X = pY, we obtain *E*U(v) = pU((1-p)Y) + (1-p)U(-pY), and U(*E*v) = U(p(1-p)Y+(1-p)(-pY)) = U(0). Thus, inequality (4) holds if U is convex (i.e., the individual is risk loving) but does not hold if U is concave (i.e., the individual is risk-averse). Risk-neutral individuals possess linear utility functions of the form U(v) = λv which implies that U(*E*v) = λ*E*v = *E*(λv) = *E*U(v). Thus, risk-neutral individuals are indifferent to fair bets.

Given that brief review of the economic approach, we now consider religious choice. The classic discussion of religious behavior as choice under uncertainty is Pascal's Wager (Pascal 1966 [1670]; see also Durkin and Greeley 1991). Reflection on this decision problem suggests many possible specifications (see Montgomery 1992). One simple version is given by the decision-tree diagram below.



In this version of Pascal's Wager, the individual is faced with the choice to be religious or not religious. (Anticipating the GSS and WVS data, this choice might be reflected either in church attendance or in the more general claim to be "a religious person.") We assume that religiousness imposes some cost C. If heaven exists (probability x) and the individual was religious, she receives an afterlife reward R. If hell exists (probability y) and the individual was not religious, she receives an afterlife punishment P. Otherwise, the individual receives an afterlife payoff of zero.[3]

[3] In Pascal's ([1670] 1966) original argument, he asserts that R is infinite and thus obtains the result that religiousness is the optimal choice if there is any possibility of heaven (i.e., any $x > 0$ implies $EU(\text{religious}) > EU(\text{not religious})$). Here, we presume that both the afterlife reward R

Given the ordering of payoffs ($R–C > 0 > –C > –P$), inspection of the decision tree immediately reveals that either choice could be the riskier option depending on the probabilities x and y. If the individual is certain that heaven does not exist ($x = 0$) but unsure about hell ($0 < y < 1$) then religiousness provides insurance against an afterlife punishment. If the individual is certain that hell does not exist ($y = 0$) but unsure about heaven ($0 < x < 1$) then religiousness becomes a gamble on an afterlife reward. In the more general case where both heaven and hell are uncertain ($0 < x < 1$ and $0 < y < 1$), both choices entail risk.[4]

To compute expected utilities, we need to recognize the time dimension implicit in the individual's decision problem: costs are borne in the present while afterlife payoffs are received only in the future. Formally, we allow afterlife payoffs to be discounted by a subjective discount factor β between 0 and 1 (compare Azzi and Ehrenberg 1975). Thus, expected utilities are

$$(6) \quad EU(\text{religious}) = U(-C) + \beta[xU(R) + (1-x)U(0)],$$
$$EU(\text{not religious}) = U(0) + \beta[yU(-P) + (1-y)U(0)],$$

and the individual chooses to be religious if

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and punishment P are finite. Azzi and Ehrenberg (1975) defend this assumption by noting that even an infinite (never-ending) stream of payoffs will have a finite present discounted value.

[4] Given this (very simple) version of Pascal's Wager, individuals who are certain that heaven and hell exist (and thus hold the subjective probabilities $x = y = 1$) would face no risk. But given a more elaborate model with probabilistic links between present behavior and afterlife payoffs, risk persists even for these individuals. In Appendix 1, we develop a more general version of Pascal's Wager, demonstrating that the predictions drawn from the simpler model remain valid.

(7) $EU(\text{religious}) \geq EU(\text{not religious})$.

Again normalizing the utility function so that $U(0) = 0$, we obtain the condition

(8) $\beta[xU(R) - yU(-P)] \geq -U(-C)$.

Intuitively, the left-hand side of inequality (8) reflects the expected future benefits from religious participation while the right-hand side reflects the present costs.

To derive probabilistic claims from inequality (8), we might assume variation in either the costs of religiousness (C) or the disutility of religiousness ($-U(-C)$) across individuals.[5] Conceptualizing the disutility $-U(-C)$ as a random variable ε, the probability of religiousness equals

(9) $\text{prob}\{\varepsilon \leq \beta[xU(R) - yU(-P)]\}$.

Recognizing that ε might sometimes be negative – religiousness might generate this-worldly benefits rather than costs – it becomes possible to rationalize religious participation by some individuals who completely discount future outcomes ($\beta = 0$) or do not believe in an afterlife ($x = y = 0$).

To explain sex differences in religiousness, sociologists have often emphasized differential socialization (see Miller and Stark 2002) while economists might emphasize differences in wages and hence the value of time (see Azzi and Ehrenberg 1975). Essentially,

[5] Given that both assumptions generate similar empirical predictions, the latter assumption is developed here, while analysis of the former assumption (which requires introduction of the economic concept of "certainty equivalents") is presented as Appendix 2.

both arguments focus on sex differences in the present costs of religiousness (the right-hand side of inequality 8). Equivalently, these arguments implicitly assert that the distribution of ε differs across sexes, presumably having a lower mean for females than males. In contrast, rejecting these conventional explanations for sex differences, Miller and Stark emphasize differences in the expected future benefits of religiousness (the left-hand side of inequality 8). To develop a test of the risk preference argument, we thus maintain the assumption that the distribution of ε does not vary by sex.

Focusing now on the expected future benefits of religious participation, we might first consider whether sex differences in the discount factor β are responsible for differential religiousness. While Miller and Stark (2002) and Miller and Hoffmann (1995) clearly emphasize sex differences in risk preferences, Stark (2002) seems to conflate male "risk taking" with an inability to delay gratification. If males tend to have lower subjective discount factors than females, it is obvious from (9) that males will tend to be less religious than females. But the evolutionary rationale for male impatience is unclear, at least with respect to the rational-choice reasoning employed by Miller and Hoffman (1995). Indeed, extreme male impatience would seem inconsistent with evolutionary arguments for differential risk preferences which emphasize male willingness to incur *present* costs to obtain *future* mating opportunities. Thus, we will presume here that the discount factor does not vary systematically by sex, and we emphasize that a theory that turns on sex differences in *time* preference (discount factor) is not a theory of differential *risk* preference. We will return to the difference between time preference and risk preference in the conclusion.

We might next consider whether sex differences in risk assessment – beliefs in the existence of heaven and hell reflected in the probabilities x and y – are responsible for

differential religiousness. We discuss this topic further below. For now, while Miller and Stark (2002) sometimes seem to conflate these two concepts as well, it is important to maintain the distinction between risk *preferences* (reflected in the shape of the utility function) and risk *assessment* (reflected in subjective probabilities). As discussed above, differences in risk preferences may cause two individuals with the *same* subjective beliefs to make different choices. Thus, in our test of the risk preference argument, we compare those males and females who make similar assessments of risk. That is, we examine rates of religiousness among those with similar beliefs about the existence of heaven and hell.

Having addressed the other potential sources of sex differences in religiousness, we now suppose (following Miller and Stark) that these differences are driven by sex differences in risk preferences. As discussed above, risk preferences are reflected in the subjective utilities associated with gains and loses. Recognizing that utility scales are arbitrary, direct comparison of subjective utility levels across individuals might seem problematic. However, assuming that all males have the utility function $U_M(v)$, that all females have the utility function $U_F(v)$, and normalizing these functions to have the same level and slope at the origin so that $U_M(0) = U_F(0) = 0$ and $U_M'(0) = U_F'(0)$, some straightforward comparisons become possible. If males are more risk loving than females (so that U_M is more convex than U_F), then males will receive higher subjective utility from heaven but lower subjective utility from hell. More formally, we obtain the inequalities

$$(10) \quad U_M(R) > U_F(R) \quad \text{and} \quad -U_M(-P) < -U_F(-P)$$

which are illustrated in Figure 2.[6] Several of our key empirical predictions derive solely from the inequalities in (10). However, if we further assume symmetry in the afterlife rewards and punishments (so that R = P) and impose an "inverted" symmetry in the utility functions (so that $U_M(v) = -U_F(-v)$ for all v), we obtain the stronger result

(11) $U_M(R) = -U_F(-P) > -U_M(-P) = U_F(R)$,

allowing us to more clearly rank subjective utilities both within and between sexes.

FIGURE 2 ABOUT HERE

Given equation (9), the proportion of individuals of sex g (= M for male or F for female) with afterlife beliefs x and y who choose to be religious may be written

(12) $\text{pr(religious}|\ g, x, y) = \text{prob}\{\varepsilon < \beta[xU_g(R) - yU_g(-P)]\}$.

For individuals who believe in neither heaven nor hell (x = y = 0), the bracketed term $[xU_g(R) - yU_g(-P)]$ reduces to zero. Thus, among these individuals, the model predicts that the rate of religiousness will not vary by sex. Formally,

(13) $\text{pr(religious}|\ M, 0, 0) = \text{pr(religious}|\ F, 0, 0) = \text{prob}\{\varepsilon < 0\}$.

[6] While Figure 2 assumes that males are risk loving while females are risk averse, note that the inequalities $U_M(R) > U_F(R)$ and $-U_M(-P) < -U_F(-P)$ merely require females to be *relatively* more risk averse than males (so that, in an absolute sense, both genders could be risk averse or both could be risk loving).

Intuitively, because these males and females expect no future benefits, the proportion who choose to be religious will be low regardless of sex.

For individuals who believe in heaven but not hell (x = 1, y = 0), the bracketed term $[xU_g(R) - yU_g(-P)]$ reduces to $U_g(R)$. Given inequality (10), this subjective utility level is larger for males than females. Thus, among these individuals, the model predicts that males will be more religious. Formally,

(14) $\text{pr(religious}|\text{ M, 1, 0)} = \text{prob}\{\varepsilon < \beta U_M(R)\}$
$> \text{pr(religious}|\text{ F, 1, 0)} = \text{prob}\{\varepsilon < \beta U_F(R)\}.$

Because the afterlife reward generates more subjective pleasure for risk-loving males than risk-averse females, males have a stronger incentive to become religious. For individuals who believe in hell but not heaven (x = 0, y = 1), the bracketed term $[xU_g(R) - yU_g(-P)]$ reduces to $-U_g(-P)$. Given inequality (10), this subjective utility level is larger for females than males. Thus, among these individuals, the model predicts that females will be more religious:

(15) $\text{pr(religious}|\text{ F, 0, 1)} = \text{prob}\{\varepsilon < \beta[-U_F(-P)]\}$
$> \text{pr(religious}|\text{ M, 0, 1)} = \text{prob}\{\varepsilon < \beta[-U_M(-P)]\}.$

Intuitively, because the afterlife punishment generates more subjective pain for risk-averse females than risk-loving males, females have a stronger incentive to become religious.

Finally, for individuals who believe in both heaven and hell (x = y = 1), the bracketed expression becomes $[U_g(R)-U_g(-P)]$. Given only inequality (10), the sign of the expression

(16) $[U_M(R)-U_M(-P)] \gtrless [U_F(R)-U_F(-P)]$

remains ambiguous. However, we might anticipate that the difference between these bracketed expressions (and hence the sex differential in religiousness) would be small in absolute value. Indeed, imposing the stronger symmetry assumptions that led to inequality (11), the model predicts no differences by sex:

$$(17) \quad \text{pr(religious}|\ M, 1, 1) = \text{prob}\{\varepsilon < \beta[U_M(R) - U_M(-P)]\}$$
$$= \text{pr(religious}|\ F, 1, 1) = \text{prob}\{\varepsilon < \beta[U_F(R) - U_F(-P)]\}.$$

Given belief in both heaven and hell, both males and females have a strong incentive for religious participation. But differential risk preferences would not generate differential religiousness because the greater subjective utility that males place on heaven is balanced by the greater subjective disutility that females place on hell.

Having emphasized the empirical predictions of the model for religiousness by sex controlling for afterlife beliefs, it may also be worth noting that the model generates intuitive predictions for differences in religiousness within sex across belief classes. In particular, simply using the fact that the terms $U_g(R)$ and $-U_g(-P)$ are all positive, the model predicts

$$(18) \quad \text{pr}(g, 0, 0) = \text{prob}\{\varepsilon < 0\}$$
$$< \text{pr}(g, 1, 0) = \text{prob}\{\varepsilon < \beta U_g(R)\}$$
$$< \text{pr}(g, 1, 1) = \text{prob}\{\varepsilon < \beta[U_g(R) - U_g(-P)]\},$$

$$\text{pr}(g, 0, 0) = \text{prob}\{\varepsilon < 0\}$$
$$< \text{pr}(g, 0, 1) = \text{prob}\{\varepsilon < \beta[-U_g(-P)]\}$$
$$< \text{pr}(g, 1, 1) = \text{prob}\{\varepsilon < \beta[U_g(R) - U_g(-P)]\}$$

for both sexes $g \in \{M, F\}$. Incentives for religiousness grow with belief in both heaven and hell. Thus, those who believe in neither ($x = y = 0$) have less incentive to become religious than those who believe in one or the other (either $x = 1$ or $y = 1$), while those who believe in both ($x = y = 1$) have the largest incentive. Given the stronger assumptions underlying inequality (11), we obtain

(19) $pr(M, 0, 0) = pr(F, 0, 0)$
$< pr(M, 0, 1) = pr(F, 1, 0)$
$< pr(M, 1, 0) = pr(F, 0, 1)$
$< pr(M, 1, 1) = pr(F, 1, 1).$

Intuitively, this ordering reflects the fact that risk-loving males are more motivated by heaven than hell, while risk-averse females are more motivated by hell than heaven.

PREDICTIONS

At this point, our attempt to pursue formally the implications of Miller and Starks's argument yields both specific empirical predictions and a quandary. The implications are presented again as Prediction Set A of Table 1. When we divide populations into four subgroups based on their belief in heaven and in hell, the only group for which we are led unambiguously to predict greater religiousness among females than males is those who believe in hell but not in heaven. As it happens, this combination of beliefs is quite rare in all of the countries that have participated in either the WVS or the ISSP surveys, as we discuss further below. For the three subgroups that together represent the overwhelming majority of survey respondents, the predicted sex difference in religiousness is either ambiguous (and expectedly small) or of a greater religiousness among *males*. What makes this a quandary is that Miller and Hoffman

(1995) embarked on risk preference theory in an effort to explain the known greater religiousness of females. In other words, a formal examination of the argument leads us to be skeptical of whether Miller and Hoffman's broadest explanans—that females tend often to be more religious than males—actually follows from their key suppositions that (1) religiousness is a rational choice based on an "expected utility model," (2) males are more risk-loving than females, and (3) this is the important psychological difference responsible for any sex difference in religiousness. While below we will examine whether these predictions are consistent with available data, we can anticipate negative results.

TABLE 1 ABOUT HERE

One might consider it unfair, however, to regard such findings as inconsistent with risk preference theory. We, not they, asserted that explaining religious choice in terms of afterlife beliefs would seem to require consideration of the influence of possible afterlife rewards as well as possible afterlife punishment. An alternative, perhaps, would be to maintain that risk attitudes do serve as the crucial psychological variable for understanding sex differences in religious choice, but to posit that only the prospect of afterlife punishment—*not* the prospect of heavenly rewards—figures (or figures importantly) in religious choice. In other words, one can posit that the prospect of hell is a sufficient deterrent to irreligiousness for many people, but the prospect heaven is not sufficiently rewarding to provoke religiousness.

This leads to the second set of predictions presented in Table 2. If the sex difference in religiousness really is to be explained by the application of differential risk attitudes to the aversion of hell, then it seems reasonable to conclude that one would not expect to observe sex differences among those persons who do not believe in hell (and regardless of whether or not those persons believe in heaven). A greater religiousness among females, however, would be

expected for those who do believe in hell, and thus, if belief in hell predominates among members of a population, then we would expect to observe a greater religiousness among females than males overall (see Roth and Kroll [forthcoming] for similar reasoning).

We can obtain a still different set of predictions if we weaken the supposed causal potency of the theory to an assertion that different risk attitudes contribute importantly to sex differences in religiousness, rather than being the only or dominant determinant of these differences. That is, one could posit that other, unspecified factors also figure into the greater religiousness of females, but that, without the (putatively "physiological") difference in risk preferences, the greater religiousness of females would be less than it otherwise is. Accordingly, then, when we look among those who do not believe in hell, we would be unsurprised if females were more religious than males, but we would expect the difference in religiosity to be less than it is among those who do believe in hell.

EMPIRICAL RESULTS

Given the highly general nature of Miller and Stark's theory, we sought to include data from many different countries in our empirical investigations. Toward this end, we used two different cross-national data sources: the 1990 and 1995 World Values Survey (combined when possible) and the 1998 International Social Survey Programme. The World Values Survey attempts representative, comparable surveys of values and attitudes for a large number of populations; we use 48 that ask pertinent items and have sufficient sample size. The ISSP conducts topical modules in what are typically larger surveys in their host countries (in the United States, the ISSP is conducted as part of the General Social Survey), and 24 populations include the relevant questions from the 1998 module on religion and have sufficient sample size

for use here. Tables for later analyses list the populations used in both sources (Table 3 for WVS and Table 5 for ISSP); following others' practice, we will hereafter refer to the populations as "nations" or "countries" even though not all of them are.

Both the WVS and the participating surveys in the 1998 ISSP ask respondents about their beliefs in the existence of heaven and hell. The WVS asks about belief simply as a "yes" or "no" question, while the ISSP provides four response categories by adding "definitely" and "probably" to both the "yes" and "no" alternatives. Taken together, these data offer considerable leverage to examine whether the sex difference in religiousness varies depending on respondent's beliefs about the existence in heaven and hell.

Ideally, for our purposes, respondents in many countries would be distributed in at least modest quantities across all permutations of belief in heaven and hell. Instead, as already noted, inspection of the data reveals that there is virtually no one in any place surveyed who believes in the existence of hell but not heaven. Across the 73 countries/regions surveyed in any wave of the WVS, the percentage of the population who believe in hell but not heaven was below 1% in 61 countries, below 2% in all but 3 countries, and had a maximum of 3.3% (Taiwan). Among those who believe in hell, the probability of belief in heaven exceeded 95% in all but 5 countries, and was never lower than 91.3% (Latvia).[7] Consequently, we exclude this category from our

[7] It is worth emphasizing that the combination of hell but no heaven does not seem a *logical* impossibility. Indeed, belief patterns that would seem logically necessary fare less well in survey data. For instance, in the United States sample of the WVS, conditional on believing in heaven, only 86% of respondents report believing in life after death. Thus, non-trivial numbers of Americans appear to believe in heaven but not an afterlife, a belief pattern precluded by the skip pattern on some surveys (e.g., the 1996 Religion and Politics Survey). One possible

analyses; we also exclude countries do not have at least fifty persons in each of the three other permutations (belief in heaven and hell, belief in heaven but not hell, and belief in neither).

For both samples, we focus here on results regarding one relatively objective measure of religious participation (self-reported church attendance) and one more subjective measure. In the WVS, the subjective measure we use is "How important is God in your life?" with responses on a ten-point scale with endpoints labeled "Not at all" and "Very." In the ISSP, the subjective measure we use is "Would you describe yourself as...?" with seven options ranging from "extremely religious" to "extremely non-religious." We choose these subjective measures because they seemed most consistent with Stark's (2002; Stark and Glock 1969) reasoning about the best subjective measure of the construct of interest. The analyses we present are based on simple ordered probit models with only sex as a regressor, although substantively the results are not affected by the inclusion of controls and are consistent with alternative specifications trying other measures of observed religiosity. We present the results briefly because they are also broadly consistent with the analysis of the WVS by Roth and Kroll (ms), although their analytic strategy and measures differ somewhat.[8]

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reaction to this result would be to exclude respondents who say no to the life after death question but express belief in heaven or hell; doing so does not produce results substantively different from those presented here. We do not exclude them in the presented analyses because of the possibility that many of the seemingly inconsistent responses could reflect a belief that what is being asked about in a question of "life after death" is something different (e.g., reincarnation) than the fate of the spirit after physical death.

[8] Importantly, although Roth and Kroll's (ms) main results separate respondents by belief in hell, they also conduct analyses in which belief in hell is included as a covariate, and seem to believe

Table 2 provides a summary of the relevant results for the predictions presented above, in terms of both the direction of results and their statistical significance. We can see that, consistent with other work, females overall are more religious than males on at least one of the religious measures in all of the WVS and ISSP samples, and these results are statistically significant in the vast majority of instances. Although we showed above that applying a decision-theoretic perspective to those who believe in both heaven and hell might predict ambiguous and small results, there is a clear pattern for females to be more religious than males, thus refuting Prediction Set A of Table 1 as expected.

TABLE 2 ABOUT HERE

If we look at results conditional on belief in heaven and hell, we do not observe any pattern in which the sex difference in religiosity is confined to only those whose belief in the afterlife includes hell. Indeed, a larger number of countries observe results in the expected direction when analyses are restricted to those who believe in neither heaven nor hell than those who believe in both heaven and hell. Results are more mixed when considering the group that

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that risk preference theory would be supported by changes in the sex difference with the inclusion of belief as a control. In any case, if A and B are binary variables (e.g., sex and belief in hell) and the relationship between A and an outcome is strong when B = 0 and nothing when B = 1, this is properly estimated by stratifying analyses by B or by including the interaction term A × B. Only if A and B are correlated will the coefficient for the effect of A on Y be affected by the inclusion of B in the model, which is irrelevant to whether there is an interaction. As we argue, risk preference theory does not require a correlation between gender and belief. In short, those parts of Roth and Kroll's analyses that use belief in hell as a covariate do not actually test the risk preference argument but rather an argument that turns on risk assessment.

believes in heaven but not hell, but this group is smaller than either of the two others. Overwhelmingly, in all groups, when significant results are observed, it is in the direction of females being more religious than males. These results would seem also to refute Prediction Set B and thus the idea that aversion to hell may be the dominant explanation for the sex difference in religion.

We can then turn to the Prediction Set C, which specifies just that if aversion to eternal punishment was important for understanding sex differences in religion then these differences ought to be largest for those who believe in hell. Here, looking first at the ISSP, we can see that sex differences are more often larger among believers in hell than nonbelievers, although nowhere is the difference significant. In the WVS, sex differences are also more often larger among believers in hell than nonbelievers, and here for 10 of the 48 countries surveyed the differences for females are significantly larger (at the $p < .05$ level) than for males. Consequently, while results seemed to flatly contradict the first two sets of predictions, the weaker third set is not as inconsistent with the data. It would seem still quite wishful to regard these results as positive support of a weaker version of the risk preference hypothesis, especially given Freese's (2004) finding that a more direct (according to Miller [2002]) risk preference measure did not much attenuate observed sex differences in the WVS data.

Table 3 provides country-by-country results for the combined 1990 and 1995 WVS. The nations for which a significantly greater sex difference among believers in hell is observed—Peru, South Africa, Chile, Romania, Colombia, Great Britain, Uruguay, Switzerland, the Netherlands, and Sweden—do not share any discernible characteristics that would explain why

they are more consistent with the weaker risk preference theory than others.[9] Given that significant differences between coefficients are especially hard to evaluate for nonlinear regression models in which the baseline value for the dependent variable varies between groups (i.e., nonbelievers in hell regarding religion as less important on average than believers), these results should be regarded as weak. In addition, notable also in Table 3 is that the United States is second of all nations in the percentage who believe in hell (73.2%). There might seem some irony in American researchers making hell the basis of a universalist theory of sex differences in religiosity when hell is so much more popular in America than elsewhere (and much less ubiquitous than the sex difference itself).

TABLE 3 ABOUT HERE

RISK ASSESSMENT

The foregoing test of the risk preference argument was built upon the standard economic conception of choice under uncertainty. On that view, risk preferences (risk-aversion, risk-neutrality or risk-lovingness) are reflected in the shape of the utility function (concave, linear or convex) and are conceptually distinct from risk assessment (i.e., the process by which individuals form subjective judgments about the likelihood of future outcomes). Our test for sex differences in risk preferences thus examined sex differences in religiousness conditional on beliefs. But

[9] More correctly, one would look at the countries that have the largest gender differences regardless of significance, to avoid conflating sample size with substantive characteristics of countries, but the overlap between the two lists is considerable and looking at nations with nontrivial gender differences but small WVS samples (e.g., Japan, Denmark) does not provide any additional information suggestive of similarity among countries with larger differences.

moving outside economics, discussions of "risk taking" in sociology and psychology often seem to conflate risk preferences and risk assessment. Arguably, a male propensity for "risk taking" might be reflected more in their denial of an afterlife – males might assign lower subjective probability to heaven or hell – than in their subjective utility levels associated with those outcomes. Given a sex differential in risk assessment, some version of the Miller and Stark's argument (one understood as an argument about risk assessment rather than risk preferences) might seem to survive our preceding test.

Standard economic theory would seem to provide little help explaining systematic sex differences in religious beliefs (Montgomery 1996). Within orthodox economics, beliefs are not chosen and hence do not reflect an actor's interests. Consequently, Pascal's Wager should understood as a choice between action and inaction given a fixed belief, rather a choice between belief and non-belief (Montgomery 1992). As such, within standard economic theory it would make no sense to suggest that beliefs are chosen on the basis of risk preferences (against Miller and Stark 2002, p 1418). Of course, economic theory recognizes that beliefs can be updated (using Bayes' Rule) in light of new information. Thus, sex differences in afterlife beliefs might stem from asymmetric information (assuming that females are more likely than males to receive "signals" implying that heaven and hell truly exist). Arguably, if information flows through social networks with a sex-based homophily bias, economic models of "herd behavior" (Bikhchandani, Hirshleifer and Welch 1998) might provide some part of the explanation for persistent sex differentials. But these models incorporate strong restrictions on information flow

that might seem implausible in a religious context: females and males do talk, often, and so one would expect any credible "signal" to quickly become common knowledge.[10]

Non-standard economic theories might provide more leverage. Akerlof and Dickens (1982) and Akerlof (1989) develop theoretical models in which actors hold not those beliefs that are most accurate (based on the information they possess) but rather those beliefs with which they feel most comfortable. That the most discomfiting configuration of afterlife beliefs (no heaven, but hell) is by far the least common might seem consonant with this perspective. Against orthodox economic theory, the perspective would allow beliefs to driven by interests (including risk preferences). Attempting to take seriously the Miller and Stark's suggestion that sex differences in beliefs are driven by differential risk preferences, Appendix 3 contains a simple model of self-serving bias in belief formation. The intuition from this model is that beliefs in heaven and hell are biased upwards (downwards) conditional on the choice to be religious (irreligious), and that males (females) have a greater incentive to distort their beliefs in heaven (hell). In other words, among those who are religious, we might expect that males are more likely to believe in heaven than females, while females are more likely to believe in hell, with the opposite to be the case for those who are not religious. Note that this model would seem to reverse the direction of causation maintained within the rest of Miller and Stark's argument: actions now determine beliefs, rather than vice versa. In the attempt to explain religious beliefs, we lose the explanation for religious behavior.

[10] Moreover, any serious attempt within orthodox economics to explain gender differentials in religious belief would need to grapple with the theoretical results that rational actors cannot agree to disagree (Aumann 1976) and that common knowledge about actions negates asymmetric information about events (Geneakoplos 1992).

Recall our observation that, for anywhere included in WVS or ISSP, if someone believes in hell, they almost certainly believe in heaven; in contrast, there are many more people who believe in heaven but do not believe in hell. The preceding logic implies the prediction that we might expect the category of believers in heaven but not hell to be disproportionately appealing to religious males and to nonreligious females. As before, this prediction can be weakened to allow for the possibility of a general tendency for females to endorse beliefs in heaven and hell overall. In this case, we might still expect the specific belief in heaven and not hell to be increasingly popular among males relative to females as religiosity increases. Table 4 summarizes these predictions.

TABLE 4 ABOUT HERE

For simplicity, we consider only results from the 1998 ISSP. Before considering the specific model results, we looked first at just the bivariate relationship between sex and joint belief in heaven and hell. Not surprisingly, in all ISSP countries, males are less likely than females to believe in the existence of both heaven and hell, and in most cases the relationship was significant (20 of 24 countries significant at $p < .05$; not shown). Less obviously, however, in a majority of countries, females were also relatively more likely than males to believe in heaven without hell than heaven and hell (18 of 24 countries, but only 3 significant at $p < .05$). Given that risk preference theory would make the clearest predictions for a cosmology with hell but not heaven, it is intriguing that observed beliefs actually might show a slightly greater attraction of females toward its opposite.

Table 5 tests the pertinent interaction terms for our attempt to respecify the theory in formal terms of risk assessment. We use attendance at services as our measure of religious behavior, which again is measured as a six category variable ranging from “never” (=0) to “once

a week or more" (=5). We estimate a multinomial logit with coefficients presented using belief in heaven but not hell as the base category. Prediction Set E proposes that as religiosity increases, the relative odds of believing in heaven and hell versus heaven but not hell should increase for females. This corresponds to positive coefficients for "female × attendance" in the left panel of Table 5. Prediction Set E also proposes that increased religiosity is associated with increases in the relative odds of believing in neither heaven nor hell versus heaven but not hell for males. This corresponds to negative coefficients for the interaction term in the right panel of Table 5.

TABLE 5 ABOUT HERE

We can see that in neither case are many interaction terms significant nor are they consistently in one direction or the other. For the comparisons among believers in heaven, 12 of 24 coefficients are in the predicted direction, and only 1 is significant and in the predicted direction. For the comparisons among nonbelievers in hell, only 6 of 24 interactions are in the predicted direction, and again only one is significantly so. Because Prediction Set E is a weaker version of Prediction Set D, the failure to find support for E is a failure for D as well. In sum, these results do not support our attempted modification of the theory, indicating that this way of thinking about the possible relationship between sex differences in risk assessment and religiosity is not a promising avenue for explaining sex differences in religiosity.

\IF NOT RISK PREFERENCE, THEN WHAT?

Confronted with the risk preference argument, many sociologists might immediately reject its rational-choice premise that religious behavior can be understood as the product of expected-utility maximization given subjective beliefs about the afterlife. On this view, survey responses to questions about belief in heaven and hell should not be interpreted as subjective

probability assessments. And even if these responses could be understood in this way, it would seem implausible that these probabilities are then entered into a decision calculus governing the choice to be or not to be religious. Opponents of the rational-choice perspective might further emphasize the difficulty of specifying Pascal's Wager as a decision problem given the manifold conceptions of God and hence many conceivable mappings from religious behavior into afterlife outcomes.[11] If an economic theorist is unsure precisely how to specify Pascal's Wager as a decision-theory problem, it is hard to imagine that every individual has given the problem a clear personal specification (much less derived the optimal solution).[12]

Nevertheless, we have attempted in this paper to evaluate the risk preference theory as articulated by Miller and Hoffman (1995) and Miller and Stark (2002) on its own terms, deriving empirical predictions from a formal decision-theoretic model. Given the standard economic conception of risk preferences, one problem with the risk preference argument becomes immediately obvious: being irreligious is not necessarily a riskier choice than being religious.

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[11] Beyond the complications introduced in Appendix 1, a more complete specification of Pascal's Wager would need to incorporate the possibility of multiple *types* of Gods, each of whom might require a different form of religious behavior and might (or might not) look kindly upon behavior directed toward other Gods (see Montgomery 1992).

[12] In response, an economist might assert that individuals need not be conscious of decision problems, but merely behave as if they were solving such problems (see, e.g., Becker 1976). However, this "as if" defense becomes less compelling when there is no possibility of learning through trial-and-error. Obviously, in the present context, individuals make one-time choices (whether or not to lead a religious life) that cannot be reversed following success or failure (which becomes apparent only after death).

Hence, even if females are more risk averse than males, the risk preference argument does not necessarily imply that females will choose to be more religious than males. Our formalization of the risk preference argument thus yields predictions that are conditional upon the individual's belief in heaven and hell. However, we join Roth and Kroll (ms) in finding little empirical reason to believe that afterlife beliefs explain much of the sex difference in religiosity, and Freese (2004) found earlier that an apparent measure of risk preference itself does little to resolve observed sex differences. Our exploration of modifying the theory to focus on risk assessment instead of risk preference proved likewise fruitless. For these reasons, we conclude that sex differences in "risk preference" or "risk assessment" with regard to the afterlife evince little promise of explaining the sex difference in religion.

Miller and Stark (2002) and Stark (2002) formulate their argument as a matter of "biological" versus "social" causes, or more specifically innatist "physiology" versus "socialization." We think this was an unfortunate framing decision, except that by invoking the specter of innate causes the theory has almost certainly drawn more attention to the underlying theoretical problem than it otherwise would have (regarding the particular provocation of "biology" to sociologists, see Freese, Li, and Wade 2003). The logically prior question for this literature, we think, is the degree to which psychological traits, of the sort collected by "personality" broadly conceived, explain sex differences in religiosity. An alternative would be to imagine the difference as pertaining entirely to differences in immediate circumstances, as in the empirically discredited explanations that focused on sex differences in work or other time obligations. Others would be that females occupy social roles in which incumbents are expected to exhibit more religiousness, or that females' subordinate position leads the escapist or otherwise therapeutic benefits of religion to be greater on average for females than males (see

Francis 1997; Miller and Stark 2002 for review of theories). As noted, the question is to what extent males and females face different religious choice problems with the same psychology (different because of systematic sex differences in circumstances or the implications for males and females of religious content) and to what extent males and females respond to similar religious choice problems with different psychology (regardless of the origins of these differences).

Francis (1997) and Miller and Stark (2002) amply summarize reasons to be skeptical of the possibility of an explanation of the sex difference that focuses exclusively on immediate situational differences and does not articulate some reference to more immediate psychological factors. In concluding their own disconfirmation of risk preference theories, Roth and Kroll (ms) seem to advocate returning to explanations that minimize the role of intervening psychology, which we think conflicts with the balance of available evidence and thus would be a mistake. In our view, psychological differences seem almost certain to figure in understanding the sex difference. We need to understand with specificity what these psychological differences are that figure centrally in the observed religious difference, and only then will we be able conduct a more fruitful assessment of the relative contribution of genes and environments (including, but not limited to, "socialization") in the development of these psychological differences. Miller and Stark's blurring together of two fundamentally distinct questions—*Is the sex difference "biological"? Is the sex difference the results of differences in risk preferences?*—only invites confusion in an area for which clear thinking is sorely needed.

In this respect, discussions of male "risk taking" also conflate a variety of claims about preferences, beliefs, and actions that should remain conceptually distinct. The confusion seems to stem from "risk-taking behaviors" having causes that are not preference for risk per se, so

seeing commonalities between "risk-taking" and irreligiousness do not imply that preference regarding risk per se is the pertinent commonality. In particular, male "risk taking" in risk preference theory is sometimes equated with claims about (a) risk preference (that males are more risk-loving than females), (b) risk assessment (that males assign lower probabilities to bad outcomes), (c) time preference (discount factors; that males are less willing to delay gratification), or (d) rebelliousness (that males are less willing to obey social norms). In drawing upon evolutionary psychology, Miller and Stark alternate between these claims. Generally, Miller and Stark (2002) seem to be making claim (a), though occasionally veer toward claims (b) and (d), especially in their discussion of Japan (pp 1416-1418).[13] In contrast, Stark (2002: 496) clearly emphasizes claim (c), saying that "male irreligiousness... [is] rooted in the fact that far more males than females have an underdeveloped ability to inhibit their impulses, especially those involving gratification and thrills."

More generally, the effort to identify psychological variables pertinent to understanding sex differences in religiosity is a task complicated by the lack of good psychological measurement in prominent social survey data that include measures of religion. Indeed, it may well be that the pertinent intervening psychological variables for the sex difference in religiousness are already well enough understood, and it is more that the datasets used by sociologists in this area have not allowed them to repeat the feat. In studies that contain measures of so-called "masculinity" and (especially) "femininity" but with limited non-population samples, these measures of personality—despite their limitations (discussed below)—explain most or all of the variation that would otherwise be attributed to respondents' sex

[13] Importantly, Roth and Kroll (ms) report being unable to reproduce Miller and Stark's empirical findings regarding Japan.

(Thompson 1991; Francis and Wilcox 1996; Francis and Wilcox 1997; Francis and Wilcox 1998; Thompson and Remmes 2002; Francis 2005). Ideally, comparable measures would be available in the ISSP and WVS, and plausibly they might explain much or even all of the sex difference that the failure of risk preference theory leaves still mysterious.

Miller and Stark (2002) consider matters instead in terms of the extent to which individuals are "socialized" into "traditional gender roles," which can then be operationalized by social attitude questions about the proper place of males and females that are familiar to researchers who have worked with GSS or WVS data. What cannot be emphasized enough is that these attitude questions are not personality characteristics, and the failure of these attitude items (or changes in sex-associated societal roles) to account for sex differences in religiosity does not at all speak to the relevance of psychological characteristics associated with "masculinity," "femininity," or any other aspect of personality. Without clearer understanding of the specific psychology involved, these data are also poor for drawing any conclusions about the relative importance of genetics and environments. Large-scale cross-sectional surveys allow sociologists to imagine the possibility of doing developmental psychology on the cheap, but the resulting inferences here are too often convoluted and confused, especially when the pertinent psychological characteristics are not even attemptedly measured.

Indeed, the implications of deficient data are perhaps exacerbated by the unfortunate identification of the "psychological" with "biological" and the opportunity for this to be pitted against the "social" by researchers whose disciplines are strongly inclined to favor "social" explanations at every turn (indeed, may see the relevance of their discipline hinging on the

success of "social" explanations).[14] Sullins (forthcoming), for example, concludes from his analysis of the General Social Survey that "non-social factors are independently generally less powerful than social factors" in explaining either subjective or behavioral indicators of religiosity. On the side of "non-social factors" are some survey items that are far from direct or thorough measures of psychological constructs already demonstrated to be important for religiosity. The item measuring "tender-mindedness," might seem closest to the "femininity" measures of other studies, asks respondents whether "I would describe myself as a pretty-soft hearted" person, while risk "tolerance" is measured by how fearful respondents report being to walk alone at night.[15] The "social factors" side, meanwhile, includes variables posing such obvious endogeneity problems for estimating causal effects as the percentage of friends who belong to one's religious congregation (termed a "network" measure) and the relative fundamentalism of one's religious affiliation (considered a "demographic" measure), as well as an earlier measure of one's own religiosity (attendance at age 12, termed a "socialization" measure).

While "data duels" between binary competitors may be a favorite trope of quantitative sociology, contests between "psychological" and "social" are generally wanting in the absence of

[14] The epistemic double standard at work is illustrated by how Stark, the advocate of the biological position, feels compelled to articulate at the outset how reaching this conclusion "was not done eagerly or even very willingly" and to add that he regards current work in evolutionary psychology to be "mostly worthless" (2002: 496).

[15] "Tender-mindedness" in this respect also calls attention to the trait of "agreeableness" from the Five Factor Model of personality, which is known to be associated with religiousness and with measures of femininity (Saroglou 2002).

some conceptualization of whether social factors are thought to be working by affecting circumstances or by shaping subsequent psychology. Experienced social differences are thought to operate precisely by affecting more immediate psychological causes—this is the fundamental logic of "socialization" explanations (with specific reference to sex differences in religion, see Francis 1997). In other words, socializing experiences are posited to have psychological effects that in turn influence later behavior, and so pitting "psychology" against "socialization" makes it unclear how an analyst believes the later influence of socialization works. Analyses that define earlier measures and likely effects of the outcome as "social factors" and weak and indirect measures of psychology as "non-social factors" can be counted upon to produce results in which the "social factors" prevail, but what exactly been won remains unclear. Ultimately, such work might contribute more to assuaging the chronic insecurities of sociologists than to elaborating our understanding of how psychology, social experiences, and present social circumstances interact dynamically to produce differences among social groups.

Existing work gives ample reason to think that measures attempting to tap "femininity" are central to explaining the sex difference, but theory lags behind in trying to determine precisely what about these measures leads to differential attraction of the more "feminine" to religion. With respect to whatever psychological trait(s) prove important for describing the proximate psychology, Sullins's work provides an extremely important clue for researchers interested in articulating theory that links this psychology to religiousness. He shows that sex differences are larger for "affective" rather than "active" measures of religiosity, and that differences seem especially pronounced for reported frequency of prayer. More importantly, though, we can modify and extend part of Sullins's analyses for the GSS to all ISSP countries. Table 6 compares the bivariate difference in the two measures considered above with the

bivariate difference net of reported frequency of prayer.[16] Overall, the results suggest that sex differences in church attendance and religious self-concept may be entirely explained over these countries by the difference in frequency of prayer.[17] To us, the implication is that the task of explaining the sex difference in various religious measures may be usefully replaced (at least for the time being and for the mostly predominantly Christian countries included in the 1998 ISSP) to a concentration on explaining the observed sex differences in prayer. Despite our inclination toward observable behaviors like service attendance, this finding leads us to urge researchers to think more about developing theories orienting toward explaining the difference in frequency of

[16] While the Philippines had complete data on the relevant variables, the prayer measure for the Philippines seemed to produce anomalous data relative to even other highly religious countries in the ISSP, so it is excluded from the analyses.

[17] Following an analytic strategy with which we disagree, Sullins (forthcoming) suggests his results show that the prayer measure evinces substantial gender bias in self-report, with females apparently overreporting their real frequency of prayer to a greater degree than males. Regardless of the truth of the proposition, we note that the result that prayer resolves the other gender difference in measures suggests that whatever psychology is behind the reporting differences would seem importantly implicated in the other differences as well. In other words, one cannot simultaneously attribute the gender difference in prayer substantially to self-report biases and regard measures of attendance at services as an "objective" measure or at least one not similarly biased, as this would be inconsistent with prayer resolving the gender difference in attendance at services.

prayer.[18] Whether a rational choice perspective will be useful for developing such theories is an open question.

TABLE 6 ABOUT HERE

Analysis of the prayer item in the ISSP makes also plain the limitations of differences in content of belief for understanding sex differences in religiousness, at least within the Christian religious tradition in which prayer is commonly a private, personal act. Table 7 considers how the sex difference in prayer is influenced by beliefs in the existence of God (measured with a six category nominal variable that allows characterization as atheist, agnostic, believing in a "higher power," having wavering beliefs, having some doubts, or having no doubts), beliefs in the veridicality of the Bible (a four category nominal variable in which the Bible is characterized either as the actual word of God, inspired by God, an ancient book of man, or not applying to the respondent). Given the use of questions about the Bible, we look only at predominantly Christian nations (i.e., excluding Japan in addition to Israel) and exclude respondents who report growing up in a non-Christian religious household. Looking down the list, one can see that the degree of attenuation varies and that afterlife beliefs per se contribute relatively little to the

[18] We do not wish to overstate this, as certainly there are findings about gender differences in religion for which we have no empirical reason to believe can be explained by differences in private prayer, and seemingly reason to expect this is not the case. As one notable example, Stark (2002) begins by discussing the difference in the success of new religious movements at recruiting females. In addition, we should emphasize that what we are calling for is not necessarily theories of prayer per se, but theories that recognize that some cause(s) of variation in prayer seems central to understanding of sex differences in a broader set of measures of religiosity.

overall attenuation. On the whole, though, these various belief measures together only account for about a quarter of the sex difference in frequency of prayer. Most of the sex difference, then, is not about differences in basic beliefs about the existence of God, veridicality of the Bible, or existence of an afterlife, but the religiosity of males and females with similar beliefs.

TABLE 7 ABOUT HERE

Risk preference theorists thus seem to have been on the right track in their focus on a psychological characteristic whose relevance is independent of belief formation, even if risk preference itself does not work. As noted, we think a promising avenue of future work is to engage the measures of "femininity" and "masculinity" that have already been shown repeatedly to be very important—indeed, often *sufficient*—for explaining the sex difference in religiosity in select samples. Many scholars have long been skeptical of "masculinity" and "femininity" scales as such, for good reasons (e.g., Pedhazur and Tetenbaum 1979), including the lack of psychological coherence for the individual measures comprising such scales. For our purposes, the labels given to the measures are not important, and ambiguity about the meaning of the scales is precisely what provides the puzzle for analysts. If these scales do in fact resolve observed sex differences in affective religiousness, then we need to understand what it is about what is measured by those scales yield differential religiousness. If one had the primary data from these studies, the obvious next step would be to look at which scale items contributed to resolving the differences and which did not. As things stand, whether the pertinence of masculinity and femininity seem ultimately to turn on "impulsivity," "nonconformity" "aggressiveness" (three constructs raised at varying points by Stark (2002) which would all be best left conceptually distinct) or something else entirely, is a matter for future research. The point worth repeating is that any empirical demonstration that some psychological characteristic(s) resolves the sex

difference in religiosity demands theoretical work toward explaining why the characteristic(s) influences religiosity—work that is separate and likely more tractable than the question of why males and females differ in the characteristic(s) in the first place. The work is more difficult in the present case because the scales of "masculinity" and "femininity" themselves need to be scrutinized to figure out what parts of these scales resolve the differences and how these parts might be usefully conceptualized in genuinely explanatory terms (rather than terms that just reify existing interpretations of "masculinity" and "femininity").

At this point, we think more is to be gained from large-scale survey data that has extensive psychological measures on a single population rather than weak measures on many populations. Cross-population variation in the magnitude of a sex difference in an outcome like religiousness can provide important clues to the intervening (psychological or other) mechanisms, as one might infer why the way the outcome is realized in different societies would make specific factors more important for some populations than others. Miller and Stark (2002) attempted to do this deductively with the afterlife beliefs of different countries and religious groups, but their conclusions from this exercise are not supported when individual-level data on belief are used (Roth and Kroll ms).[19] Whether cross-population variation can be productively used to generate explanations of the sex difference in religiousness that withstand empirical scrutiny remains to be seen. Because religion is so heterogeneous within and across populations, variation in the sex difference does not at all speak to how traits relevant to religiousness in any

[19] Indeed, in this regard, religion provides a site for demonstration of the deeply sociological point that social contexts (in this case the structure, content, and practice of different religious traditions) influences the degree to which psychological difference between persons (however caused) end up being relevant for different domains of their lives.

population are determined. In sum, we think existing evidence suggests much promise for the effort to construct an explanation of the intervening psychology of the observed sex difference in religiousness. At the same time, we believe sociologists ultimately hinder themselves in this effort when they succumb to the illusion that the same data will provide decisive insight into how sex differences in this intervening psychology originates.

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APPENDIX 1. A MORE GENERAL SPECIFICATION OF PASCAL'S WAGER

There are many possible conceptions of God, implying many different mappings from religious behavior to afterlife payoffs. Thus, there are many possible specifications of Pascal's Wager. In the text, we developed a simple version that was chosen in light of existing survey questions on religious belief. Here, we consider a more general version to explore the robustness of our empirical test of the risk preference argument.

Again suppose that an individual can choose to be religious or not religious. In either case, there are four possible contingencies: only heaven exists (probability x'), only hell exists (probability y'), both heaven and hell exist (probability z'), and neither exist (probability $1-x'-y'-z'$).

Suppose that the individual chooses to be religious. If only heaven exists, she receives R with probability t and 0 with probability (1-t). If only hell exists, she receives 0 with probability t and –P with probability (1-t). If both heaven and hell exists, she receives R with probability t and –P with probability (1-t). If neither exists, she receives 0 for sure. Intuitively, t is the

probability that God demonstrates "trustworthiness" by not allowing bad things (a non-rewarded afterlife) to happen to good people (individuals choosing to be religious). Alternatively, assuming that God is not omniscient, t might be interpreted as the probability that God makes a Type I error.

Suppose that the individual chooses not to be religious. If only heaven exists, she receives R with probability m and 0 with probability (1-m). If only hell exists, she receives 0 with probability m and –P with probability (1-m). If both heaven and hell exists, she receives R with probability m and –P with probability (1-m). If neither exists, she receives 0 for sure. Intuitively, m is the probability that God demonstrates "mercifulness" by allowing good things (a non-punished afterlife) to happen to bad people (individuals choosing not to be religious). Alternatively, m might be interpreted as the probability that God makes a Type II error.

Computing the expected utility generated by each action, we obtain

(A1.1) $EU(\text{religious}) = U(-C) + \beta\{x't\,U(R) + y'(1-t)U(-P) + z'[tU(R) + (1-t)U(-P)]\};$

(A1.2) $EU(\text{not religious}) = \beta\{x'm\,U(R) + y'(1-m)U(-P) + z'[mU(R) + (1-m)U(-P)]\}.$

The individual chooses to be religious if

(A1.3) $EU(\text{religious}) \geq EU(\text{not religious})$

which implies

(A1.4) $\beta(t-m)[(x'+z')U(R) - (y'+z')U(-P)] \geq -U(-C).$

Given $x'+z' = x$ (the probability that heaven exists with or without hell) and $y'+z' = y$ (the probability that hell exists with or without heaven), inequality (A1.4) becomes identical to inequality (9) with the exception of the (t-m) term on the left-hand side of (A1.4). Intuitively, this term reveals that the incentive for religious behavior decreases as God's mercy becomes more likely relative to God's trustworthiness. In the special case where t = m, the probabilities of receiving afterlife payoffs are not conditional on the individual's chosen action, so there is no expected net benefit from religious behavior.

Our simpler model implicitly assumed that, conditional upon the existence of heaven or hell, God is definitely trustworthy (t = 1) and definitely not merciful (m = 0). However, our empirical tests of Miller and Stark's argument (summarized in Table 1) would remain valid under the weaker conditions that (t-m) is positive and does not vary by sex. Ideally, given survey questions that probed not merely beliefs about the existence of heaven and hell (assessments of probabilities x and y) but also beliefs about the link from actions to afterlife payoffs (assessments of probabilities t and m), we could control for the latter beliefs in the same manner that we controlled for the former.

APPENDIX 2. AN ALTERNATIVE DERIVATION OF EMPIRICAL PREDICTIONS

To derive probabilistic claims from inequality (8), we assume in the text that the disutility of religiousness $-U(-C)$ is stochastic, given by the random variable ε, with the same distribution of ε for males and females. Here, we make the alternative assumption that the cost of religiousness C is stochastic, given by the random variable ϕ, with the same distribution of ϕ for males and females. In place of equation (12), we now obtain

(A2.1) $\text{pr(religious}|\ g, x, y) = \text{prob}\{\phi \leq -U_g^{-1}(-\beta[xU_g(R) - yU_g(-P)])\}$

where U_g^{-1} denotes the inverse function of U_g. Adopting economic terminology, the term $-U_g^{-1}(-\beta[xU_g(R)-yU_g(-P)])$ is a "certainty equivalent" that converts lottery outcomes into a monetary benefit that be compared directly to monetary costs (see Kreps 1990, p 83). In the case where the individual is risk neutral (so that $U_g(v) = \lambda v$ and $U_g^{-1}(u) = u/\lambda$), this certainty equivalent reduces simply to $\beta[xR+yP]$. The certainty equivalent is lower than $\beta[xR+yP]$ if the individual is risk averse, and higher than $\beta[xR+yP]$ if she is risk loving.

We may now use (A2.1) to compare the probability of religiousness for males and females. Conditioning on the subjective probabilities x and y, religiousness is more likely among males when

(A2.2) $-U_M^{-1}(-\beta[xU_M(R) - yU_M(-P)]) > -U_F^{-1}(-\beta[xU_F(R) - yU_F(-P)]).$

Conversely, religiousness is more likely among females when inequality (A2.2) is reversed so that the female certainty-equivalent exceeds the male certainty-equivalent.

To simplify our analysis, we assume that females are risk averse while males are risk neutral. (Our results extend immediately to the case where males are risk loving, and the analysis could be extended to cover the case where males are risk averse in absolute terms but still relatively less risk averse than females.) Formally, this implies that $U_M(v)$ is linear (i.e., $U_M(v) = \lambda v$) while $U_F(v)$ is concave (i.e., $U_F'(v) > 0$ and $U_F''(v) < 0$ for all v). Following our assumptions in the text, we normalize the utility functions (without loss of generality) so that $U_M(0) = U_F(0) = 0$ and $U_M'(0) = U_F'(0) = \lambda$.

We may now consider the sex differential in religiousness given the four possible combinations of belief in heaven and hell. Given belief in neither heaven nor hell ($x = y = 0$), both certainty equivalents (i.e., both sides of inequality A2.2) become zero. Thus, both males and females would become religious with prob$\{\phi \leq 0\}$ and there would be no sex differential in religiousness. Intuitively, in the absence of afterlife considerations, religious behavior is rational only if it generates this-worldly benefits.

Given belief in heaven but not hell ($x = 1$, $y = 0$), the male certainty-equivalent reduces to βR while the female certainty-equivalent reduces to $-U_F^{-1}(-\beta U_F(R))$. Concavity of the female utility function implies that $U_F(v) < \lambda v$ for all $v \neq 0$ and that $U_F^{-1}(u) > u/\lambda$ for all $u \neq 0$. Hence, given a positive discount factor ($\beta > 0$), we obtain

$$(A2.3) \quad \beta R > \beta U_F(R)/\lambda > -U_F^{-1}(-\beta U_F(R)).$$

Thus, males are more likely than females to become religious. Intuitively, given the concavity of the female utility function, even relatively small costs of religious participation would impose large disutility. Thus, while males are willing to incur costs up to βR, females are not willing to incur costs that high.

Given belief in hell but not heaven ($x = 0$, $y = 1$), the male certainty-equivalent reduces to βP while the female certainty-equivalent reduces to $-U_F^{-1}(\beta U_F(-P))$. Given the concavity of the female utility function, Jensen's inequality implies that

$$(A2.4) \quad (1-\beta)U_F(0) + \beta U_F(-P) < U_F(-\beta P)$$

if the discount factor is bounded so that $0 < \beta < 1$. Given $U_F(0) = 0$, this implies

(A2.5) $-U_F^{-1}(\beta U_F(-P)) > -U_F^{-1}(U_F(-\beta P)) = \beta P.$

Thus, females are willing to incur higher costs than males and are hence more likely to be religious. Note that, if individuals did not discount future payoffs ($\beta = 1$), both certainty-equivalents would reduce simply to P. In this case, both males and females become religious with prob$\{\phi < P\}$and there would be no sex differential in religiousness. From a formal perspective, the discount factor acts like a probability: individuals evaluate the decision problem as though there was a probability β of going to hell conditional on irreligiousness. Hence, even if hell is a certain outcome for the irreligious, risk-averse females have more incentive than risk-neutral males to choose religiousness.

Finally, given belief in both heaven and hell ($x = y = 1$), the male certainty-equivalent reduces to $\beta[R+P]$ while the female certainty-equivalent reduces to $-U_F^{-1}(-\beta[U_F(R)-U_F(-P)])$. Because these terms cannot be ordered unambiguously, the religiousness rate could be higher among either males or females (depending on parameter values). But further analysis reveals that, in many cases, males would be more likely than females to be religious. In the special case with no time discounting ($\beta =1$), the male-certainty equivalent always exceeds the female certainty-equivalent. To see this, note that

(A2.6) $-U_F^{-1}(-[U_F(R-z)-U_F(-P-z)])$

is equal to the female certainty-equivalent when $z = 0$, equal to the male certainty-equivalent when $z = R$, and (differentiating A2.6 with respect to z) monotonically increasing in z (given that $U_F'(-P-z) > U_F'(R-z)$ for any z). Thus, we obtain

(A2.7) $R+P > -U_F^{-1}(-[U_F(R)-U_F(-P)])$

which implies that males are more likely than females to be religious. To consider the more general case ($\beta \leq 1$), define λ' such that $\lambda'[R+P] = U_F(R)-U_F(-P)$. (Graphically, λ' is the slope of the chord connecting the points $\{-P,U_F(-P)\}$ and $\{R,U_F(R)\}$.) The female certainty-equivalent becomes $-U_F^{-1}(-\beta\lambda'[R+P])$ which is less than $(\lambda'/\lambda)\beta[R+P]$. Thus, if $\lambda' < \lambda$, the female certainty-equivalent is less than the male-certainty equivalent (and hence fewer females will be religious) for all β. If $\lambda' > \lambda$, the female certainty-equivalent will exceed the male certainty-equivalent (and hence more females will be religious) given β sufficiently small.

APPENDIX 3. A SIMPLE MODEL OF SELF-SERVING BIAS IN BELIEF FORMATION

Miller and Stark (2002, p 1418) suggest that sex differences in religious beliefs are driven by differential risk preferences. From the perspective of orthodox economic theory, beliefs are not volitional and hence this claim is nonsensical. But drawing upon non-orthodox economic perspectives (Akerlof and Dickens 1982; Akerlof 1989; Montgomery 1994; Rabin 1994), we develop a simple model of biased belief formation in order to determine the empirical implications of the Miller and Stark's suggestion.

Following Akerlof and Dickens (1982), we assume that beliefs are chosen to minimize the cognitive dissonance that occurs following a decision.[20] Assuming that an individual has chosen to be religious, she would thus wish to alter beliefs to increase the difference

[20] See Aronson (1988) for discussion of dissonance as a consequence of decision-making. Developing a related model in which post-decision dissonance alters utility parameters, Montgomery (1994) interprets dissonance reduction as a subconscious phenomenon. Thus, even

(A3.1) $[EU(\text{religious}) - EU(\text{not religious})] = U(-C) + \beta[xU(R) - yU(-P)]$

and hence strengthen the apparent wisdom of her choice. If the individual could simply choose any beliefs x and y (subject to the restriction that x and y are between 0 and 1), she would obviously choose to set x = y = 1 (given that U(R) and –U(–P) are positive). But under the presumption that beliefs are not completely malleable, we might posit a "loss function" capturing the dissonance generated when subjective beliefs diverge from objective beliefs. Formally, suppose that the objective probabilities of heaven and hell (based on a non-biased assessment of available information) are given by x_0 and y_0. Further suppose that the loss function is equal to

(A3.2) $\alpha[(x-x_0)^2 + (y-y_0)^2]$

where x and y are subjective (chosen) beliefs and α is an exogenous parameter. Thus, dissonance costs are proportional to the square of the differences between subjective and objective beliefs. Combining (A3.1) and (A3.2), we now suppose that the individual chooses subjective beliefs to maximize

(A3.3) $[EU(\text{religious}) - EU(\text{not religious})] - \alpha[(x-x_0)^2 + (y-y_0)^2]$

which captures both the dissonance from decision making (inversely related to the first term) and the dissonance from distorted beliefs (directly related to the second term).

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within this non-orthodox perspective, we might continue to assert that beliefs are not (consciously) chosen.

Differentiating (A3.3) with respect to x and y, we obtain the optimal subjective beliefs in heaven (x*) and hell (y*):

(A3.4) $x^* = x_0 + [\beta/(2\alpha)]\, U(R)$;

(A3.5) $y^* = y_0 + [\beta/(2\alpha)]\, [-U(-P)]$.

(We might further add the restriction that x* and y* must remain between 0 and 1, or else assume α is large enough that this constraint is not binding.) Given the ordering of subjective utilities from equation (10) in the text, we obtain the following orderings of subjective probabilities:

(A3.6) $x_M^* > x_F^* > x_0$ and $y_F^* > y_M^* > y_0$.

In words, for individuals who have chosen to be religious, we should expect males to have a stronger belief than females in heaven. Intuitively, given that males place a higher subjective utility on heaven, they have more incentive to distort their belief in heaven, increasing x* further above x_0. Analogously, we should expect females have a stronger belief than males in hell.

Note that our analysis has been conditioned on the choice to be religious. If the individual had instead chosen not to be religious, expression (A3.3) becomes

(A3.7) $[EU(\text{not religious}) - EU(\text{religious})] - \alpha[(x-x_0)^2 + (y-y_0)^2]$,

equations (A2.4) and (A2.5) become

(A3.8) $x^* = x_0 - [\beta/(2\alpha)]\, U(R)$

(A3.9) $y^* = y_0 - [\beta/(2\alpha)]\,[-U(-P)]$,

and (A3.6) becomes

(A3.10) $x_0 > x_F^* > x_M^*$ and $y_0 > y_M^* > y_F^*$.

Intuitively, for individual who have chosen not to be religious, beliefs in heaven and hell are now distorted downward. But again we find distortion of beliefs about heaven greatest among males, and distortion of beliefs about hell greatest among females.

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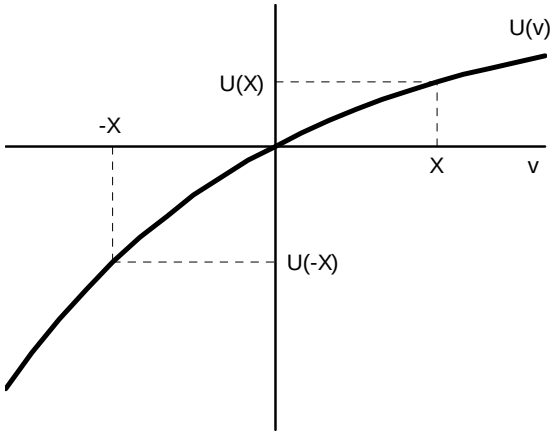
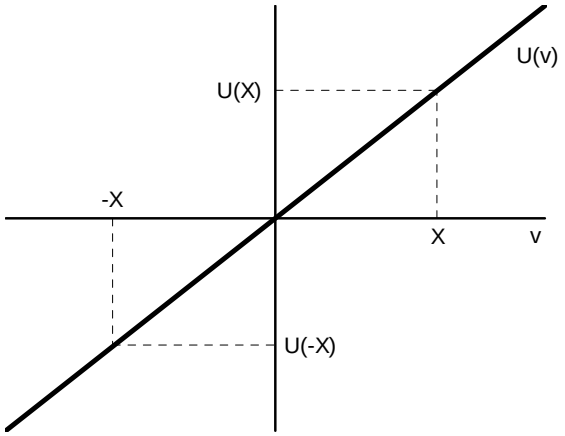
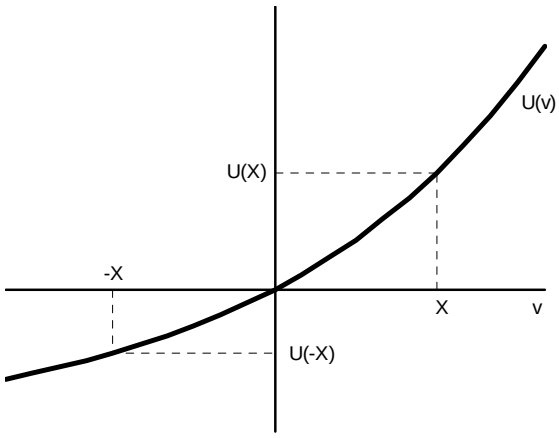
Figure 1. Risk preferences



risk aversion
implies U(X) < –U(–X)

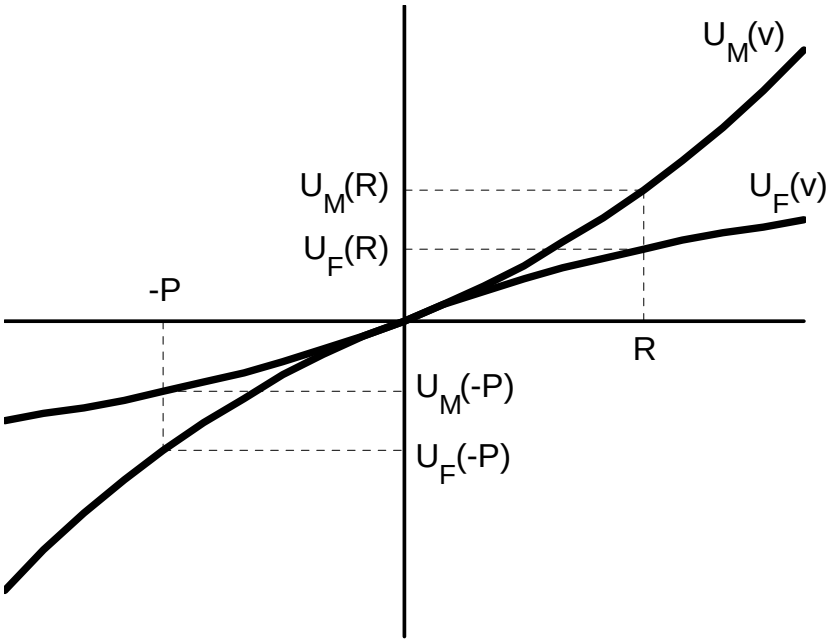


risk neutrality
implies U(X) = –U(–X)



risk loving
implies U(X) > –U(–X)

Figure 2. Differential risk preferences by sex



If males are relatively more risk-loving than females, then

$U_M(R) > U_F(R)$ and $-U_F(-P) > -U_M(-P)$

Table 1. Predicted sex differences in religion derived from alternative specifications of the risk preference theory

Prediction Set A (Sex difference influenced by rewards and punishments)

For those who believe in:	*Predicted sex difference:*
Both heaven and hell [1,1]	Ambiguous; expectedly small
Hell but not heaven [0,1]	Females more religious
Heaven but not hell [1,0]	Males more religious
Neither heaven nor hell [0,0]	No gender difference

Prediction Set B (Sex difference influenced by punishments only)

For those who believe in:	*Predicted sex difference:*
Both heaven and hell [1,1]	Females more religious
Hell but not heaven [0,1]	Females more religious
Heaven but not hell [1,0]	No gender difference
Neither heaven nor hell [0,0]	No gender difference

Prediction Set C (Sex influenced by punishment and non-afterlife considerations)

Both heaven and hell [1,1]	Females more religious: larger difference
Hell but not heaven [1,0]	Females more religious: larger difference
Heaven but not hell [0,1]	Females more religious: smaller difference
Neither heaven nor hell [0,0]	Females more religious: smaller difference

Table 2. Summary of sex differences in religiosity, 1998 ISSP and 1990 & 1995 WVS samples

	1998 ISSP				1990 & 95 World Values Survey			
	Regard self as religious person		Attendance at religious services		Importance of religion in life		Attendance at religious services	
Which gender is more religious?	Females	Males	Females	Males	Females	Males	Females	Males
Overall	24	0	24	0	47	1	48	0
	(100)	(0)	(100)	(0)	(98)	(2)	(100)	(0)
# sig ($p < .05$)	22	0	20	0	47	0	43	0
	(92)	(0)	(83)	(0)	(98)	(0)	(89)	(0)
Believes in heaven and hell	18	6	18	6	47	1	42	6
	(75)	(25)	(75)	(25)	(98)	(2)	(88)	
# sig ($p < .05$)	8	0	6	0	35	1	31	0
	(33)	(0)	(25)	(0)	(73)	(2)	(65)	(0)
Believes in neither	23	1	22	2	47	1	47	1
	(96)	(4)	(96)	(8)	(98)	(2)	(98)	(2)
# sig ($p < .05$)	15	0	14	0	34	0	38	0
	(63)	(0)	(58)	(0)	(71)	(0)	(79)	(0)
Believes in heaven, not hell	12	12	14	10	43	5	41	7
	(50)	(50)	(58)	(42)	(89)	(10)	(85)	(15)
# sig ($p < .05$)	2	0	5	1	21	1	19	1
	(8)	(0)	(21)	(4)	(44)	(2)	(40)	(2)
Is gender difference smaller among nonbelievers in hell?	Yes	No	Yes	No	Yes	No	Yes	No
All	19	5	17	6	34	14	34	14
	(79)	(21)	(74)	(26)	(71)	(29)	(71)	(29)
# sig ($p < .05$)	0	0	0	0	10	1	10	1
	(0)	(0)	(0)	(0)	(21)	(2)	(21)	(2)

Table 3. Bivariate ordered probit for importance of religion in one's life by belief in hell, combined 1990-1995 World Values Survey

	% belief in hell	Believes in hell	Does not believe in hell	Difference	N
Nigeria	73.5	.438	.470*	-.032	3616
USA	73.2	.395***	.315***	.080	3053
Puerto Rico	72.7	.356	.399*	-.043	1089
Peru	64.2	.617*	.317**	.300*	1066
South Africa	63.6	.514***	.240***	.274***	4959
Lithuania	59.1	.182*	.509*	-.327	673
Georgia	56.5	.202***	.273***	-.071	2137
Poland	55.4	.263	.043	.219	462
Venezuela	55.1	.331**	.242**	.089	1101
Mexico	53.7	.229***	.220***	.009	2683
Ireland	53.6	.318**	.246*	.072	924
Chile	49.2	.500***	.287***	.214*	2348
India	46.1	.130***	.051***	.079	4187
Moldova	45.4	.164**	.244	-.080	735
Argentina	45.1	.408***	.387***	.022	1896
Romania	43.3	.433**	.140*	.292*	922
Brazil	42.9	.347***	.208***	.138	2806
Croatia	42.5	.090**	.334*	-.245	1037
Canada	42.2	.387***	.325**	.062	1550
Australia	42.1	.350***	.191***	.159	1837
Andalusia	42.0	.624***	.630**	-.007	1538
Italy	41.0	.405***	.251*	.154	1634
Colombia	40.5	.452***	.206***	.246**	2904
Armenia	36.4	.222***	.561**	-.338**	1520
Finland	34.9	.393***	.305*	.088	1216
Spain	32.0	.445***	.440***	.005	4425
Belarus	30.9	.292***	.350**	-.058	2252
Great Britain	30.1	.621***	.185*	.437**	1275
Portugal	29.2	.387**	.801	-.414	955
Japan	27.8	.281**	.040	.241	1134
Galicia	26.9	.439***	.279	.160	1036
Uruguay	24.8	.460**	.066	.394*	923
Basque	24.3	.377***	.296*	.081	1819
Switzerland	23.9	.477***	.188**	.290*	2133
Russia	23.7	.454***	.347**	.107	2906
Slovenia	22.2	.182***	.374*	-.192	1682
Austria	21.5	.291***	.392	-.101	1131
Norway	20.1	.451***	.409*	.041	2112
Bulgaria	17.8	.339***	.315	.024	1571
France	17.7	.078***	.404	-.327	881
Belgium	16.9	.286***	.173*	.113	2420
Hungary	16.6	.342***	.492	-.149	877
West Germany	16.5	.428***	.353*	.075	2528
Netherlands	15.2	.142*	-.503	.645*	889
Iceland	13.0	.327**	.739	-.412	607
Sweden	10.4	.559***	.116	.442*	1696
Denmark	8.1	.461***	.221	.240	919
East Germany	7.7	.218***	.183	.035	2134

* $p < .05$, ** $p < .01$, $p < .001$. Listwise deletion for missing data.

Table 4. Predicted sex differences in risk assessment

	Religious	Non-religious
Prediction Set D		
$\frac{\Pr(heaven, hell)}{\Pr(heaven, \sim hell)}$	Greater for females	Greater for males
$\frac{\Pr(heaven, \sim hell)}{\Pr(\sim heaven, \sim hell)}$	Greater for males	Greater for females
Prediction Set E		
$\frac{\Pr(heaven, hell)}{\Pr(heaven, \sim hell)}$	Relative odds for females increases as religiosity increases	
$\frac{\Pr(heaven, \sim hell)}{\Pr(\sim heaven, \sim hell)}$	Relative odds for males increases as religiosity increases	

Table 5. Coefficients from Multinomial Logit Model for Interaction of Sex and Participation in Religious Services, 1998 ISSP

	Believes in Heaven and Hell			Believes in neither Heaven nor Hell			
	female	attendance	female × attendance	female	attendance	female × attendance	N
West Germany	-.186	.240	.076	-.650	-.481***	.170	851
East Germany	.312	.370**	-.032	.090	-.433***	-.466*	872
Great Britain	-.278	.177	-.044	-.993**	-.384**	.167	568
Northern Ireland	.201	.099	-.025	-.024*	-.679***	.321	640
USA	.680*	.278***	-.301**	-.183	-.476***	-.050	1104
Austria	-.020	.265*	-.036	-.336	-.334**	.065	823
Hungary	.058	.150	.007	-.994*	-.664***	.201	976
Italy	-.901	.078	.139	-.360**	-.522***	.182	861
Ireland	-.456	.033	.138	-.337	-.518***	-.124	904
Netherlands	-.193	.239***	.042	-.713***	-.591***	.236**	1561
Norway	-.122***	.265**	.392**	-.312***	-.137***	.282	1123
Sweden	-.304	.402**	-.034	-.953**	-.685***	.047	918
Czech Republic	.201	.340*	.032	-.929*	-.838***	.412*	1124
Poland	.285	.368**	-.373*	.674	-.386**	-.269	860
New Zealand	-.421	.411***	-.063	-.016***	-.588***	.149	828
Canada	-.380	.174*	-.091	-.195***	-.467***	-.006	667
Japan	.450	.136	-.246	-.073	.040	-.265	894
Spain	.182	.149**	-.074	-.473*	-.408***	.000	2070
Slovak Republic	-.656	.362***	.116	-.610	-.696***	.089	1139
France	-.319	.028	.119	-.948**	-.036***	.301	928
Portugal	-.373	.132	-.028	-.971*	-.548***	.124	1129
Chile	-.331	-.030	.117	-.392	-.340***	.003	1421
Denmark	-.331***	.221	.244	-.236***	-.454***	.250	1022
Switzerland	-.324*	-.067	.259	-.005***	-.351***	.326**	817

* $p < .05$, ** $p < .01$, *** $p < .001$. Listwise deletion for missing data.

Table 6. Ordered probit coefficients for sex difference in religiosity with and without controls for frequency of prayer, 1998 ISSP

	Regards self as religious person			Attendance at religious services			
Country	bivariate	adding prayer	% decrease	bivariate	adding prayer	% decrease	N
West Germany	.276***	.029	89.5	.273***	.073	73.2	967
East Germany	.294***	.025	91.4	.212*	-.190	189.8	955
Great Britain	.383***	-.013	103.3	.423***	.050	88.1	676
Northern Ireland	.183*	-.061	133.0	.175*	-.031	117.8	731
USA	.278***	-.033	111.9	.242***	-.033	113.7	1186
Austria	.379***	.020	94.9	.264***	-.085	132.3	968
Hungary	.415***	-.259***	162.5	.352***	-.347***	198.6	993
Italy	.350***	-.035	109.9	.289***	-.135	146.7	996
Ireland	.341***	.153*	55.2	.192*	-.070	136.5	966
Netherlands	.203***	.037	81.6	.121*	-.056	146.2	1841
Norway	.286***	.011	96.1	.193***	-.060	131.3	1447
Sweden	.257***	.044	82.8	.320***	.158*	50.8	1086
Czech Republic	.249***	.006	97.5	.200**	-.055	127.6	1136
Poland	.348***	-.035	110.0	.443***	.089	79.9	1089
New Zealand	.297***	-.038	112.8	.246***	-.102	141.6	922
Canada	.229**	-.060	126.3	.130	-.213*	263.1	743
Japan	.121*	-.042	134.8	.079	-.086	208.4	1243
Spain	.545***	.128**	76.5	.531***	.092	82.6	2325
Slovak Rep	.408***	.023	94.4	.430***	-.002	100.6	1277
France	.083	-.128	254.0	.064	-.176*	376.1	1062
Portugal	.327***	-.111	133.9	.502***	-.077	115.4	1184
Chile	.320***	.033	89.8	.418***	.107	74.4	1471
Denmark	.278***	.048	82.6	.176**	-.009	105.1	1037
Switzerland	.133*	-.182**	236.4	.177*	.071	59.7	980
Combined	.274***	-.010	103.8	.245***	-.053***	108.8	27281

* $p < .05$, ** $p < .01$, *** $p < .001$. Models use listwise deletion on sex, prayer, or either dependent variable.

Table 7. Attenuation of sex difference in prayer by measures of religious belief, predominantly Christian nations in 1998 ISSP

Country	bivariate	adding beliefs about God and Bible	adding afterlife beliefs	% attenuation	N
West Germany	.379***	.167*	.168*	55.7	731
East Germany	.382***	.426***	.422***	-10.5	719
Great Britain	.554***	.416***	.344***	38.0	546
Northern Ireland	.387***	.173	.161	58.4	575
USA	.490***	.389***	.380***	22.6	957
Austria	.532***	.421***	.395***	25.7	729
Hungary	.813***	.728***	.748***	7.9	924
Italy	.650***	.565***	.541***	16.8	741
Ireland	.412***	.240**	.193*	53.3	803
Netherlands	.220***	.121	.055	75.0	1381
Norway	.389***	.195*	.143	63.2	959
Sweden	.398***	.247**	.183*	54.0	834
Czech Republic	.409***	.398***	.326***	20.2	965
Poland	.683***	.502***	.524***	23.2	696
New Zealand	.371***	.312***	.248**	33.2	752
Canada	.387***	.337***	.204*	47.3	531
Spain	.704***	.500***	.484***	31.2	1835
Slovak Rep	.543***	.393***	.411***	24.2	1072
France	.164*	.224**	.150	8.4	817
Portugal	.748***	.721***	.679***	9.3	1055
Chile	.608***	.562***	.537***	11.8	1363
Denmark	.358***	.246**	.229**	36.1	946
Switzerland	.469***	.539***	.438***	6.7	804
Combined	.437***	.349***	.3219***	26.4	21384

* $p < .05$, ** $p < .01$, *** $p < .001$. Listwise deletion for missing data.