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**Government Support for Science in an Era of Resource Constraint:  
Exploring the Role of Religion**

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**Government Support for Science in an Era of Resource Constraint:  
Exploring the Role of Religion**

by

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**Thesis**

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In recent years, much has been made in popular media of the purported conflict between religion and science. The goal of this study is to examine the relationship between multiple measures of religion and attitudes toward federal expenditures on science. This study uses data from the 2008 wave of the General Social Survey, a national probability sample of American adults. Using multinomial analysis, this study finds that biblical literalists are generally less likely to wish for the expansion of federal spending on science than others. This opposition to the expansion of federal spending on science was uninfluenced by more general attitudes toward science or distrust of either the government or social institutes. Denominational affiliation and frequency of church attendance were unrelated to views on federal scientific expenditures. Contrary to previous depictions, the relationship between religious belief and attitudes toward science is not inherently adversarial. Implications of these findings and directions for future research are discussed.

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## **INTRODUCTION**

In 1950 President Harry Truman declared that scientific advisors were crucial in forming and directing presidential policy and set about making scientific knowledge the basis for all policy decisions. When his second term ended, Eisenhower entered the presidential office and supporters claimed that he would bring in the most scientific presidency to date (The Science Newsletter 1952). Since Truman's decision, presidents and presidential hopefuls have repeatedly affirmed the belief that science and technology are crucial to the future of America (Lawler 2004a, Lawler 2004b). Presidents have increased the roles of scientific advisors in nearly all areas of federal bureaucracy, from the Department of Defense, to transportation, to education, and economics (Bronk 1974). In addition to integrating scientific advisors in existent departments, the Office of Scientific and Technological Policy was founded, as were the National Science Foundation, the National Science Board, and a host of other organizations supporting academic scientific research and the adoption of technological advancements in industry. In 1972, President Nixon gave the first Presidential Address on Science and Technology, placing science in the same category as international relations, domestic policy, and budgetary issues. This decades-long expansion of scientific investment by presidents indicates the great political popularity of science as a basis for government decision-making among American voters.

Increased emphasis on the role of the federal government in supporting scientific development in the United States began in the same era as the Cold War. During that period of heightened competition for superior international positions, scientific and

technological supremacy became a marker of international dominance. This scientific battle most notably focused on military advancement and space exploration, but also involved oil technologies, agricultural production, and countless other fields of research. Akera (2006) directly ties the rise of modern computing in America to the events of the Cold War. The Space Race, although ultimately won by the USSR with Sputnik, spurred American interest in and expenditures on scientific advancement and cemented the perception that scientific advancement and national security were intrinsically linked.

Even when the “Culture Wars” had arguably reached their peak during the 2004 presidential race between George W. Bush and John Kerry, both candidates affirmed a commitment to expanding scientific spending, though they argued about the direction of resource allocation and proper regulation of areas of scientific research (Bush and Kerry 2004). This unity in endorsing continual expansion of scientific spending among candidates who are emblematic of perceived national divisions, reaffirms the notion that American culture has become increasingly defined by its commitment to ideas of science and scientific progress. Indeed, scientific literacy has been deemed by many to be a crucial element of good citizenship (Lee and Roth 2003).

American presidents and presidential candidates have echoed the sentiments of many in government and many American citizens when they equate scientific development with economic stability, increased health, environmental protection, and national security. President Obama made an emphasis on scientific reason and policies founded in science a keystone message of his presidential campaign. In a science policy paper during his campaign, he called for a “new era of scientific innovation” and said he

wished to double federal spending on science (Barras 2008). An even greater commitment to science as the basis for policy-making became one way in which he defined himself in contrast with the previous administration (Barras 2008).

America is not alone in linking scientific progress with economic growth and national security. The governments of developed European countries and of the European Union have followed a similar trajectory of increased emphasis on science and spending in support of scientific research. The European Science Foundation, established in 1974, works to coordinate the efforts of scientific research institutions in its member countries and to influence government policies dealing with scientific issues. While the ESF works to coordinate research, the European Research Council is a cross-national European body devoted to funding scientific research and emphasizing progress in all scientific fields.<sup>i</sup> Finally the European union itself, in addition to focusing on economics and social issues, has committed monies to funding scientific progress, in the hopes of improving the stability of member nations and the well-being of their populations.

In developing countries increased scientific expenditures have been treated as a benchmark of progress and increased stability. The Science and Development Network is a not-for-profit organization devoted solely to tracking and providing information on scientific issues and policies in the developing world. That organization shares the same beliefs as the American government that scientific progress can “reduce poverty, improve health, and raise standards of living around the world.”<sup>ii</sup> Thus it becomes clear that there is a cross-national commitment to the concept of science as a solution to all modern problems, however such problems may be defined.

Despite widespread stated support for scientific spending by politicians and most of the general public within the U.S., there is still a trend toward anti-scientific beliefs. Some of this is driven by institutions and cultures, which reject prevailing scientific teachings on evolution and human origins, the laws of physics, the nature of the environment, and many other important domains. This rejection might take the form of overt disavowal of scientific methods, understandings, or professionals. It might also involve the distortion or misuse of scientific fact to support a particular world-view.

Antiscientific thinking is common in New Age and Pagan self-help literature as well. For example, some New Age self-help books argue that the power of ‘want’ or ‘will’ can serve to alter reality such that the individual engaged in willful thinking will achieve heretofore impossible goals. The most recent example of such works is the extraordinarily popular book The Secret, a New York Times Bestseller, which argued that positive thinkers magnetically attract wealth and are destined to experience perfect health and longevity (Byrne 2006). Byrne also claimed that negative thoughts are responsible for poverty, poor health, and natural disasters. These claims contradict the findings of social scientific, biological, and environmental scientific knowledge, but are extremely popular among American readers, who purchased millions of copies of this work and supported a subsequent movie. <sup>iii</sup>

Not only does anti-scientific belief persist in American culture despite the popularity of science, but the American education system itself is less successful at instilling scientific knowledge and skills in students than the education systems of other nations. The National Center for Education Statistics tracks the performance of American



students in multiple subjects and compares their skills to those of students in other nations. They use two sources to track different facets of students' achievement in science; the Trends in International Mathematics and Scientific Study (TIMSS) and the Program for International Student Assessment (PISA). TIMSS strictly tracks students' familiarity with scientific concepts they should be exposed to in schools, while PISA tracks students' abilities to apply that knowledge to various situations encountered in every day life. The two studies also measure students at different points in their education, with TIMSS testing students between 4<sup>th</sup> and 8<sup>th</sup> grade and PISA focusing primarily on 15-year-olds.<sup>iv</sup> While American students failed to outperform students of other nations in either survey, their scores on the TIMSS assessment of education generally compared better to students of other nations than their scores on the PISA. Figure A shows the TIMSS scores of US students and students of other developed nations.<sup>v</sup> In grades 4 and 8 U.S. students did better than the international average, but consistently below many other developed nations. They also experienced a sharper decrease in performance relative to other nations by the time they'd reached 8<sup>th</sup> grade, suggesting the possibility of a widening gap between the U.S. and other developed countries over time.<sup>vi</sup>

Moreover, while U.S. students did relatively well when compared to students in other nations in the acquisition of scientific knowledge, they performed below the international average in their ability to apply scientific knowledge and skills to real-world situations. Figure B shows U.S. achievement scores relative to other developed nations.<sup>vii</sup> U.S. students ranked 19<sup>th</sup> of the 29 Organization for Economic Cooperation and

Development (OECD) countries for which data was available and 22<sup>nd</sup> of the 39 countries that participated in the study. This serves to illustrate the dual nature of Americans' experiences with science. Politically and socially, Americans are highly supportive of science and scientific funding, but they often lack the ability to apply scientific knowledge or principles to their daily lives.

**Figure A. Average TIMSS science scores of 4th- and 8th-graders, by country: 2003**

Grade 4		Grade 8	
Country	Average Score	Country	Average Score
International Average	489	International Average 5	473
Singapore	565	Singapore	578
Chinese Taipei	551	Chinese Taipei	571
Japan	543	Korea, Republic	558
Hong Kong SAR <sup>1,2</sup>	542	Hong Kong SAR 1,2	556
England 2	540	Estonia	552
<b>United States 2</b>	<b>536</b>	Japan	552
Latvia	532	Hungary 3	543
Hungary 3	530	Netherlands 2	536
Russian Federation 3	526	<b>United States 5</b>	<b>527</b>
Netherlands 2	525	Australia	527
Australia 2	521	Sweden	524
New Zealand	520	Slovenia	520
Belgium-Flemish 3	518	New Zealand	520
Italy	516	Lithuania 4	519
Lithuania 4	512	Slovak Republic	517
Scotland 2	502	Belgium-Flemish	516
Moldova, Republic of	496	Russian Federation	514
Slovenia	490	Latvia	512
Cyprus	480	Scotland 2	512
Norway	466	Malaysia	510
Armenia	437	Norway	494
Iran, Islamic Republic of 3	414	Italy	491
Philippines	332	Israel 3	488
Tunisia	314	Bulgaria	479
Morocco	304	Jordan	475
		Moldova, Republic Of	472
		Romania	470
		Serbia 4	468
		Armenia	461
		Iran, Islamic Republic of	453
		Macedonia, Republic of	449
		Cyprus	441
		Bahrain	438
		Palestinian National Authority	435
		Egypt	421
		Indonesia 4	420
		Chile	413
		Tunisia	404
		Saudia Arabia	398
		Morocco 4,5	396
		Lebanon	393
		Philippines	377
		Botswana	365
		Ghana	255
		South Africa	244
		Average is higher than U.S. Average	
		Average is not different than U.S. Average	
		Average is lower than U.S. Average	

1 Hong Kong is a Special Administrative region (SAR) of The People's Republic of China

2 Met International Guidelines for replacement rates only after replacementschools were included

3 National defined population covers less than 95 percent of desired po

**Figure B. Average PISA science literacy scores of 15 year olds, by country; 2003**

Country	Average Score	Country	Average Score
OECD average	500	<b>Non-OECD countries</b>	
<b>OECD countries</b>			
Finland	548	Hong Kong-China	540
Japan	548	Liechtenstein	525
Korea, Republic of	538	Macao-China	525
Australia	525	Russian Federation	489
Netherlands	524	Latvia	489
Czech Republic	523	Uruguay	438
New Zealand	521	Serbia and Montenegro	436
Canada	519	Thailand	429
Switzerland	513	Indonesia	395
France	511	Tunisia	385
Belgium	509		
Sweden	506	Average is significantly higher than U.S. Average	
Ireland	505	Average is not significantly different from U.S. Average	
Hungary	503	Average is significantly lower than U.S. Average	
Germany	502		
Poland	498		
Slovak Republic	495		
Iceland	495		
United States	491		
Austria	491		
Spain	487		
Italy	487		
Norway	484		
Luxembourg	483		
Greece	481		
Denmark	475		
Portugal	468		
Turkey	434		
Mexico	405		

Note: The test for significance between the U.S. and the Organization for Economic Cooperation and Development (OECD) average was adjusted to account for the contribution of the U.S. average to the OECD average. Because PISA is principally an OECD study, t

The relationship of Americans with science, then, is far from straightforward. Support of science is popular in political rhetoric where it has been viewed as a solution to a host of American ills. Politically, science has been regarded as a means of maintaining a superior economic, political, or defensive position over the rest of the world or even a method of increasing equality within the nation. President Obama’s campaign and presidential address are emblematic of this American belief in science as the solution to all modern problems (Stolberg 2009, Nurse 2008, Duncan 2008). In contrast to the political popularity of science, the performance of American students in

sciences is at or behind international averages (National Center for Education Statistics Report on 2006 Education Standings). Additionally, religion and science in America have been frequently depicted in popular media as vehement opponents (Ecklund 2010a). Given the complex and seemingly contradictory nature of American attitudes toward and understanding of science, it is worthwhile to ask what factors shape attitudes toward federal spending on science in America.

My study seeks to evaluate and explain the ways that religious denominations and belief in biblical literalism impact attitudes toward federal scientific expenditures. I will examine several possible reasons that religious belief commitments might affect attitudes toward science. I will also posit and evaluate several potential intervening mechanisms such as knowledge of science, political values, and individual distrust of scientific, political, or social institutions, and individual level of scientific understanding, that could explain the relationship between religious belief and attitudes toward federal scientific spending. Using the results of these analyses, I will suggest potential reasons for the relationship between religious conservatism and opposition to science. Finally, I will suggest directions for future research into this complex inter-relationship.

## **BACKGROUND INFORMATION**

### **Biblical Literalism and Attitudes toward Science**

Concurrent with a rise in support for scientific investment was a growing belief that religion and science were inextricably and powerfully in conflict. In 1940, Albert Einstein penned an opinion piece in which he posited that ideas of a personal god and a belief in the Bible as literal truth directly conflicted with, and were inferior to, science. On the other hand, he argued, provided that individuals used science only to ascertain facts and religion to make moral evaluations about those facts, “conflict between them appears impossible”<sup>viiiix</sup>. His focus on biblical literalism and particular types of Christian doctrine as the source of conflict is one that is reflected in much of modern media and academic depictions of these issues. Academic studies on religion and science have focused on a few specific instances of conflict as evidence of perceived irreconcilable differences between scientific and Christian religious communities.

In order to evaluate these apparent areas of conflict between science and biblical literalism, it is first necessary to examine what is commonly meant by biblical literalism. Biblical literalism, as generally defined, and questioned in the GSS, is the belief that the Bible is the “literal word of God” rather than written or determined by man. While it has often been treated as a simple, straightforward definition, several works have revealed that the definitions of biblical literalism and biblical inerrancy are actually quite complex. For individual readers, there is evidence that understanding of biblical writings is based largely on the context and interpretive understanding of the readers (Bartkowski 1996, Woodberry and Smith 1998). For communities deeply invested in biblical literalism,

which elements of the Bible are highlighted for common discourse and which are treated as background is subject to great variation (Boone 1989). Indeed, even the direction of interpretations, from individual members to denominational doctrine or from religious leaders to individuals, is subject to debate.

Literalism and religious conservatism rather than describing a clear set of beliefs and understandings might more accurately be treated as a marker of commitment to a particular religious community. Allegiances to specific pastors may bring with them specific attendant belief commitments. Particular values of religious leadership can also shape literalist belief commitments. In addition, many denominations have their origins in fundamental differences of biblical interpretations. All these contribute to important variations in how particular individuals or religious groups define biblical literalism. Hempel and Bartkowski (2008) addressed such potential variations across religiously conservative groups in an analysis of current measures of conservatism. While they found that there was little variation in understanding of religious group conceptual frameworks across individuals of different ages, races, genders, or regional location, they reaffirmed the importance of understanding and analyzing religious conservatism as a host of various belief commitments dealing with views of scripture, salvation, and sinfulness.

Because of the complex and layered nature of biblical literalism, perceived challenges to literalist beliefs, like those presented by science above, become challenges not just to ideological views and belief commitments but to the very basis of group identity. Two areas where science directly conflicts with literalist belief that have become prominent features in media depictions of religion are based around explanations for the

origins of life and the age of the earth itself. However, the relative importance that particular literalist communities place on either of these areas of conflict might vary significantly. As consequence it is necessary to look past specific examples of doctrine and into larger areas of philosophical disagreement.

A more central philosophical source of conflict might be in understandings of and attitudes toward life. Conservative Christians are likely to hold strongly to the view that life is sacred and can be given only by God. They will be more likely to view technological and scientific advances related to issues of life as a violation of God's domain. This violation is likely to be particularly troublesome to them as they believe humans to be innately sinful and would be leery of the potential for human perversion and abuse of such technologies. As consequence they would view issues like abortion, reproductive genetics, and cloning as a gross violation of God's will and an opportunity for man's innate sinfulness to cause extraordinary damage.

In separate articles analyzing these areas of conflict, Evans and others have found that religious conservatism and higher rates of attendance were associated with more negative attitudes toward abortion, cloning, and work using reproductive genetics (Evans 2002a, Evans and Hudson 2007, Evans 2002b). Such opposition has been largely the reason for protests against abortion and stem-cell research in recent years but could easily be seen as more generally applying to multiple fields of scientific endeavor in which the power of human beings over their environment is increased, allowing for even greater violations of God's will. This leads to the first two hypotheses:



**H1:** Biblical Literalists will be more opposed to federal spending on science than non-literalists.

**H2:** Biblical Literalists will hold more negative attitudes toward science than non-literalists. These attitudes will mediate the link between biblical literalism and federal spending on science.

Beyond those areas of conflict between faith and science centered on attitudes toward life, biblical literalists might have an additional reason for opposing federal expenditures on science. Biblical literalists tend to regard humans as innately flawed because of their vulnerability to sin (Ellison and Musick 1995). They often see modern social problems as the consequence of human flaws and the inescapability of sinfulness. Literalists would then be concerned about the entirety of humanistic efforts to perfect or improve human life in defiance of God's will. These attempts, they would argue, would be tainted by human sinfulness in the form of abuses of power over others, violence, and the pursuit of selfish ends. They might also regard suffering as an important consequence of man's sinfulness as ordained by God and see humanistic advances as an attempt to circumvent divine law.

In addition to concerns about scientific research, literalists might also be more concerned about technological expansions that result from scientific progress. They might be more likely to view such expansions as challenging to their particular traditional or moral belief commitments. For example, the development of the internet has opened

access for children to a variety of pornographic or otherwise upsetting materials. Likewise developments in contraceptive methods have met with similar moral outrage. Thus literalists and other religious conservatives would oppose federal expenditures which might increase the power of science to challenge their particular set of values. This leads to an additional hypothesis:

**H3:** Biblical Literalists are more distrustful of the scientific community than others. This distrust will mediate the link between biblical literalism and federal scientific spending.

Literalists might be particularly concerned that scientific research and technological advancement will result in criticisms directed toward traditional religious attitudes and religious teachings. They might fear that such criticisms would undermine their religious communities and result in a loss of adherents. For instance, they could anticipate conflict between scientific and religious approaches to ascertaining truth. Many forms of Protestant religiosity, particularly literalist religiosity, treat the Bible as the final authority on all subjects. They also could tend to regard conflicts between Biblical truth and science as tests of faith. It was this line of reasoning that Einstein(1940) saw as conflicting with science. As he pointed out, the scientific method at the core of scientific research requires that information be replicable by others before it can be accepted as true. This idea that all truth must be proven by replication leaves little room for the presence of a divine will to order and affect events in the world. It also fails to allow for

the idea of unknowable divine truths that by definition cannot be grasped or explained by the works of men. These differences might seem initially esoteric, but can have a profound effect on approaches to education, and the perception of a gulf between religion and science.

Scientific education endorsed and required by government organizations can directly conflict with religious teachings and thus jeopardize intergenerational transmission of religion. Children who receive state-mandated training in science might increasingly come to doubt the claims of their parents or co-religionists. This concern is embodied in the frequent textbook controversies that have repeatedly been the focus of media attention (Sherman 1988). As consequence, biblical literalists and religious conservatives might fear that federal or national commitment to science would erode the congregational bases of biblical literalists.

Beyond larger ideological fears, biblical literalists and conservative Christians might have generally less scientific knowledge and education to rely on in making assessments of the dangers or goals of science. Numerous studies have demonstrated an inverse relationship between religiosity and academic performance. Religious fundamentalism, often defined by a commitment to biblical literalism, has been inversely linked to individuals' and their children's educational attainment overall (Beyerlein 2004, Darnell and Sherkat 1997, Sherkat and Darnell 1999). Sherkat (2010) found that while higher rates of religious service attendance were associated with a small increase in performance on verbal ability measures, both belief in biblical inerrancy and affiliation with conservative Protestant denominations were associated with poor verbal test

performance. On the other hand, for those youth defined as ‘at-risk’ religious affiliation and rates of religious service attendance appear to have a buffering effect, encouraging education completion. (Rengerus and Elder 2003). Indeed, multiple studies have shown positive educational outcomes associated with higher levels of commitment to religion or particular forms of religiosity (Regnerus 2009, Muller and Ellison 2001, Sikkink 2009). Research, then, suggests that while higher rates of religious involvement are positively linked with student academic achievement, particularly for ‘at-risk’ youth, conservative Protestantism and a belief in biblical literalism, are associated with negative long-term educational outcomes. The specific mechanisms through which religion influences educational outcomes may be somewhat unclear, but the strong nature of the relationship is evident across these and other studies.

While there is some evidence of poorer academic performance among religious individuals, there is an indication that for those religious conservatives who do pursue higher education, science remains a popular choice. While academics in both natural and social sciences have relatively low levels of religiosity when compared to the general public, when they are compared to other academics they are among the more religious (Ecklund 2010b). Thus while there is compelling evidence that overall religiously fundamentalist individuals are less educated about science than others, for those religious individuals who do pursue higher education there is little evidence to indicate a negative impact on their attitudes toward science.

Despite this evidence of Christianity in higher levels of education, conservative Christianity and academic science remain in apparent conflict. This conflict might come

from two sources: conservative distrust of elite institutions and conservative opposition to the values instilled by such institutions. Conservative religious groups have been demonstrated to hold generally more hostile attitudes toward organized, secular education (Darnell and Sherkat, 1997; Deckman, 2002; Deckman, 2001; Sherkat and Darnell, 1999). Other studies have shown that some conservative religious groups, particularly those devoted to doctrine, routinely organize in opposition to public education institutions (Sikkink and Hill, 2005). Higher education institutions and scientific communities are both often perceived by religious conservatives as hostile to their values; with some cause. They see such institutions as striving to replace Judeo-Christian religious and social ethics with secular humanist values. They are also opposed to public forms of education because they believe that public and elite education in its current form requires that students engage in the sin of pride through promotion of self-love and they also believe that education institutes serve to promote particular humanist, or liberal values regarded as antithetical to the values of the religious group (Hood et al., 2005; Darnell and Sherkat, 1997; Deckman, 2004; Sherkat and Darnell, 1999; Sikkink, 1999; Sikkink and Hill, 2005 ). Federal funding which would offer the opportunity to expand such elite intuitions would then be opposed by religious conservatives as promoting both sinfulness and a rejection of particular sorts of religious belief.

Biblical literalists and conservative Christians might also be more likely to have their attitudes toward science shaped by fellow congregants than members of other social groups as consequence of the nature of group social capital. Putnam (2000), in his discussion of social capital, carefully distinguished between bonding social capital, which

occurred in insular groups with few social connections to the larger world, and bridging social capital which allowed individuals to access and interact meaningfully with larger networks with members of different groups and backgrounds. Researchers have found that evangelical religious groups tended to engage primarily in bonding social capital, unlike members of other religious groups or non-religious individuals (Putnam 2000, Beyerlein and Hipp 2005). Beyerlein and Hipp (2005) found that this focus on bonding social capital often narrowed the power and scope of evangelical groups and could negatively impact their ability to solve community problems. This focus on bonding social capital among evangelicals and biblical literalist religious groups can reinforce group beliefs and attitudes toward science, limiting access to the scientific community and opportunities to interact with scientists and academics. As consequence, fears about science or negative attitudes toward scientific endeavors are less likely to be challenged by scientists and more likely to become group norms. Biblical literalists or religious conservatives might also receive critical messages about science from religious officials who might use opposition to media representations of science as a way of reinforcing religious group identity. These negative views would naturally be reflected in opposition to scientific spending. Distrust of educational institutions and negative attitudes toward science lead to two additionally hypotheses:

**H4:** Biblical literalists will be less likely to understand science. Understanding of science will mediate the relationship between biblical literalism and attitudes toward scientific spending.

**H5:** Biblical literalists will tend to be more distrustful of social institutions. This distrust will mediate the relationship between biblical literalism and attitudes toward federal scientific spending.

Religious conservatives have also adopted attitudes of opposition to government expansion and adherence to economic conservatism, particularly in recent years (Barker and Carman 2000). This opposition can come from a suspicion of government values and intentions, or of the motivations of government agents and bureaucrats. Felson and Kindell (2007) found that those members of conservative religious denominations who were of higher SES were more likely to express a belief in smaller government and have more conservative political attitudes. They posited that part of this attitude came from the deliberate efforts of Republican candidates to court the financial and political support of those religiously conservative individuals (Felson and Kindell 2007). Additionally, biblical literalist beliefs in the inherent sinfulness of man might lead them to prefer the limitation of power in the hands of any one government organization or any one individual. Biblical literalists have begun to identify with a preference for smaller, more restricted government, lowered federal expenditures, and social conservatism (Felson and Kindell 2007). Increasingly economic and social conservatism have become integral to biblical literalist identity. Such political values would be linked to a general opposition to federal expenditures. This potential relationship leads to an additional hypothesis:

**H6:** Biblical literalists will be more distrustful of government institutions. This relationship will mediate the relationship between biblical literalism and attitudes toward federal scientific spending.



## **DATA**

To explore this question, data were drawn from the 2008 wave of the General Social Survey, a nationally representative probability sample conducted by the National Opinion Research Center. The GSS uses probability sampling of non-institutionalized American adults living in the contiguous 48 states. The survey is cross-sectional and, since 1994, has been conducted on even numbered years with roughly 3,000 participants per year. There are multiple forms of the survey each year, all containing the same core questions but with random subsets of participants receiving different sets of additional questions. The relevant question on attitudes toward national science spending has only been asked on surveys since 2002. Of those years in which the question has been asked, the 2008 survey had the largest group of participants who also answered questions about attitudes toward science and confidence in social and governmental institutions. As consequence, I rely on the 2008 wave of the survey. After deletion of those respondents who were not assigned relevant ballot for completion, and listwise deletion of missing cases, the effective sample size is 1,853 American adults. This dataset is uniquely appropriate for this study due to the nationally representative nature of the sample and the multiple measures of both science and religion used in the survey.

## **MEASURES**

### **Dependent Variable**

The dependent measure in this study is respondent's attitudes toward federal spending on science. Respondents were asked a series of questions about their attitudes toward national spending on a variety of issues. Respondents' answers to the question "Are we spending too much, too little, or the right amount on supporting scientific research?" form the dependent variable. This science spending variable was reverse coded so that 0= too little, 1= about right, and 3= too much.

The answer "about right" had the largest group of respondents from the subsample and is used as the comparison category in the primary multinomial logit analysis. Further analyses using "too little" as the comparison category yielded useful information and will also be analyzed in this study. Multinomial logit regression models with "too much" as the comparison category yielded no further information and will be omitted from this paper but are available as well.

This dependent variable is arguably limited by individual citizen's lack of knowledge about the exact amount of money currently spent on science at the federal level or the ways in which these funds are dispersed. However, this question is appropriate for the present analysis as individuals' responses are an indicator of individual support of federal agendas and priorities.

## **Religion Variables**

Respondents' levels of religiosity, religious behaviors, and religious affiliations were measured in several ways. In order to analyze how both religious behaviors and religious affiliations can impact attitudes toward science, multiple measures of religion were included in this study.<sup>x</sup>

Greater rates of religious service attendance might increase respondent's likelihood of holding attitudes toward science that are shaped by, and in concert with the broader attitudes of their religious community. As higher rates of religious service attendance among adolescents have been associated with better educational outcomes (Regnerus 2000), frequency of attendance can influence individual access to and understanding of scientific information in multiple ways. Attendance rates might also be a useful indicator of whether high rates of bonding social capital in religious communities have a negative impact on individual attitudes toward science. Individual attendance frequency was coded as a dummy variable for regular religious service attendance which compared weekly or more attendance to attendance less than every week.<sup>xi</sup> Answers were coded 1= weekly or more, 0= less than once a week.

In addition to this measure of religious practices, two measures of specific religious beliefs were included in this study. These measures were respondents' denominational affiliation and beliefs concerning the nature of the Bible. Religious affiliations were recoded using the classification scheme constructed by Steensland et al(2000). The resulting dummy variable categories were: Catholic, Evangelical, Mainline

Protestant, Other Christians, non-Christian religions, and no religion.<sup>xii</sup> Individuals who did not answer the relevant questions were dropped from the sample.

The second variable included to evaluate the ways that doctrinal beliefs shape attitudes toward science measured belief in biblical literalism. Much research has supported the importance of belief in biblical literalism in shaping the experiences, behaviors, and health outcomes of congregants. Belief in Biblical literalism, particularly with regard to questions about the origins of man or the Earth, would be likely to shape respondents attitudes toward science and their support of scientific research more generally<sup>xiii</sup>. To evaluate belief in biblical literalism, respondents were asked “Which of these statements comes closest to describing your feelings about the Bible?” and chose between “The Bible is the actual word of God and is to be taken literally, word for word”, “The Bible is the inspired word of God but not everything in it should be taken literally, word for word” or “The Bible is an ancient book of fables, legends, histories, and precepts recorded by men.” This measure was recoded as a dummy variable measuring literalism (1=“The Bible is the actual word of God”, 0=all other responses).

### **Government, Institutional, and Scientific Distrust**

Governmental and institutional distrust would both be likely to impact attitudes toward spending on science research or indeed any form of government spending. Religiously conservative individuals who identify themselves as being strongly in conflict with mainstream values and beliefs would be likely to be critical of social and

governmental institutions. Finally, the tendency of members of conservative denominations to embrace conservative economic and political beliefs would encourage them to oppose any form of government spending.<sup>xiv</sup> Two scale variables were constructed in response to the possible connection between religion and institutional distrust.

A scale variable measuring distrust of government was constructed from participant responses to questions measuring respondents' levels of trust in the army, legislature, executive branch, and judicial systems ( $\alpha=.65$ ). The variable range was 0-8 with higher scores indicating greater levels of overall distrust. For example, a score of 8 on the scale corresponds to an individual replying that they had "hardly any trust" in each of the four government organizations. A response of zero means that the respondent had 'a great deal of trust' in all branches.

A scale variable measuring distrust of social institutions was also constructed ( $\alpha=.58$ ) The institutional distrust variable was constructed from scale variables measuring participant trust of the press, businesses, organized labor, the medical community, the clergy, and the education system. Each trust variable was recoded as a dummy variable (1=hardly any trust, 0=some trust or a great deal of trust).<sup>xv</sup> The recoded variables were then combined to construct a variable measuring institutional distrust. The resulting variable range was 0-6, with higher numbers corresponding to higher levels of distrust.

Finally a dummy variable was created to measure participant trust of the scientific community (1= "hardly any trust", 0= all other responses).

## Control Variables

This study also controlled for a number of potentially confounding factors that could be linked to both religious belief and attitudes concerning federal expenditures on science. As consequence, I included measures of political affiliation, race, education level, age, and region of residence.

Political views were measured from respondents answer to the scale measure “We hear a lot of talk these days about liberals and conservatives. I’m going to show you a seven-point scale on which the political views that people might hold are arranged from extremely liberal--point 1--to extremely conservative-- point 7. Where would you place yourself on this scale?” This variable was recoded as a dummy variable (1= somewhat liberal, liberal, or very liberal, 0=all others).<sup>xvi</sup>

Age was recoded as a series of dummy variables: less than 35 years old, 35 to 49 years old, 50 to 64 years old, and 65 years old or more.<sup>xvii</sup> Other controls were constructed as dummy variables, including, region of residence (1=south, 0= all other regions) and gender (1=male, 0= female)<sup>xviii</sup>

As understanding of science and science research was likely to shape participant attitudes toward science spending, education was also included as a control. Education has also been shown to affect political views and attitudes and could affect attitudes toward both science spending and federal spending in general. Education levels were coded as a dummy category (1= bachelors or higher, 0=less than bachelors)<sup>xix</sup>.

Finally, race was constructed as a series of variables. Those variables separated whites, African Americans, and members of other races.

## RESULTS

The descriptive statistics for all variables are presented in Table 1. On average, public attitudes toward spending lean slightly toward increased spending, with a score of 2.29. An average score of 2 would indicate comfort with current rates of spending and a score of 3 would indicate support for increased spending. The average score indicates, then, general approval among respondents for scientific spending. Indeed, 41.17% of GSS respondents felt that federal spending on science was insufficient. Only 12.21% of respondents felt that federal spending on science should be cut. The strength of approval for increased federal spending on science is particularly powerful in a time of increased economic constraints and concern about government expansion and national debt.

The strength of approval for scientific spending is in concert with the general trust of the scientific community among respondents. When asked about their trust in the scientific community, only 3.79% of respondents said they had ‘hardly any’.

The religious measures in this study are similar to those reported by other analyses of the GSS. Conservative Protestants represented 27% of the sample population. Within the sample population, 26% reported attending church once a week or more. Additionally, 31% of respondents agreed that “the Bible is the actual word of God”.

In general, survey respondents were not distrustful of the government or social institutions. Government distrust had a maximum score of eight, but a mean of 4.04. Of all respondents, 2.88% were distrustful of all four government organizations and 60.96% of respondents had some or a great deal of trust in all four branches. Likewise, distrust



of social institutions, with a maximum potential score of seven, had a mean of .95. In this case, 50.72% of respondents were not distrustful of any of the seven social institutions measured and only .21% of respondents were distrustful of all seven institutions.

In general, respondents were also highly approving of science. When asked whether they thought “Modern science does more harm than good”, only 8.8% of respondents agreed or strongly agreed. A larger proportion of respondents, 34.29% percent, agreed or strongly agreed with the statement “Science makes our way of life change too fast.”

The respondents varied widely in educational achievement, with 28% holding a Bachelors, Masters, or PhDs. When respondents were asked whether they had a “clear understanding of scientific study” 14% reported that they had “little understanding”.

The average participant age was 47.5. The majority of respondents were female (53%). The majority of respondents were white (77%), 14% were African American, and 9% were members of other, non-white races. The majority of respondents were either politically moderate, or politically conservative, with 26% referring to themselves as “slightly liberal”, “liberal”, or “extremely liberal”. Finally, 37% of respondents were living in the southern region of the United States.

**Table 1: Descriptive Statistics**

	Mean	Standard Deviation	Range
<i>Dependent Variable</i>			
Attitudes toward spending	2.29	.02	1-3
<i>Religion Variables</i>			
Biblical Literalism	.31		0-1
Frequently Attend Church	.26		0-1
Evangelicals	.27		0-1
Mainline Christians	.14		0-1
Other Christians	.15		0-1
Catholics	.23		0-1
Other Religions	.04		0-1
Non Religious	.17		
<i>Demographic/Social Descriptors</i>			
Liberal	.26		0-1
Male	.47		0-1
Southern	.37		0-1
<i>Age</i>			
Less than 35	.26		0-1
35-49	.29		
50-64	.27		
65 or older	.18		
<i>Race</i>			
Black	.14		0-1
Other Race	.09		0-1
<i>Education</i>			
Bachelors Degree or Higher	.28		0-1
<i>Distrust Measures</i>			
Distrust of Social Institutions	.98	.03	0-6
Distrust of Government	4.04	.05	0-8
<i>Science Variables</i>			
Science causes harm	.09		0-1
Science changes things too quickly	.34		0-1
Doesn't understand science	.14		0-1
Distrust of Scientific Community	.04		0-1

**Table 2: Correlations of Key Measures**

	SS	BL	FA	HD	SF	SH	DS	DSC	DSI	DG
SS-Science Spending	1.00									
BL- Biblical Literalism	- 0.14***	1.00								
FA- Frequent Church Attendance	- 0.06**	0.24	1.00							
HD- Higher Degree	0.15***	-0.21***	0.04	1.00						
SF- Science changes things too fast	- 0.06t	0.11***	-0.01	-0.10***	1.00					
SH- Science does more harm than good	- 0.10***	0.11***	0.02	-0.11***	0.04t	1.00				
DS- Don't understand science	- 0.07**	0.11***	0.01	-0.18***	0.06*	0.06*	1.00			
DSC- Distrusts the scientific community	- 0.17***	0.04t	0.02	-0.07***	-0.01	0.16***	0.05*	1.00		
DSI- Distrusts social institutions	- 0.05t	-0.04	-0.05*	0	-0.05*	0.20***	-0.02***	0.39***	1.00	
DG- Distrusts the government	- 0.2	-0.02	-0.01	0.03	-0.04	0.17*	-0.02t	0.28***	0.41***	1.00

\*\*\* p < 0.001; \*\* p < 0.01; \* p < 0.05; t p < 0.1.

Table Two displays a correlation matrix of the key measures used in this study. The table offers some preliminary information about the relationships between relevant measures. The majority of the measures were not highly correlated, but the directions of correlations are notable.

First, support of scientific spending was somewhat correlated with many of the relevant measures. Support of scientific spending was negatively correlated with frequent church attendance (-.06). Scientific spending was also, unsurprisingly, negatively correlated with a belief that science does more harm than good (-.10), distrust of the scientific community (-.17), and a lack of understanding of science (-.07). Opposition to scientific spending was uncorrelated with the variable measuring distrust of the government.

The relationships between scientific distrust and the other measures were generally quite small, with only one relationship of interest emerging. Distrust of the scientific community was negatively correlated with possession of a higher degree (-.07). This might provide some indication that the difference in level of education between religious conservatives and others noted in previous studies might be partially responsible for the perceived conflict between science and religion. The relationship is quite small, however, providing an early indication that while level of education might have an influence on the relationship between religion and distrust of science it might not completely explain it.

Attitudes toward science, lack of scientific knowledge, and distrust of the scientific community are correlated in the expected directions with one exception. A

belief that science changes ways of life too quickly was unrelated to distrust of the scientific community. The correlations are not particularly large, with values ranging from -.01 to .16, reinforcing the importance of evaluating multiple measures of attitudes toward science.

Distrust of social institutions was correlated with distrust of the scientific community (.39), and with the belief that science does more harm than good (.20). These correlations are among the largest present between measures. Distrust of government was also correlated with distrust of the scientific community (.28), and a belief that science does more harm than good(.16). Distrust of social institutions and distrust of government had the largest correlation of all measures (.41).

Finally, the correlation table offers a preliminary opportunity to analyze the hypothesized links between biblical literalism and attitudes toward science. Biblical literalism was negatively correlated with support for scientific spending (-.14), lending credence to H1 and H2. Additionally, biblical literalism was positively correlated with a belief that science changed life too quickly (.11), a belief that science does more harm than good (.11), and a lack of scientific understanding (.11). These relationships offer some support for H2, that biblical literalists are more opposed to science than non-literalists. These relationships lend partial support for H3 and H4, although it does not provide evidence of mediating relationships. Belief in biblical literalism was not correlated with a distrust of social institutions or a distrust of the government contrary to H5 and H6.

**Table 3: Multinomial Logit Odds Ratios**

	Model 1		Model 2		Model 3		Model 4	
	Too Little	Too Much	Too Little	Too Much	Too Little	Too Much	Too Little	Too Much
<b>Demographic and Religious Controls</b>								
Biblical Literalist	0.69**	1.14	0.69**	1.18	0.70**	1.10	0.71**	1.12
Frequently Attend Church	0.87	1.07	0.88	1.09	0.87	1.06	0.88	1.08
Mainline	1.07	1.07	1.09	1.47	1.07	1.07	1.10	1.38
Other Christians	0.89	1.38	0.88	1.42	0.87	1.46	0.87	1.48
Catholic	0.84	1.28	0.86	1.39	0.85	1.27	0.87	1.34
Other Religions	1.52	0.80	1.54	0.83	1.51	0.89	1.53	0.90
Non-Religious	1.16	1.56t	1.15	1.48	1.17	1.66	1.17	1.62
Politically Liberal	1.19	0.92	1.18	0.94	1.20	0.95	1.18	0.94
Male	1.00	1.01	0.99	0.97	1.00	1.02	0.97	1.01
Southern Residence	1.00	1.04	1.02	1.06	1.01	1.05	1.02	1.07
Age 35 to 49	1.08	1.01	1.05	0.94	1.08	1.02	1.04	0.97
Age 50 to 64	1.33*	1.28	1.28t	1.15	1.34*	1.27	1.27	1.18
Age 65 or older	1.37t	0.75	1.30	0.66	1.37t	0.75	1.29	0.68
Black	0.98	2.33***	0.98	2.37***	1.01	2.10***	1.02	2.13***
Other Non-White	1.20	2.14**	1.22	2.24**	1.21	1.86*	1.23	1.91*
Bachelors Degree or Higher	1.33*	0.53**	1.32*	0.51**	1.32*	0.59*	1.29*	0.57*
<b>Organizational Distrust</b>								
Distrust of social institutions			1.03	1.24**			1.06	1.10
Distrust of government institutions			1.13t	1.20*			1.14*	1.18t
<b>Science Attitudes</b>								
Science changes ways of life too fast					0.93	1.17	0.94	1.18
Science does more harm than good					0.72t	1.25	0.65*	1.09
Don't understand science					1.07	1.30	1.10	1.34
Don't trust the scientific community					0.82	5.64***	0.60	3.57***
Pseudo-R Squared	0.036		0.047		0.049		0.053	

About right is the base outcome. Conservative protestants, whites, people with less than a bachelors, people less than 35 as reference categories

\*\*\* p < 0.001; \*\* p < 0.01; \* p < 0.05; t p < 0.1.

Table 3 presents a series of multinomial logit models, gauging the effects of religion and science variable predictors on the odds of opposing or supporting scientific spending. In this multinomial series “About Right” is treated as the base outcome. There are several benefits to using this particular form of analysis to examine the ways that religion can influence attitudes toward spending. Multinomial logit is appropriate in this instance as the dependent variable is a categorical measure.<sup>xx</sup> While the dependent variable appears to be ordinal, and thus more appropriate for ordered logit, it is difficult to argue a specific measurable difference exists between ‘too little’ and ‘about right’.<sup>xxi</sup> In this case, multinomial logit can reveal important differences between those who regard current levels of spending as appropriate and those who feel that current rates of expenditures are insufficient.<sup>xxii</sup>

Model 1 is a baseline model, including only the demographic and religious control measures. The next model includes the scale measures for institutional and government distrust intended to evaluate the moderating influence of distrust of mainstream social institutions on religious individuals’ attitudes toward federal spending on science. The third model includes those variables measuring respondents’ attitudes toward science. This model allows for an examination of the moderating effects of different aspects of science which might potentially conflict with religion. The final model combines all variables included in the study. Cell entries displayed in Table 3 are odds ratios.

Model 1, with controls for multiple religion variables confirms that doctrinal commitments, particularly to biblical literalism, are the key source of religious

disapproval of federal scientific expenditures. Neither denominational affiliation nor frequency of attendance significantly affected the odds of being in any category. Biblical literalism has a significant and stable effect on belief that spending on science is 'about right' rather than 'too little'. Individuals who subscribed to a belief in biblical literalism were 31% less likely to agree that federal expenditures on science were insufficient, as opposed to supporting current levels of spending, when compared to non-literalists. (OR=.69, p=.002). These odds and level of significance varied little in subsequent models. Literalist disinclination toward increased spending provides some support for H1.

Model 2 included two scale variables measuring institutional and government distrust. The inclusion of variables measuring distrust did not change the decreased odds of increases of federal expenditures on science among biblical literalists, as compared to current levels of spending (OR=.69, p=.003). This suggests that H5 and H6 are false.

Model 3 included multiple measures of general attitudes toward science. These measures evaluated lack of scientific understanding, distrust toward the scientific community, the belief that science changes things too quickly, and the belief that science does more harm than good. These measures of attitudes toward science failed to significantly alter biblical literalists' decreased odds of supporting increased federal expenditures on science (OR=.70, p=.004). This result indicates that H2, H3, H4 and H5 are false.

While biblical literalists did have lower odds of supporting increased federal spending on science, they did not have significantly higher odds of regarding current



levels of spending as ‘too much’, when compared to ‘about right’ (OR=1.14, p=.418). This remained fairly steady across all models to the final combined model (OR=1.10, p=.522). This contradicts H1 that biblical literalists are generally more opposed to federal spending on science. Literalists do not appear to be actively opposed to all scientific spending, rather literalists are inclined to reject increases in spending on science.

Religious affiliation does not affect odds of endorsing either the expansion or the reduction of government spending compared to belief that current levels of expenditure are appropriate. No religious or nonreligious affiliations significantly increased or decreased odds of supporting increased or decreased spending, as compared to current levels of federal spending on science.

Rates of religious service attendance likewise did not affect odds of believing that rates of scientific spending are too little (OR= .87, p=.285) or too much (OR=1.07, p=.725) in the baseline model. The final complete model also displayed no significant attendance effects for the ‘too little’ (OR=.88, p=.326) or ‘too much’ (OR 1.08, p=.705) categories when compared to the ‘about right’ category. This suggests that attitudes toward science spending are not shaped by intensity of religious community membership or religious community structure.

Despite their lack of influence on the impact of religion on attitudes toward spending, the measures of distrust presented in model 2 offers interesting information about what factors drive opposition to scientific expenditures. Distrust of social institutions increased odds of regarding current rates of scientific spending as ‘too high’

by 24%, when compared to believing that current rates of spending were appropriate (OR:1.24, p=.003). Distrust of the federal government also increased odds of regarding current rates of scientific spending as too high by 20% (OR:1.20, p=.04), as opposed to regarding current levels as appropriate. The significance of these effects disappears in the combined model for both social institution distrust (OR:1.18, p=.08) and government distrust (OR:1.10, p=.227). This suggests that distrust of social and government institutions are not the most powerful influence on disapproval of scientific spending.

In general, attitudes toward science had little influence on attitudes toward current rates of scientific expenditure. However, distrust of the scientific community presented in models 3 and 4 was the most powerful force driving opposition to scientific spending. In model 3 distrust of the scientific community increased odds of regarding current levels of spending as 'too much' by 464%, when compared to believe that current levels of spending were appropriate (OR=5.64, p<.001). While the percentage of increase declined in model 4 to 257% (OR:3.57, p<.001), it remained the most powerful influence on attitudes toward scientific spending.

Race also had a powerful effect on attitudes toward federal spending on science. When white respondents were used as the reference category, African American respondents and respondents of other racial backgrounds were significantly more likely to regard current levels of science spending as 'too much'. This relationship remains fairly constant across all models, although attitudes toward science slightly explain the effect.<sup>xxiii</sup> In the final combined model African Americans had 113% greater odds of saying that current levels of spending were 'too much' (OR: 2.13, p<.001) and members

of other races had 91% greater odds of saying that current levels of spending were 'too much' (OR=1.91, p=.02), as opposed to 'just right'. This suggests that whites are generally more supportive of science than others. Possession of a Bachelors or higher

**Table 4: Multinomial Logit Odds Ratios**

	Model 1		Model 2		Model 3		Model 4	
	About Right	Too Much	About Right	Too Much	About Right	Too Much	About Right	Too Much
<b>Demographic and Religious Controls</b>								
Biblical Literalist	1.45**	1.67**	1.44**	1.71**	1.42**	1.57*	1.41**	1.58*
Frequently Attend Church	1.15	1.23	1.14	1.24	1.15	1.23	1.14	1.22
Mainline	.93	1.28	.92	1.35	0.94	1.23	.91	1.26
Other Christians	1.15	1.59t	1.14	1.61t	1.15	1.68*	1.14	1.69*
Catholic	1.18	1.51	1.16	1.83t	1.17	1.50	1.14	1.54t
Other Religions	.66	.53	.65	1.62t	.66	1.44	.65	.59
Nonreligious	.86	1.33	.87	1.29	.86	.59	.87	1.41
Southern Residence	1.00	1.03	.98	1.04	.99	1.06	.98	1.06
Male	1.00	1.02	1.01	.98	1.00	1.05	1.03	1.04
Age 35 to 49	.93	.93	.95	.89	.93	.95	.96	.94
Age 50 to 64	.75*	.96	.78t	.90	.75*	.92	.79	.93
Age 65 or older	.73t	.56*	.77	.51*	.73t	.54*	.78	.53*
Black	1.02	2.38***	1.02	2.43***	.99	2.08***	.98	2.10***
Other Non-White	.83	1.78*	.82	1.84*	.83	1.55	.81	1.55
Politically Liberal	.84	.77	.85	.79	.83	.79	.84	.79
Bachelors Degree or Higher	.75*	.40***	.76*	.39***	.76*	.45***	.77*	.42***
<b>Organizational Distrust</b>								
Distrust of social institutions			.97	1.20**				1.03
Distrust of government institutions			.89t	1.07				1.03
<b>Science Attitudes</b>								
Science changes ways of life too fast					1.08	1.26	1.08	1.26
Science does more harm than good					1.38t	1.72*	1.55*	1.69*
Don't understand science					.94	1.22	.91	1.23
Don't trust the scientific community					1.21	6.85***	1.68	5.97***
Pseudo-R Squared	.034		.044		.053		.054	

Too Little is the base outcome. Conservative protestants, whites, people with less than a bachelors, people less than 35 as reference categories

\*\*\* p < 0.001; \*\* p < 0.01; \* p < 0.05; t p < 0.1.

degree was also highly significantly correlated with attitudes toward scientific spending. Those who had a higher degree had 29% lower odds of believing that current levels of spending were ‘too much’ (OR=1.29, p=.03) as opposed to appropriate in the final combined model.

Table 4 presents the odds ratios for the multinomial logit models when ‘too little’ is the base category. This offers an opportunity to more closely evaluate the way that relationships between religion and science impact likelihood of regarding current levels of federal spending on science as appropriate, the largest category of response.

As in Table 4, model 1 is a baseline model with religious and demographic controls included. Model 2 incorporates the scale measures of distrust of social institutions and distrust of the government. Model 3 includes those measures of attitudes toward science. Model 4 is the final combined model including attitudes toward science and distrust.

This set of models further explains the complicated relationship between biblical literalist beliefs and attitudes toward federal science spending. In the baseline model, compared to those who think that current levels of scientific expenditure are too low, biblical literalists have 45% increased odds of thinking current levels of spending are appropriate (OR:1.45, p=.002) and 67% increased odds of thinking current levels of spending are ‘too much’ (OR:1.67, p=.004). As in Table 3, neither scientific attitudes nor distrust of social and government institutions explained the relationship between biblical literalism and attitudes toward federal science spending. In the final cumulative model, biblical literalists had 41% greater odds of thinking current rates of scientific spending

were ‘just right’ (OR:1.41,  $p=.006$ ) and a 58% increase in odds of saying current levels of spending were ‘too much’ (OR:1.58,  $p=.014$ ), as opposed to ‘too little’. These statistics again provide partial support for H1, although they indicate that biblical literalists are less opposed to scientific spending overall than disinterested in increasing levels of spending further.

Those variables measuring government and institutional distrust failed to influence biblical literalists’ odds of supporting scientific spending, suggesting that H5 and H6 are wrong. In model 3, biblical literalists’ likelihood of believing that scientific spending was ‘too much’ decreased slightly in significance and magnitude when variables measuring attitude toward science were included (OR:1.57,  $p=.014$ ). This decrease is likely explained by the powerful effects of distrust of science on attitudes toward scientific spending. This indicates partial support for H3, that literalists are generally more likely to be distrustful of the scientific community and that this distrust partially explains biblical literalist attitudes toward federal spending on science. However, the effects of the inclusion of variables measuring attitudes toward science did not completely explain biblical literalist likelihood of viewing science spending as ‘too much’ relative to ‘too little’.

Other Christians were somewhat more likely to believe that current levels of federal spending on science was ‘too much’ as opposed to ‘too little’, even in the combined model (OR:1.69,  $p=.037$ ). Catholics also had slightly greater odds of being in the ‘too much’ category in the combined model (OR:1.54,  $p=.097$ ), when compared to the ‘too little’ category. No other religious affiliations were significantly related to

attitudes toward scientific spending. These relationships, while interesting, offer little evidence that support for scientific spending varies meaningfully by religious tradition.

In this set of models, a handful of demographic characteristics remained significant predictors. The age of respondents was somewhat important, with respondents aged 65 or older having significant lower odds of thinking current levels of spending were 'too much', even in the cumulative model (OR:.53,  $p=.024$ ) when compared to 'too little'. Race remained significant, with African American respondents being much more likely to think that scientific spending was 'too much'(OR: 2.10,  $p<.001$ ). Finally, possession of a higher degree significantly decreased likelihood of agreeing with current levels of spending (OR:.77,  $p=.016$ ) or opposing expansions of spending (OR:.42,  $p<.001$ ), as compared to supporting increased spending.

## **DISCUSSION**

While much has been made in both popular media and academic writing about the apparent conflict between religion and science, the exact sources of this conflict have often been poorly explicated. In general, researchers have focused less on the elements of religion or religiosity that influence conflict than on either education issues or particular conflicts over reproductive issues. Research has shown mixed evidence of disparities in educational outcomes between religious and non-religious students. This mixed evidence hints that the relationship between religion and scientific understanding is more complicated and nuanced than generally believed.

Those works that engage in analysis of particular conflicts over reproductive genetics, cloning, euthanasia, or abortion technologies provide valuable evidence about the ways that religious conservatives or biblical literalists perceive those particular issues, but do not ask how literalists view science more generally or view scientific researchers. Likewise, the ways that religious groups' perceived discomfort with science in general affect policy attitudes or political beliefs have been largely ignored. This lack of attention to the ways that religion can shape attitudes toward science spending and scientific policy is particularly surprising in a nation where support for both science and scientific investment is remarkably high.

This paper sought to augment the limited body of work analyzing the relationship between religion and science by examining the ways that various elements of religious belief, religious group membership, and religious attendance can affect individuals' support for scientific spending. It focused particularly on support for federal scientific



spending and the ways that religious individuals' attitudes toward such spending may be shaped by general distrust of social institutions or the government, by lack of scientific knowledge, by rejection of science as conflicting with values, or by distrust of the scientific community. Using cross-sectional data from the General Social Survey, a large nationwide probability sample of U.S. citizens administered by the National Opinion Research Center, I conducted multinomial logit analyses of the ways that religion shapes attitudes toward federal scientific spending. This use of multinomial logit regression allowed for a more nuanced analysis of the difference between opposition to spending on science and disinterest in the expansion of federal scientific spending. In using multiple measures of religiosity and science, I sought to evaluate the influence of generally theorized areas of conflict on actual attitudes toward scientific policy. Several findings from this analysis deserve emphasis.

In general, frequency of church attendance and denominational affiliations failed to affect individuals' attitudes toward science spending. This finding is surprising in light of research indicating that conservative or evangelical religious groups perform more poorly on science tests or oppose particular scientific projects. This suggests that the mechanisms driving religious opposition to science might not be the consequence of religiosity or membership in specific religious communities. In this analysis, only literalism had a consistent relationship with attitudes toward federal spending on science. The lack of a consistent relationship between measures of religiosity and opposition to spending, suggests that the relationship between literalism and opposition to increases in federal spending may be a marker for something else entirely. This suggests that future

analyses of the relationship between religion and science would benefit from the use of multiple measures analyzing the particular nature of biblical literalist beliefs. This would be particularly valuable in light of the many variations of literalist belief that exist.

This analysis also found that the relationship between biblical literalism and opposition to science spending was largely a consequence of biblical literalist disinterest in the expansion of scientific investment. This disinterest was unaffected by the measure controlling for distrust of the government, which would indicate an opposition to federal expansion. Literalist opposition to the expansion of federal spending on science was not a consequence of a general literalist distrust of the government.

Biblical literalist opposition to expansion of science spending was seemingly not a consequence of moral objections that science caused more harm than good or that science changed ways of life too quickly, objections that would indicate biblical literalists regard science as a threat to either their belief commitments or the lives of their children. Biblical literalist opposition to scientific spending was also not explained by the measure evaluating levels of scientific knowledge. This suggests that, despite mixed evidence indicating that biblical literalists perform more poorly in science, biblical literalists did not oppose policies of science spending because they felt that they did not understand the nature of science. Opposition to the expansion of federal spending on science was not an apparent consequence of a particular ideological opposition to science among biblical literalists or literalist ignorance of science.

For those biblical literalists who did believe that federal spending on science was excessive when 'too little' was used as the base outcome, distrust of the scientific

community might have partially driven their reluctance. Biblical literalists might be less concerned about science as a concept, subject, or means of addressing problems, than distrustful of the individuals who currently engage in scientific research. This possible distrust might be the embodiment of a concern about the political agendas of scientists, although when political views were controlled for literalists were still concerned about expanding spending. Alternately this distrust might be a consequence of biblical literalist belief that man is inherently sinful. The embodiment of the scientist as one who is inherently with sin and in possession of the power to engage in matters that literalists would generally regard as more appropriately the domain of God might be the driving force behind the concerns of those literalists most opposed to policies of federal scientific spending. Future analysis more directly addressing literalists' conceptions of scientists, of the ways that scientists conduct research, or their knowledge of the ethics commitments and education of scientists, might offer valuable insight into this perceived conflict.

While distrust of the scientific community might have had some influence on the attitudes of biblical literalists most opposed to scientific spending, it did not have an apparent effect on the attitudes of literalists more generally. The inability of variables measuring general attitudes toward science or distrust of the scientific community to explain the relationship between biblical literalist belief and reduced likelihood of supporting scientific expansion also prompts questions for future research. It would be valuable to ask what biblical literalists were thinking about when asked this particular question. Did they generally associate science with national security or medical technology? Or did they equate science with those particular aspects of scientific research

that have generally attracted the attention and censure of their religious communities? Unfortunately, those variables in the survey which might have been useful in answering this question were asked of too few respondents to permit useful analysis. Future studies addressing whether biblical literalists oppose particular areas of scientific and support others would be valuable in addressing this apparent conflict.

Due to the nature of the survey and the available measures of scientific policy preferences, I was unable to evaluate what respondents knew or believed to be the role of the government in funding scientific projects. Respondent knowledge about the role of the government in science might vary importantly by religious denomination or doctrinal belief. Variations in respondents' knowledge about federal scientific investment might partially explain biblical literalists' consistent opposition to increased federal scientific spending. Additionally, research addressing not just federal spending on science but the potential role of federal regulation in managing the direction of scientific research and the means by which it is conducted would be extremely useful. Biblical literalists, who might be generally more distrustful of scientists might approve of a larger role for the federal government in scientific endeavors if that role was perceived as being one of increased regulation. If biblical literalist opposition to scientific spending is based primarily in concerns about the nature of mankind and about how that nature could lead to heightened exploitation of science or encroachment on the domains of God, then their opposition might disappear if that increased spending came with increased federal regulation or control of science.

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- <sup>i</sup> A description of the organization and its mission can be found at [erc.europa.eu/](http://erc.europa.eu/)
- <sup>ii</sup> A description of the organization's goals can be found at [SciDev.Net/en/content/overview](http://SciDev.Net/en/content/overview)
- <sup>iii</sup> 16 million copies sold according to [thesecret.tv](http://thesecret.tv)
- <sup>iv</sup> An overview of PISA is available at <http://nces.ed.gov/surveys/pisa/> . An overview of TIMSS is available at <http://nces.ed.gov/timss/>
- <sup>v</sup> The statistics and tables presented in Figures A and B come directly from the National Center for Education Statistics report on 2006 education standings. The report is available at : <http://nces.ed.gov/pubs2006/2006073.pdf>
- <sup>vi</sup> More detailed discussion of the data presented in those studies and their possible meanings are presented in Martin et al 2003 and Lemke et al 2003
- <sup>vii</sup> Figure B and the related statistics came directly from the National Center for Education Statistics report on 2006 education standings. The report is available at: <http://nces.ed.gov/pubs2006/2006073.pdf>
- <sup>ix</sup> Written for the conference on Science, Philosophy, and Religion held in New York
- <sup>x</sup> Frequency of prayer was included in earlier analyses but was dropped when it proved insignificant and had no impact on the primary relationships tested. For the same reasons other measures of religious involvement available in the GSS were also initially included but were dropped.
- <sup>xi</sup> Attendance was coded several other ways including as a continuous variable in earlier analysis. When analysis of the variable indicated that weekly or greater attendance were the relevant levels of attendance, this dummy variable was constructed. Interaction terms of biblical literalism and attendance were included in earlier models but were dropped when they proved insignificant.
- <sup>xii</sup> African American religious denominations were split into the relevant conservative, mainline, etc. categories rather than together as a separate variable. Race and religion interaction terms were constructed but were dropped when they failed to explain the primary relationships evaluated.
- <sup>xiii</sup> Other GSS variables more directly addressing attitudes about faith and science conflict were included in early analysis but were dropped from final models because they dramatically reduced sample size and were statistically insignificant.
- <sup>xiv</sup> Earlier analysis attempted to create a scale measure based on responses to questions of approval for federal spending on defense, the environment, health, welfare, and other current issues. The number of respondents who answered or were asked all questions were far too small to yield a useful measure.
- <sup>xv</sup> While it is generally the case that leaving the original categories separate would create more covariance and yield a higher alpha, in this instance, when variables were not first reconstructed as dummy variables, an alpha of .56 resulted. Additionally formulations of this variable were attempted using fewer confidence variables in construction (using groups of 5, 4, or 3 confidence measures) but they failed to offer an increase in covariance or in alpha. For the same reason confidence in television (CONTV) was included in initial construction of the institutional distrust variable (creating a measure comprised of 7 confidence variables) but was dropped as it dramatically reduced covariance and the alpha.
- <sup>xvi</sup> Political attitudes were split into multiple categories in early modeling before being condensed when such distinctions proved insignificant.
- <sup>xvii</sup> Age was also evaluated as an interaction term with multiple dimensions of religion but failed to yield important results.
- <sup>xviii</sup> While population size of area of residence is quite likely to relate to both religion and attitudes toward science, the relevant question was not available for this set of models. Future analysis should evaluate the influence of population of residence on these issues.
- <sup>xix</sup> Education was separated into multiple categories (less than high school, high school diploma, junior college, some college, Bachelor's, or Graduate work) in early analysis, but examination revealed the distinction between Bachelors and higher levels of education and less than a Bachelors was the only significant one. Other measures of scientific knowledge were used (including number of correct answers on the GSS science test, and ability on the GSS vocabulary test) but proved insignificant and generally dramatically reduced the sample size. Additionally measures of interest in scientific television programming (tvbears, tvinuit, tvmelting etc) were used both as a scale measure and individual level measures. In both cases they failed to impact the primary relationships in the study. Finally, variables

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measuring the number of high school science courses respondents had taken were constructed. This variable proved insignificant as well, perhaps as consequence of the variations in state-level requirements of public school science courses and the variation in science requirements between public and private schools.

<sup>xx</sup> The formula for multiple logit regression is  $\text{logit}[P(y=1)] = \alpha + \beta_1 x_1 + \dots + \beta_k x_k$ . A simple description of logistic regression can be found in Statistical Methods for the Social Sciences by Alan Agresti and Barbara Finlay 2009 pp 483-519

<sup>xxi</sup> For more on the use of multinomial logit see also Hausman and McFadden (1984), McFadden, Tye and Train (1976)

<sup>xxii</sup> Johnson (1997) elaborates upon the benefits of using multinomial logit rather than OLS or other forms of analysis in categorical analysis in which disparate effect patterns may exist.

<sup>xxiii</sup> Interaction terms to evaluate whether the effects of race were partially explained by different forms of biblical literalism were run with the multinomial logit models. These interactions were largely insignificant across models. The relationship between race and science were not explained by different interpretations of biblical literalism.

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