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The Adoption of Solar Energy Financial Incentives Across the States, 1974-2007

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1. Introduction

Heightened concerns over energy prices, energy security, fossil-fuel scarcity, and climate change are spurring a revival of interest in renewable forms of energy in the United States. Potential for significant solar-based energy production has helped place solar policies high on the nation's policy agenda. This renewed interest comes after more than thirty years of experimentation with solar policies, primarily at the state level. Indeed, since 1974 almost every state adopted some type of financial incentive directed towards encouraging solar-power production and many states adopted and modified multiple types of solar incentives over time.

Thus while the current interest in solar power may yield major federal initiatives, historically it has been the state governments – America's laboratories for policy innovation – that have provided support for solar energy (Rabe 2004) and it may prove the case that support for solar remains primarily a state-level policy. Consequently it is important to understand the factors across the states that affect the adoption of solar incentives. In this paper we perform an event history analysis on solar incentive adoption from 1974 to 2007. Unlike the far majority of event history analyses in public policy studies, which examine policy adoption as a single event, we examine solar-incentive adoption as a multi-event phenomenon with individual states at different points adopting different types of incentives or otherwise changing incentives already in place.

This analysis will help us understand the various factors that affect solar adoption. Does it matter if the state has a great deal of solar potential due to its climate? Does a state's energy context, such as energy prices affect support for solar? How much do internal socio-economic and political factors, such as the ideology of a state's citizenry, affect solar adoption?

We proceed as follows. Section 2 provides an overview of solar financial incentives at the state level. Section 3 follows with brief consideration of the (now voluminous) literature on state policy diffusion and innovation and the far smaller literature on states and renewable energy policies. In Section 4 we describe the statistical model of solar incentive adoption we estimate. Section 5 presents the empirical results. Section 6 concludes.

2. Solar Incentives

State experimentation with solar incentives began in the mid-Seventies within the context of the energy crisis and the growing environmental movement. In 1974 both Arizona and Indiana adopted property-tax incentives directed towards encouraging the purchase of residential solar technology. Within two years 26 more states adopted various incentives and by 1981 the total number swelled to 44 (Hinds 1981; Sarzynski 2009a).

This initial wave of solar-incentive adoption coincided with the provision of a variety of federal programs, such as income-tax credits, and support for solar-energy research (Moore 1982). Federal support for solar power virtually disappeared in the 1980s and remained dormant until just recently. State interest in solar power also faded overall in the mid-1980s and 1990s, but many states kept and even augmented their incentive programs during the period. Action accelerated considerably in the new century.

Often particular types of policies resemble each other as they disperse across the states. This can occur because the states are influencing and even copying each other, or it can occur because the nature of the policy or politics around that policy constrain potential variation. The various solar incentives offered by states since 1974 resemble each other in the broad sense that they address solar power and that they fit into a small set of general categories of incentives (explained below). Otherwise, the various incentives offered by the states differ dramatically in detail. It may be that similar factors influenced states to adopt solar power incentives. However, the variation in detail suggests that states were not learning from each other but rather devising their own particular policies.

Solar Design Features

Solar incentives vary widely by function, type, method used to calculate the incentive value, caps on incentive value, eligible technology, and by the sector(s) that can claim the incentive.

- *Function* - States offer financial incentives directed toward achieving two primary functions: (1) to encourage purchase and use of solar technology; and (2) to encourage R&D or equipment manufacturing and supply.
- *Type* - States have the option to adopt many different types of financial incentives. For our purposes, incentives are classified as follows: (1) income tax incentives (personal and/or corporate; credits or deductions); (2) cash incentives (e.g., grants, rebates); (3) sales tax incentives; (4) property tax incentives; and (5) financing incentives (e.g., favorable loan terms).
- *Method of Calculating Incentive Value* - The amount of income tax and cash incentives can be calculated in multiple ways, including: (1) as a fixed dollar value; (2) as a share of installed cost (cost-based); (3) based on the installed capacity of the solar technology (capacity-based); or (4) based on the energy output of the solar technology (performance-based), also known as production incentives. Maximum value can be calculated in similar ways.
- *Eligible Technology* – The various eligible solar technologies fit into two general categories: (1) solar electric; and (2) solar heating and cooling. Solar electric technologies include photovoltaics (PV) and solar thermal electric systems, which produce electricity that can be used on-site or produced off-site and transmitted to the end-users. Solar technology can also be used directly to provide heating or cooling of water or building. Some incentives expressly include solar pool water heating, while others include solar water heating but not solar pool

water heating, and are mentioned accordingly. (For more detail on solar technologies Sarzynski 2009a 2009b.)

- *Eligible Sector* - Often, incentives can be claimed by recipients from multiple sectors, including: (1) residential; (2) commercial; (3) industrial; (4) agricultural; (5) government; (6) schools; (7) nonprofits; and (8) power providers. Residential incentives can apply to single-family homes or multi-unit residential structures, and in some cases apply only to affordable housing developers.

Most state financial incentives for solar technology are designed to encourage the initial purchase and use of solar technology, and of these, most apply to customer-sited solar technology. Customer-sited solar technology is a form of distributed energy generation that produces energy for on-site use and provides for all or part of a customer's energy needs. For instance, a solar hot-water heater on a single-family residence may provide all of the hot water a household needs each day. Similarly, solar electric panels on rooftops can produce electricity for whatever purpose and provide all or part of a household's total electricity needs. Distributed generation has the potential to reduce the overall demand for centralized electricity and associated transmission.

The Distribution of Solar Incentives Across the States

As Table 1 indicates, many states offered more than one financial incentive for purchase and use of solar technology as of December 2008. Four states (Maryland, Massachusetts, New York, and Rhode Island) featured all major types of financial incentives for purchase and use of solar technology, including both corporate and personal tax incentives. Vermont also offered all five major types for purchase and use, but did not offer personal income tax incentives. At the other end of the spectrum are two states (Arkansas and West Virginia) that did not offer any type of state-financed incentive for purchase and use of solar technology in December 2008. The rest of the states fell somewhere in between, with the majority offering two different types of incentives (Sarzynski 2009a).

3. Policy Innovation and Diffusion

Literature

Interest in what explains the diffusion of policies across political jurisdictions motivates a substantial literature in political science and policy studies (Graham, Shipan, and Volden 2008). The study of policy diffusion across the American states began primarily with Walker (1969) and blossomed dramatically with the theoretical and methodological innovations associated with

Table 1: States Offering Financial Incentives for Purchase and Use of Solar Technology as of December 2008						
State	**Personal Income Tax**	**Corporate Income Tax**	**Cash**	**Sales Tax**	**Property Tax**	**Financing**
Alabama						✓
Alaska	n/a		✓	n/a		✓
Arizona	✓	✓		✓	✓	
Arkansas						
California			✓		✓	✓
Colorado			✓	✓	✓	
Connecticut			✓	✓	✓	✓
Delaware			✓	n/a		
District of Columbia			✓			
Florida	n/a	✓	✓	✓	✓	
Georgia	✓	✓				
Hawai'i	✓	✓			✓	✓
Idaho	✓			✓		✓
Iowa	✓	✓		✓	✓	✓
Illinois			✓		✓	
Indiana			✓		✓	
Kansas					✓	✓
Kentucky	✓	✓		✓		
Louisiana	✓	✓			✓	✓
Maine			✓			✓
Maryland	✓	✓	✓	✓	✓	✓
Massachusetts	✓	✓	✓	✓	✓	✓
Michigan			✓			
Minnesota			✓	✓	✓	✓
Mississippi						✓
Missouri						✓
Montana	✓	✓		n/a	✓	✓
Nebraska						✓
Nevada	n/a	n/a	✓		✓	
New Hampshire	n/a*		✓	n/a	✓	✓
New Jersey			✓	✓	✓	
New Mexico	✓	✓				✓
New York	✓	✓	✓	✓	✓	✓
North Carolina	✓	✓			✓	✓
North Dakota	✓	✓			✓	
Ohio		✓	✓	✓	✓	
Oklahoma		✓				✓
Oregon	✓	✓		n/a	✓	✓

Table 1: States Offering Financial Incentives for Purchase and Use of Solar Technology as of December 2008						
State	**Personal Income Tax**	**Corporate Income Tax**	**Cash**	**Sales Tax**	**Property Tax**	**Financing**
Pennsylvania			✓			✓
Rhode Island	✓	✓	✓	✓	✓	✓
South Carolina	✓	✓	✓			✓
South Dakota	n/a	n/a			✓	
Tennessee	n/a*		✓			✓
Texas	n/a	✓			✓	✓
Utah	✓	✓		✓		
Vermont		✓	✓	✓	✓	✓
Virginia					✓	
Washington	n/a	✓		✓		
West Virginia						
Wisconsin			✓		✓	
Wyoming	n/a	n/a	✓	✓		

n/a denotes states that cannot offer the incentive since it lacks the specific form of tax (e.g., states with no income tax).
* Tax covers only dividends and interest.
Note: Table excludes incentives offered by utilities, nonprofits, local governments, and other entities. a). Data derived primarily from the *Database of State Incentives for Renewables & Efficiency* (DSIRE).

Berry and Berry (1990). The extant literature on state policy diffusion today is far too large to adequately review here.[1]

Speaking generally, two sets of factors affect policy diffusion. Internal factors include state characteristics internal to the given state that may affect policy adoption. For example, in the context of solar power incentives, we expect a state's solar potential and the general liberalness of its citizens to affect the adoption of solar incentives. Policy diffusion is also affected by factors external to the state, notably the influence of the national government or other states. National influence often occurs through the fiscal and statutory actions of the federal government, such as when national requirements for the dispersal of highway funds to the states led to universal adoption of the 21-year-old drinking-age requirement.

External state influence occurs mainly through competition and learning. States engage in competition with each other for economic production and tax revenue. This potentially affects the nature of policies a given state adopts, e.g., welfare provisions (Peterson and Rom 1990; Volden 2002). States also learn from each other and copy policies they see in place elsewhere. While the literature features some nuance on this point, the expectation is that learning and

[1] For a conceptually-organized review of the field see Berry and Berry (2007). For a review and assessment of the state of diffusion studies see Graham et al. 2008.

competition comes most directly from neighboring states. For example, the presence of legalized slot-machine gambling at horse tracks in Delaware affects Maryland more than the same type of gambling in Ohio affects Maryland.

Most directly relevant to our purposes are two articles that address the diffusion of policies related to renewable energy. Matisoff (2008) examined the adoption of renewable portfolio standards (RPS) by states from 1997 through 2005. RPS policies require utilities in the state to produce or purchase some quantity of electricity produced by renewable sources (Wiser and Barbose 2008). In his main set of results, Matisoff found little support for the diffusion of RPS among neighboring states. While he found no evidence that the presence of major oil and gas production in the state affected adoption of RPS, he did find evidence that a state's pollution levels as well as the potential for solar and wind production was a factor. Likewise, while the size of the state's economy (gross product per capita) did not affect RPS adoption, the ideology of a state's citizenry did affect adoption. Indeed, the relative liberalness of the citizenry proved the most important factor in the adoption of RPS, in terms of both statistical and substantive significance.

Stoutenborough and Beverlin (2008) examined the diffusion of net-metering polices across the states from 1993 to 2006. Net-metering policies require utilities to pay customers for the excess electricity customers produce on their own, such as with residential solar technology. In contrast to Matisoff, Stoutenborough and Beverlin did find a diffusion effect. The more neighboring states with net metering the more likely a given state is to adopt it itself. Likewise the more states within a given state's EPA region that adopt, the more likely the state itself is to adopt. Stoutenborough and Beverlin tested a variety of state political and social variables with a mix of results. States with more liberal governments and the presence of a public-utility commission were more likely to adopt while, oddly, states with more professional legislatures were less likely to adopt net metering. Neither citizen ideology (unlike Matisoff) nor population density affected adoption of net-metering. Finally, Stoutenborough and Beverlin test several variables that relate to the energy characteristics or policies of the states finding that: (1) solar potential did not affect net-metering adoption but windier states were more likely to adopt; (2) states that consume more electricity were more likely to adopt but states with nuclear power plants were less likely to adopt; and (3) "greener" states (defined by their adoption of environmentally-friendly policies) were more likely to adopt, but states that adopted renewable-energy financial incentives were neither more nor less likely to adopt net-metering.

A Model of Solar Incentive Adoption

The general approach we take is interchangeably called event history analysis and survival analysis. The former name is more common in public policy research. The latter name derives from the method's roots in medical research where often, quite literally, survival was the dependent variable. This origin also helps explain the presence of other grim terminology in survival analysis, such as hazard, failure, frailty, and risk set. This terminology creates awkwardness for public policy analysis, as with this paper, where the question of interest is often the creation of a new policy. In the language of survival analysis a policy adoption is a failure, survival references the period up to adoption, and hazard refers to the risk of adoption in a given period.

By far, most event history analyses, including virtually all within public policy, focus on a single event per unit of interest. In many contexts this makes sense. A mortality study is by definition a single-event analysis. Once an individual reaches failure, i.e., dies, she ceases to be at risk for death and thus the observation associated with that individual exits the set of observations still at risk. Likewise, when a state adopts a new policy and its actions thereafter are merely incremental adjustments to that policy, treating the process as a single event is appropriate. Take Berry and Berry's (1990) seminal work on lottery adoption as an example. In that case the question was what factors influenced a state to go from the condition of having no lottery to the condition of having a lottery. For most states, lottery legislation post-adoption mainly made adjustments to the policy.

In single-event cases such as the lottery or adoption of Renewable Portfolio Standards (Stoutenborough and Beverlin 2008), the analyst focuses on the covariates that affect whether and how fast a given state adopts a policy. However, some policies are better thought of in terms of multiple events, and modeling them as single events discards substantial information and potentially produces misleading results (Jones and Branton 2005; Box-Steffensmeier and Jones 2004). This is the case with solar incentives as over time states added, renewed, and replaced various incentives. Consider Arizona and Florida as examples. From 1974 to 2007 Arizona adopted or substantively revised solar incentives in 1974, 1975, 1977, 1996, 1997, and 2006. Florida adopted or revised solar incentives in 1980, 1997, 2006, and 2007.

Given the multiple-events nature of the solar incentive data we adopt the repeated-events (or conditional-gap-time model) Cox estimation suggested by Jones and Branton (2005). This is a variation of the Cox proportional-hazards model (Cox 1972 1975). The Cox model itself is quite popular in survival analysis because of its flexibility and adaptability to different settings (Box-Steffensmeier and Jones 2004).

As noted earlier, with a standard single-event model the unit of concern exits the analysis once failure is reached. In our context, then, a single-event model has a state exiting the analysis as soon as a single solar incentive is adopted. In the repeated-event model we estimate, all states stay in the analysis for the full duration of the study (1974-2007). We treat the adoption of any type of solar incentive in a given year as a solar adoption. At the outset, all states are at risk of adopting their first incentive.[2] Once a state adopts its first incentive it then enters a second risk

[2] A necessary limitation is that multiple incentives adopted in a single year are counted as a single adoption for that year. Likewise different types of incentives (property tax, sales, etc) are treated as equivalent. We also tested a competing risks model (Jones and Branton 2005) where the different types of incentives are modeled individually

set as a state in risk of adopting another incentive. When that state adopts another incentive it then enters a third risk set and so on. Thus as we move through time the states get sorted (or stratified) into different risk sets, but all remain in the analysis. Time or duration is conditional on how long the state is in a given risk set. In other words, the "clock" restarts when a state enters a new risk set.

A key attribute of this type of model is that the sequence of adoption is ordered. The model is not simply pooling all of a state's adoptions or mimicking an event-count model (Box-Steffensmeier and Jones 2004: 157n1). Rather in our approach the sequence of adoptions, the number of years with adoptions, and the length of time between adoptions are explicitly accommodated by the model and the impact of the covariates assessed accordingly.

In the analysis that follows our dependent variable is whether a given state adopted or substantively revised some type of incentive for purchase and use of solar technology in a given year. Forty-eight states are included in the dataset for the full span of years (1974-2007)[3] with one observation per state per year. For independent variables we focus on factors that relate directly to energy policy and the socio-political context of the state.

Table 1 suggests that a number of states not known for extensive sunshine (e.g., Massachusetts) offer solar incentives. Nonetheless we expect solar potential to increase the chances of solar incentive adoption for states. *Solar Potential* is measured by the statewide average annual amount of energy received from the sun in Watt hours per meter squared per day. Likewise we expect that states with higher energy prices will adopt more. *Real Electricity Prices* is the residential-sector electricity price for the state for the year as reported by the Department of Energy, adjusted into real dollars per million BTU. Residential energy prices are used because most solar incentives support residential technologies (Sarzynski 2009b). We expect states with a *Renewable Portfolio Standard* in place to adopt more incentives, and measure presence of an RPS with a dummy variable. The last variable that directly addresses solar or energy context is a dummy variable control for *Federal Policy* defined as the years in which the federal government offered an income-tax-credit for residential solar investments (i.e., 1978-1985 and 2006-2007).

In addition we include variables meant to capture the socio-political context of the states. Most important is *Citizen Ideology*. Many studies on policy adoption, including Matisoff's (2008) analysis of RPS adoption, find a relationship between adoption and the general ideological disposition of the state's citizens. We test for this using Erikson, Wright, and McIver's (1993) well-known measure which uses public opinion surveys to derive a mean position for each state

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within a larger model. The results indicated that the differences among incentives type were not significant and that our modeling strategy used here – treating all incentives the same – is correct.

[3] Gaps for some of our independent variables forced us to drop Hawai'i and Alaska, as well as the District of Columbia, from the analysis. Likewise, missing data prevented us at this writing from yet including 2008.

on a liberal-conservative continuum. We expect a positive relationship between ideology and risk for adoption indicating that more liberal states are more likely to adopt.[4]

We control for each state's economic context with *Real Per Capita Income* and *Logged Population* with the general expectation that both will prove positively related to adoption risk. To see if the *Election Year* affects adoption we include a dummy variable for state legislative election year (which for all but five states occurs in even years). Finally, in the 1970s it was still the case that many states met only in biennial legislative sessions. Since states cannot adopt solar incentives in years not in session, we included a control for *No Legislative Session*.

Note that we do not include variables that explicitly capture external effects, such as diffusion from other states. As we noted earlier, the mosaic of solar incentives across the states do not suggest much diffusion of policies. Regardless, the repeated-events model we use here does not lend itself to directly controlling for the effect of other states. We did test two models that included regional dummy variables (Census and EPA definitions, respectively). While none of the regional variables proved statistically significant they did render our models in violation of the proportional hazards assumption and were dropped.

4. Results

The coefficients produced by the Cox proportional hazard estimates are directly interpretable only in terms of direction. A positive coefficient indicates that hazard rate is increasing with increases in the given covariate. Thus "positive coefficients imply shorter survival times; negative coefficients imply longer survival times" (Box-Steffensmeier and Jones 2004: 59). For our purposes, then, a positive coefficient indicates that with higher values of the covariate a solar incentive is more likely to be adopted.

As indicated in Table 2,[5] a state's *Solar Potential* is both positive and statistically significant, as is the coefficient for *Real Electricity Prices*. Also as expected *Renewable Portfolio Standards* are positive and statistically significant. In contrast neither the presence of federal tax incentives for solar (*Federal Policy*) nor a state's population (*Logged Population*) is associated with solar incentive adoption. At quite weak levels of statistical significance the model shows a negative relationship between *Real Per Capita Income*. This is a surprising result as conventionally we

[4] We also tested the Berry et al. (1998) dynamic alternative to the McIver et al. measure of citizen ideology as well as their measure of government ideology (a weighted-average of the ideology of a state's elected officials in a given year). We found virtually identical results for the Berry et al. citizen ideology variable that we report with the McIver et al. measure. The Berry et al. state government ideology variable proved far from statistically significant. Given that the Berry et al. dataset extends only to 2006 we opted to use the McIver et al. citizen ideology measure.

[5] A key assumption in Cox models is that the effects of covariates do not change with time, only with changes in the values of the covariate. We tested the proportional hazards assumption using the Schoenfeld residuals test suggested by Box-Steffensmeier and Jones (2004). The tests proved negative for each covariate and the model globally.

would expect higher income states to adopt more solar incentives. The main explanation turns out to be *Citizen Ideology*. Liberalness is strongly associated with solar adoption. Income and

Table 2: Stratified Cox Model of Repeated Solar Incentive Adoptions, 1974-2007

Variable	Coefficient	Robust s.e.	Hazard Ratio
Solar Potential	.0006***	.0002	1.001
Real Electricity Prices	.0366***	.0113	1.04
Renewable Portfolio Standard	.9391***	.2939	2.56
Federal Policy	.2969	.1907	1.35
Logged Population	-.0574	.1404	0.94
Real Per Capita Income	-.0001*	.00004	0.9999
Citizen Ideology	.6169***	.1816	1.85
Election Year	-.5909***	.1484	0.55
No Legislative Session	-.2460	.4675	0.78
N	1632		
Wald $\chi^2(9)$	116.06***		
Log-Likelihood	-731.939		

*** $p<.01$ ** $p<.05$ * $p<.10$ (two-tailed). Standards errors are clustered by state.

citizen ideology are positively associated (r=.45) and the presence of the ideology variable effectively turns the income variable negative.[6]

Finally, legislatures are less likely to adopt solar incentives during an *Election Year* and the control for biennial sessions (*No Legislative Session*) yielded a negative but not statistically significant coefficient.

Moving beyond the question of statistical significance is the question of substantive significance. What is the actual impact of the various covariates on solar-incentive adoption? One way to examine substantive significance is through hazard ratios, the ratio of the hazard rates of two different values of the covariate (Box-Steffensmeier and Jones 2004: 50). A hazard rate, in our context, is the probability that a state adopts an incentive by year t given survival (or non-adoption) until year t (Box-Steffensmeier and Jones 2004: 14).

Table 2 reports the hazard ratios for the various coefficients. The closer the ratio is to 1.0 the less impact changes in the given covariate make on adoption. In the case of a dummy variable the

[6] Running the same model but without *Citizen Ideology* yields a positive but not statistically significant coefficient for *Real Per Capita Income*. However, further tests showed no presence of an interaction effect between the two variables.

hazard ratio is interpreted as the hazard rate when the dummy variable is equal to one (e.g., the state has an RPS) relative to the hazard rate when the dummy variable is equal to zero (e.g., the state has no RPS). In the case of a continuous variable the hazard ratio reflects the impact of a one-unit increase in the value of the variable over its previous value (Cleves et al. 2008: 131).

The hazard ratio for *Solar Potential* shown in Table 2 (1.001) indicates that a one-unit increase in a state's potential for solar yields a .1% increase in the adoption hazard. As we show below, this adds up to a substantial impact for solar potential across the full range of the variable. For *Real Electricity Prices* a one-unit increase increases the adoption hazard by 4%. The *Renewable Portfolio Standard* hazard ratio shows that the risk of adoption is 2.56 times greater for a state with RPS relative than for a state without an RPS. By being below 1.0, the hazard ratio for *Real Per Capita Income* indicates that an increase in per capita income is associated with a drop in the adoption hazard, but the number is so trivially below 1.0 as to render the relationship substantively unimportant. *Citizen Ideology*, in contrast, exhibits a powerful effect. A one-unit increase in a state's liberalness score is associated with an 85% increase in the adoption hazard. Finally, an *Election Year* exhibits a 55% lower adoption hazard relative to non-election years.

A clearer way to show the effect of the non-binary variables is to graphically show the hazard ratios across the full range of values. This is done for selected variables in figures 1 through 3. As the figures indicate, *Solar Potential*, *Real Electricity Prices,* and *Citizen Ideology* all dramatically affect the underlying hazard ratios.

5. Discussion and Conclusion

Our repeated-events analysis suggests several conclusions about the factors that affect solar-incentive adoption. We expect factors related to the state's energy conditions to be most important in determining which energy policies it supports. Thus it is natural that states with strong solar resources are more likely to incentivize solar than states with weaker solar resources. It is also natural that places with higher electricity prices will look to alternative energy sources to encourage future savings. Indeed, we find that sunnier states and states with higher electricity prices are more active on solar-incentive adoption. Yet, we also find at least as powerful an effect, if not more powerful, for citizen ideology. This finding fits with earlier work by Sawyer and Friedlander (1983) in which a state's policy innovativeness appeared most important in predicting the size of the solar incentive offered.

Our finding on citizen ideology confirms (again) that politics matters. The aggregate ideology of a state's citizenry directly affects the adoption of solar incentives. This is hardly a startling conclusion. Indeed, much of the literature on policy adoption – across a wide range of policy types – finds a relationship between citizen ideology and a state's policy outputs. From a democratic governance standpoint this is usually a good thing (Erikson, Wright, and McIver 1993). For those who want to see the states take a more active role in formulating policies conducive to solar power (and perhaps renewable energy more generally) the role of ideology suggests a natural limit on the types of states likely to aggressively pursue solar power. Of course, it is true that the federal government could effectively trump or shape all state efforts with a national initiative. Keep in mind, however, that the U.S. Senate will play a powerful role in shaping future federal renewable-energy policies. The citizen ideology of a state shapes the behavior of its senators and the dynamics of the Senate often gives smaller, more conservative states inordinate influence (Lee and Oppenheimer 1999).

While ideology plays a clear role it is not clear that a state's capacity to address policy problems – here measured by per capita income, a variable frequently important in the policy adoption – literature plays a key role in affecting solar incentive adoption.

It appears to be the case that state Renewable Portfolio Standards independently and dramatically affect solar-incentive adoption. In looking at many of the states that currently have RPS in place it does appear that the states are turning to solar incentives as a way to comply with the standards.

Future, revisions and extensions of this paper will address several components not fully addressed here, including the addition of 2008. Another is to continue to develop a competing-events model where we account for why states adopt different types of incentives. Such a model will allow us to more fully account for the possibility of external influence, such as leader states or diffusion from neighbors. As noted earlier, this is hard to address in a stratified model but it can be addressed in a competing event model.

Figure 1: Impact of Varying Levels of Solar Potential on Hazard Ratios for Solar Incentive Adoption, 1974-2007

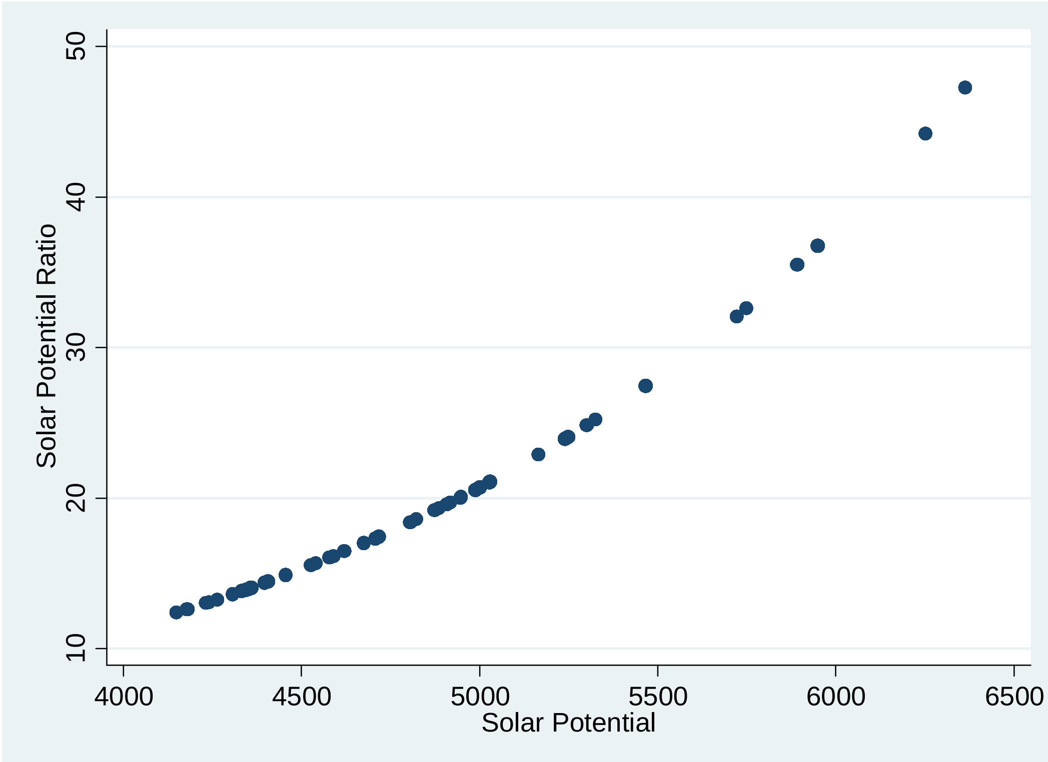


Figure 2: Impact of Varying Levels of Real Electricity Prices on Hazard Ratios for Solar Incentive Adoption, 1974-2007

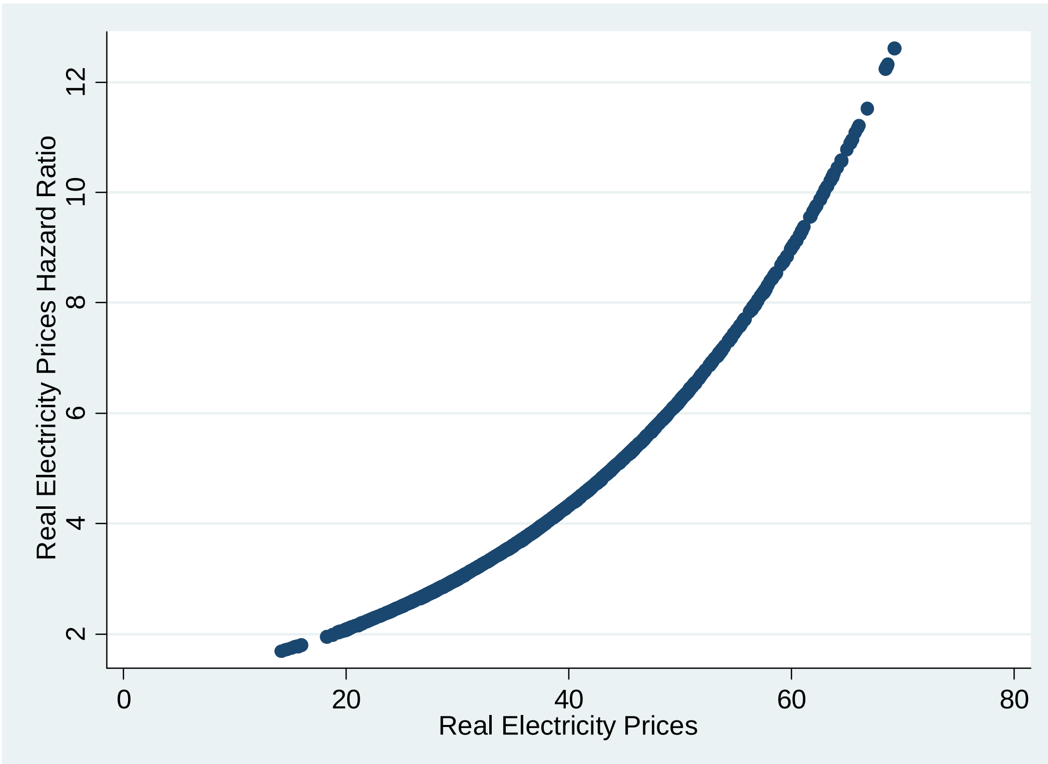
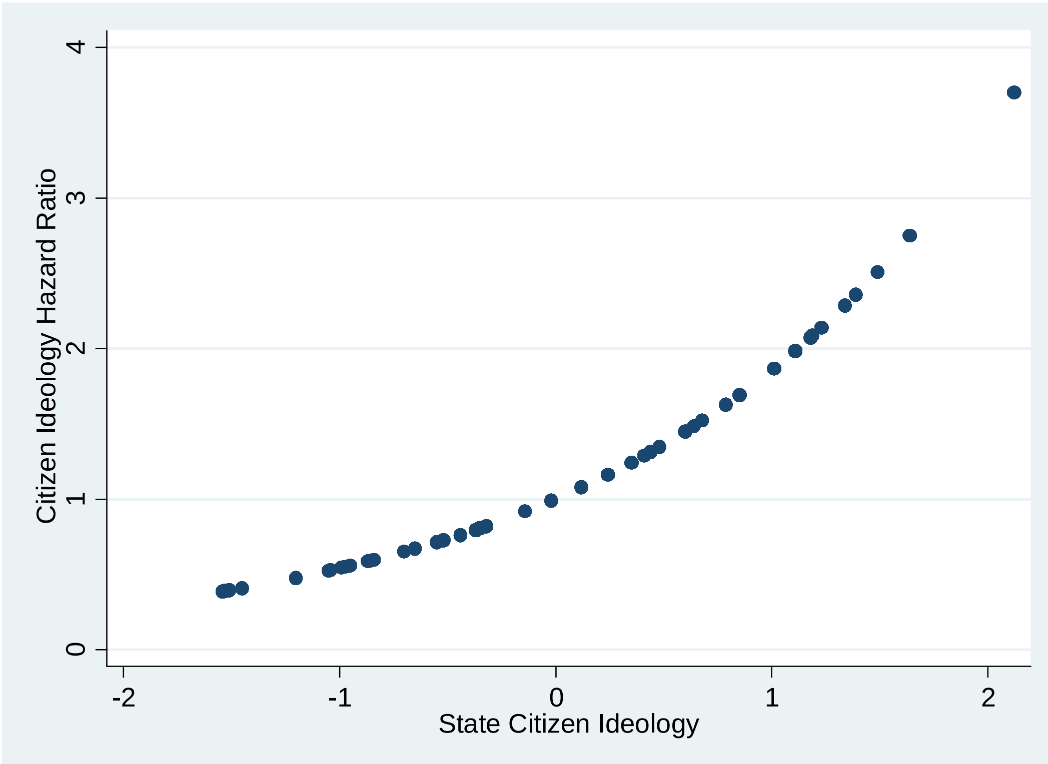


Figure 3: Impact of Varying Levels of Citizen Ideology on Hazard Ratios for Solar Incentive Adoption, 1974-2007



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