The Effect of Lobbying Contributions on Elections

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Abstract

In the U.S. elections the policies concerning energy and natural resource play an important role. This fact leads to increasingly active lobbying in the energy sector. Polarized interest groups compete to influence the decision-makers through monetary contributions. We propose a simple common agency model to study the effect of lobbying contributions on the results of elections. This model predicts that the less conservative party receives more contributions and that contributions have little effect on the results of elections. We test empirically the predictions of the model and we find that Democrats generally receive more contributions than Republicans. We also find that the election status has little correlation with the amount of contributions.

1. Introduction

Lobbying is a primary way through which interest groups, including firms and individuals, attempt to influence policymakers in the United States. Recent studies show that the lobbying industry is rather exclusive, and run by few players not only on the Federal level, but also on the state level. There are few requirements for entry into the lobbying industry. R. Kerr et al (2011) introduce the notion of lobbying capital, which is an important entry requirement in the lobbying industry.

In this paper we re-define the notion of lobbying capital as a stream of monetary contributions. Our motivating observation is that although the election results are highly uncertain, people may contribute for long periods to different politicians who fail to be re-elected. In this paper we analyze the relationship between the amount of monetary contributions (the lobbying capital) from interest groups and the results of elections at the state level. We focus on the energy and natural resource sector (thereafter the energy sector) as this sector is highly involved in lobbying in the U.S. Also, according to a 2012 report[1] conducted by U.S. Energy Information Administration (eia), the energy

[1] Annual Energy Review 2011, available at http://www.eia.gov/totalenergy/data/annual/index.cfm

expenditure remains a major share of U.S. GDP from year 1985 to 2010 as shown in Appendix Figure 1. This sector is now still a crucial component of U.S. economy and has become a major issue in elections in recent years. In 2012, the energy and natural resource sector comprised 6.7% of total lobbying contributions.

As an illustrating example, we choose Pennsylvania. Pennsylvania is considered a battleground or purple state[2] (Figure 2) for elections in the U.S., based on compiling the average margins of victory in the five presidential elections between 1992 and 2008.[3] This indicates there is nearly equal support for both polarized parties at election time. As shown in Figure 3, the current Senate party membership in Pennsylvania is also about half Democrat and half Republican.

The model that we use in this paper is the common agency model of policy formation from Martimort and Semenov (2007).[4] The idea of the model is that the polarized interest groups compete to influence a decision-maker through monetary contributions. The decision-maker chooses a one-dimensional policy and has private information about her ideal point. Competition between interest groups under asymmetric information yields a rich pattern of equilibrium strategies and payoffs. In our paper, there are two polarized groups: contributors to Democratic candidates, and contributors to Republican candidates. These groups attempt to influence policies by contributing to the election candidates each year. The candidates are the decision-makers in the common agency model. However the influences neutralize each other and in equilibrium contributions do not play an important role.

Based on the model, we propose two empirical hypotheses. Firstly, the Republican Party will generally receive more contributions than the Democratic Party in a purple state. Secondly, the lobbying capital has no obvious effect on the overall election status, but minor effect on the Republican candidates' election status.

For the empirical part, we test the relationship between the lobbying contributions and the election results, and the relationship between the

[2] Red states and blue states refer to those states of the U.S. whose residents predominantly vote for the Republican Party (red) or Democratic Party (blue) presidential candidates. Purple state stands for the approximately equal involvement of these two parties and is considered the battleground in elections.

[3] Three of these past elections were won by Democrats, Bill Clinton in 1992 and 1996, and Barack Obama in 2008, while two were won by the Republican George W. Bush in 2000 and 2004.

[4] This model was cast earlier by Bernheim and Whinston (1986) in a complete information abstract framework and then adapted by Grossman and Helpman (1994) and others towards various political economy applications (international trade, tax policies, regulation, etc.).

recipients' political parties and the lobbying contributions. We use a six year (2002, 2004, 2006, 2008, 2010, and 2012) panel data including total lobbying contributions for individual recipient in each year, the separate lobbying contributions from nine major industries in the energy sector, the recipients' political parties and their election results. The resulting dataset is sorted out from six separate raw datasets for each year from followthemonry.org. To test the predictions we suggest five regression models, which include the pooled OLS estimation, random effects regression and multivariate probit estimation methods. While the empirical results of this study may be specific to the energy sector, the method we propose in this paper is general and can be readily applied to other sectors.

The structure of the paper is as follows. Section 2 reviews the literature. Section 3 explains each variable and describes statistics for the empirical data. Section 4 outlines the theoretical model. Section 5 derives the testable hypotheses and states the empirical strategies. Section 6 examines the empirical results. The last section concludes and discusses the policy implications of the results and possible further work.

2. Literature Review

The study of Kerr et al (2011) analyzes the persistence of a lobbying firm status. By considering a dynamic model of firm behavior similar to Roberts and Tybout (1997), they prove theoretically and empirically the existence of up-front costs associated with the beginning of lobbying. They establish the following: few firms lobby, lobbying is strongly associated with firm's size and lobbying behavior exhibits a high degree of persistence. In our paper, we consider different barriers to entry to the lobbying industry, as defined by McAfee et al (2004).

Our empirical model is based on the model of ideological uncertainty and lobbying competition by Martimort and Semenov (2007). In their paper the capital requirement is the major determinant for lobbying. To maximize the social welfare they consider a two-sided lobbying game. On one side, the polarized interest groups influence the decision-making process by monetary contributions. On the other side, the ideologically motivated decision-maker makes the final decision based on the amounts of received contributions and her

ideology. In the decision maker's quasi-linear preferences function, there exists a parameter β, which characterizes how the agent trades off contributions against his own ideological bias. Goldberg and Maggi (1999) estimated β in the U.S. patterns of protection to be between 50 and 88. Bradford (2003) suggested a lower value of β but still higher than one.

Several other papers closest to ours have been concerned with the relationship between lobbying and the equilibrium policies. Besley and Coate (2001) use their well-known citizen candidate framework and come to the conclusion that if citizen candidates with extreme enough preferences are available, lobbying has no influence on the implemented policy. Klingelhöfer (2012) shows this result does not apply in a model with ideological parties instead of citizen candidates. Moreover, Kang (2011) studies the extent the lobbying expenditures affect the probability that a policy is enacted. He finds that the effect of lobbying expenditures on a policy's equilibrium enactment probability is small.

The reason why lobbying has little influence on the equilibrium policies draws Baron and Hirsch (2010, p.641)'s attention, as they point out "*...lobbying can be counteractive, where the influence of the lobbies is offsetting, resulting in little influence on policy in the legislative bargaining and leaving the lobbies worse off than if lobbying were prohibited.*"

Most of these papers share the same point that the ideology of decision-maker determines the selection of the policies and confirm the main finding in our paper; the lobbying capital has little effect on the elections result.

3. Data and Descriptive Statistics

We use data available from followthemoney.org - the official Web site of the National Institute on Money in State Politics (NIMSP). This is a nonpartisan, nonprofit organization that reveals the influence of campaign money on state-level elections and public policy in all 50 U.S. states.

We use the even year data for the energy sector in Pennsylvania from year 2002 to 2012. This is because all the odd year data from periods 2002-2012 are incomplete; for instance, there are only 16 candidates in the year 2011, corresponding with 147 records. Also, using the panel data with year gap

extends the total period, which is more appropriate for medium-run and long-run predictions.

After downloading the six data file for every single year from followthemoney.org. We find they are not ready for statistical analysis in STATA due to the following reasons:

First of all, each file is cross-sectional and contains numerous contribution records for a single candidate. Therefore, STATA cannot identify the data file as a panel data if we simply append the six cross-sectional files into one big dataset.

Secondly, every contribution is recorded upon the contributors' name. The donor may contribute to either Democratic or Republican candidate based on her preference. In this case, it is impossible to analyze the relationship between the political parties and the lobbying contributions from contributors' point of view. Therefore, we must sort out the contributions from political candidates' side.

Thirdly, according to the definition of NIMSP, the energy and natural resource sector includes thirteen industries in Pennsylvania. However the lobbying contributions in four industries together only occupy a less than 0.7 percent of the total amount. Also, including thirteen industries in the regression model seems to be more than needed.

Fourthly, the election candidates belong to four political parties in Pennsylvania: Constitution, Democrat, Libertarian and Republican. However, Constitution Party and Libertarian Party have only 2 and 7 records respectively in the 26808 records. It is principally the Democrat and Republican who compete in the election of Pennsylvania.

Last but not least, the monetary values are not adjusted for inflation. However, according to our investigation, the buying power of the U.S. dollar changes over time, so does the inflation rate. From Figure 4, we know that the annual inflation rate of U.S. fluctuates between 0.1% and 4.1% from 2003-2013.

As a result, we rearrange the every raw data files according to the following steps:

- ✧ Drop the variables that are irrelevant to our analysis, e.g. contributions' ID number, contributors' occupation, recipients' state. For more dropped variables, see appendix Figure 5;

- ✧ Drop contribution records of four minority industries: Aluminum Mining & Processing, Environmental Service & Equipment, Nuclear Energy and Smelting & Refining;
- ✧ Drop contribution records for Constitution and Libertarian candidates;
- ✧ Resort the data by recipient name, with her political party, total amount received, separate amount received from nine industries and her election result;
- ✧ Sum up the monetary amount of contributions for the same recipient.
- ✧ Adjust the monetary values for inflation in the U.S.

To adjust for inflation, all totals and tables in this paper are converted to 2012 dollars by using the information in www.usinflationcalculator.com. This website help us to easily calculate how the buying power of the US dollar has changed from 1913-2013.

Take year 2002 as an example, the Figure 6 shows an item that costs 1 dollar in 2002 is costing 1.28 dollars in 2012. The U.S. dollar actually depreciates. The purchasing power of 1 dollar is higher in 2002 than in 2012. 1 dollar in 2002 is worth 1.28 dollars in 2012. As a result, we multiply the entire monetary values by 1.28 in the 2002 data file. By duplicating the same method, we get the inflation multiplier for the other years.

Table 1: Inflation Multiplier (2002-2012)

Year	2002	2004	2006	2008	2010	2012
Inflation Multiplier	1.28	1.22	1.14	1.07	1.05	1.00

After finishing all the steps, we append the six new cross-sectional data files and finally get a resulting dataset that could be identified as a panel data in STATA. Compared to other sectors such as labor and finance, the energy sector received average amounts of contributions. Also, due to the specialty of the lobbying industry, the sample size is relatively small. The resulting data set is a panel of 1664 weakly balanced individuals, since the recipient may not occur in every single year of the election.

The dependent variable for the first two regressions ‘Amount’, which is the aggregate monetary contributions that a single candidate received for each year

and therefore, takes continuous value. For the other three regressions, we take 'Election Status' as the multivariate dependent variable. It is a dummy variable that contains six possible statuses: disqualified, lost in the general election, lost in the primary election, not up for election, withdrew, and won. We also drop 35 observations related to the contributions for the organizations such as "House Democratic Campaign of Pennsylvania," which has no corresponding election status.

We have ten variables that could be served as independent variables in our regression. These are 'Electric Utilities', 'Hunting', 'Mining', 'Miscellaneous Energy', 'Oil & Gas', 'Railroads', 'Steel', 'Waste Management', 'Water Utilities', and 'Party'.

The first nine variables are the monetary amounts that election candidates received from each industry. Including these variables in our model increases the correlation between the dependent variables and the independent variables, thus reduces the estimation error. 'Party' is a dummy variable that takes two values – 'democrat' or 'republican'. For example, if the recipient is a candidate for the Democratic Party, it is marked as 'democrat' in the data.

Appendix Table 1 describes statistically the resulting dataset. From mean values in Appendix Table 1, we know that most of the contributions are from Electric Utilities, Mining, Oil & Gas, Railroads, Steel, and Waste Management industries. For our Party variable, 42.3% of candidates are Democrat while 57.7% are Republican, indicating a relatively well-balanced number of candidates from each party in Pennsylvania. For the election results, 74.5% of the total candidates have won the election, while 14.4% lost. Together this comprises 90% of the total candidates. The other ten percent of the candidates are disqualified, or not up for elections, or withdrew from the elections.

4. The Model

We consider a model variant to Martimort and Semenov (2007). In their model, the ideal policy of the decision-maker is private information. We simplify their model by taking the ideal policy of the decision-maker constant and specify the two polarized interest groups as Democrat and Republican. Additionally, we do not taking the coalition of the interest groups and the competition of the interest groups into account.

Our model basically states that two polarized interest groups contribute to the Democratic candidates and Republican candidates to influence their decision-making process and their election results. The interest groups and decision-makers have their own utility functions. At the equilibrium, both of their preferences are maximized.

4.1 The Interest Groups - Contributors

Every year, the politicians receive contributions from interest groups P_i $(i = 1, 2)$. In our model, the interest groups are divided into two categories: 1 represents the interest groups that contribute to the Democratic Party, 2 represents those contributing to the Republican Party. Let $q \in \mathbb{R}$ be a one-dimensional policy parameter controlled by the decision-maker. Interest groups have a quasi-linear utility function over policies and monetary contributions from the interest group i to the decision-maker t_i which are given by:

$$V_i(q, t_i) = -\frac{1}{2}(q - a_i)^2 - t_i$$

The parameter a_i is P_i's ideal point in the one-dimensional policy space. The value of a_i is common knowledge. The ideal points of the interest groups are symmetrically located around the origin, and without loss of generality, we use the normalization $a_1 = -a_2 = 1$.

4.2 The Decision-Makers - Recipients

The decision-maker (the common agent) receives contributions from different contributors. She makes a decision based on the amount of contributions and her own ideology. The decision-maker has a quasi-linear utility function given by

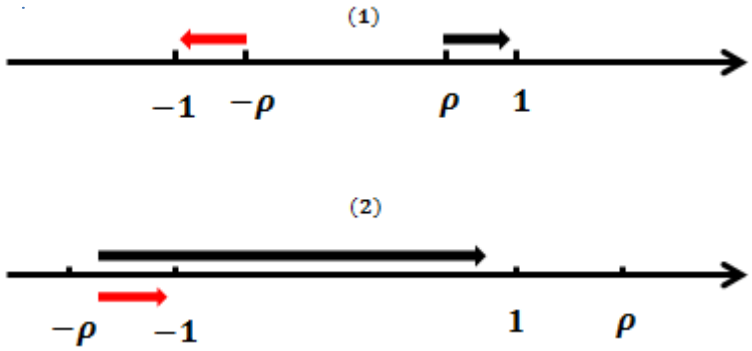
$$U\left(q, \sum_{i=1}^{2} t_i, \theta\right) = -\frac{\beta}{2}(q - \theta)^2 + \sum_{i=1}^{2} t_i$$

The parameter $\beta \geq 0$ characterizes the trade-off between contributions and the recipient's own ideological bias. When β is large the decision maker puts more weight on the ideology, which implies that the interest groups have to contribute more to influence the recipient.

The decision-maker's ideal policy θ is common knowledge. This parameter belongs to a set $\Theta = (-\rho, \rho)$ where ρ represents the degree of ideological uncertainty. The decision-maker has moderate views when her ideal point lies near the origin and more extreme views otherwise.

As shown in the graph below, the set $A = (-1, 1)$ represents the ideal point of two polarized groups. When ρ increases from (1) to (2), polarization between the two groups on the particular policy decreases since it becomes more likely that the groups' ideal points are relatively closer to each other than to the idea of decision-maker. They both want to move the policy-makers to the same direction.

Figure 1: Increase of decision-maker's ideological uncertainty



Interest groups credibly commit to offer non-negative contributions $t_i(q) \geq 0$ to affect the decision-making process. The function $t_i(q)$ represents group i's monetary transfer, according to decision maker's policy choice q.

4.3 Timing of the Game

- ✧ Interest groups non-cooperatively offer contributions $\{t_1(q), t_2(q)\}$ to the decision-maker;
- ✧ The decision-maker decides whether to accept or refuse each of these offers. If she refuses all offers, he chooses his most preferred policy and obtains his payoff of zero;
- ✧ Finally, if the decision-maker accepts the offers, he chooses the policy q and receives the corresponding payment.

The contributions are non-negative. Since it is possible that the

decision-maker is informed about his ideal point but contributors do not have this information, a weakly dominant strategy for the decision-maker is to always accept all offers. The equilibrium concept is subgame-perfect Nash equilibrium[5] and we focus on pure strategy equilibrium.

4.4 The Equilibrium

Under complete information (see Martimort and Semenov (2007)), there exists an equilibrium of the common agency game between lobbyists that achieve an efficient policy $q^*(\theta)$ maximizing the aggregate payoff of a grand-coalition, comprising both of the two interest groups and their common agent:

$$q^*(\theta) = arg\max_{q\in\mathbb{R}}\left\{\sum_{i=1}^{2} V_i(q,t_i) + U(q,\sum_{i=1}^{2} t_i\,,\theta)\right\} = \frac{\beta\theta}{\beta+2}$$

As the decision-maker's ideological bias becomes more pronounced (i.e., β increases), the optimal policy is shifted towards her own ideal point. Nevertheless, this policy always reflects both groups' preferences.

To achieve such efficient outcome, interest groups offer the truthful contributions (Bernheim and Whinston, 1986; Dixit et al., 1997):

$$t_i(q|\theta) = max\left\{0, -\frac{1}{2}(q-a_i)^2 - C_i(\theta)\right\}\text{ , for all q,}$$

and for some constant $C_i(\theta)$ (that we leave unspecified for simplicity) where we make explicit the dependence of this schedule on θ since this parameter is common knowledge. The agent is always (at least weakly) better off accepting such non-negative contributions, and with such payments, each interest group P_i makes the decision-maker residual claimant for the payoff of the bilateral coalition. This ensures that preferences are aggregated efficiently.

Although strict concavity of the objective functions ensures uniqueness of the efficient policy, many possible distributions of equilibrium payoffs might be feasible depending on θ. A payoff vector for the interest group corresponds to a

[5] A subgame perfect Nash equilibrium is an equilibrium such that players' strategies constitute a Nash equilibrium in every subgame of the original game. It may be found by backward induction, an iterative process for solving finite extensive form or sequential games. First, one determines the optimal strategy of the player who makes the last move of the game. Then, the optimal action of the next-to-last moving player is determined taking the last player's action as given. The process continues in this way backwards in time until all players' actions have been determined.

pair $(C_1(\theta), C_2(\theta))$ which ensures that the agent is at least as well-off by taking both contracts than accepting only the truthful contribution of a single group.

4.5 The Example

Consider the case of a moderate decision-maker whose ideology is known to be located at 0. The efficient policy is $q^*(0) = 0$. Thus, there exists a unique equilibrium with truthful contributions given by:

$$t_i(q|\theta) = max\left\{0, -\frac{1}{2}(q - a_i)^2 + \frac{\beta\theta}{2(\beta + 2)}\right\}, \text{for all } q \text{ and } i = 1,2$$

It yields payoffs $U^*(0) = \frac{1}{1+\beta}$ to the decision-maker and $V_i{}^*(0) = -\frac{\beta\theta}{2(\beta+2)}$ to each group.

5. Empirical Strategy

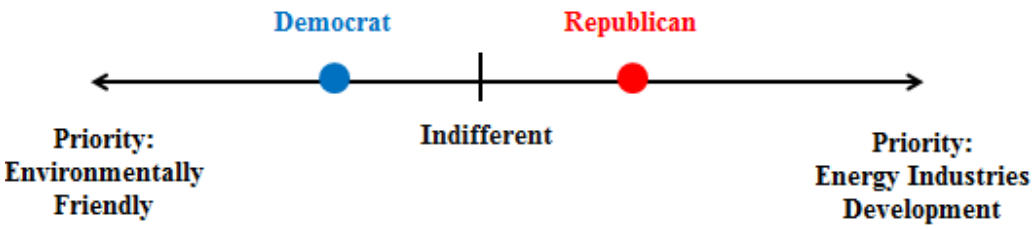
5.1 Evidences for $\beta_D > \beta_R$

Our empirical strategy based largely on the assumption that $\beta_D > \beta_R$. Again, β is the trade-off between contributions and the recipient's own ideological bias in the decision-maker's utility function. $\beta_D > \beta_R$ means the Democratic decision-maker puts more weight on the ideology than the Republican decision-maker. The evidences we collect for this assumption is as follows:

5.11 Democrats' Platform vs Republicans' Platform

From the Appendix Table 2 we can see that both parties promote distinct visions of an "all-of-the-above" approach to energy. The Republicans' vision seeming to rely primarily on the development of America's fossil fuel resources and a business-friendly regulatory regime, while the Democrats' platform promotes a "move towards a sustainable energy-independent future" that would allocate resources between fossil fuel and renewables development, alongside to a variety of "green" initiatives.

Figure 2: Trade-off line between environment and industry development



In this case, on the line of trade-off between environment and energy firms (Figure 2), the Republican is more on the energy firms' side while the Democrat is more approaching environmental side. This supports our argument that Democrats put more weight on the ideology than the Republicans.

5.12 Paper Evidence

In the Schroedel (1986), the author chooses financial sector for the analysis and argues that the Bank Underwriting Bill provides an excellent test of the impact of campaign contributions since it pits powerful financial interests against each other while minimizing the confounding effects of public pressure. He uses the logit model method to pursue the empirical tests.

The result shows that Republicans strongly favor and Democrats strongly oppose the measure, given that Republicans and Democrats are sharply divided over the merits of the Bank Underwriting Bill. This means the impact of campaign contributions is much more revealed for the Republicans than the Democrats. The result also supports the research of Ferguson and Rogers (1981).

5.13 Figures of Lobbying Contributions[6]

In the 2006 election cycle, oil and gas companies contribute over $19 million to

[6] Figures in 5.13 are from Fossil Fuels Lobby, Wikipedia - the free encyclopedia, available at https://en.wikipedia.org/wiki/Fossil_fuels_lobby

political campaigns. 82% of that money goes to Republican candidates, while the remaining 18% goes to Democrats.

In 2004, oil and gas companies contribute over $25 million to political campaigns, 80% of the total donations goes to Republicans.

In the 2000 elections, over $34 million is contributed, with 78% of that money going to Republicans. Electric utilities also heavily favor Republicans; their contributions for Republicans range between $15–20 million.

From the contributions history in the Energy sector, we can see the energy industries heavily favor Republicans than Democrats. This indicates that if the analysis can be reversed - larger contributions would imply larger weights on beta - in our paper, the Democrats definitely weight more on the ideology thus has a larger beta compared with the Republicans.

5.14 Other Evidences

"Republicans, Democrats at odds on energy issues"[7] notes "*Republicans and Democrats seem to be living on different planets when it comes to how to meet U.S. energy needs. Republicans overwhelmingly push for more oil drilling. Democrats back conservation and new energy sources such as wind and solar power…"*

A survey by The Associated Press-NORC Center for Public Affairs Research shows that the polarized positions on energy that have divided Congress and emerged in the presidential campaign also run deep among the public.

For example: Three of four Democrats surveyed report that a major reason for the county's energy problems is that industry does not do enough to support clean energy. By comparison, 43 percent of the Republicans questioned believe that.

Three of four Republicans in the poll cite government limits on drilling as a major reason for energy problems, compared with 34 percent of Democrats.

Republicans also shines a spotlight on the failure of Solyndra, a California

[7] Dina Cappiello and Matthew Daly, "Republicans, Democrats at odds on energy issues", available at http://www.apnorc.org/news-media/Pages/News+Media/republicans-democrats-at-odds-on-energy-issues.aspx

solar company that received a half-billion dollar loan from the Obama administration and later went out of business. Just 4 in 10 Republicans support government incentive programs that give money to energy companies to help them develop alternative energy sources. Two-thirds of Democrats support such programs.

The above evidences show that the Democrats care more about the energy and environmental problem, which is the ideology part in our model and the Republicans care more about the business effect, which is the monetary part in our model.

5.2 Testable Implication 1

As Ribuffo (2011, p.6) notes, "*what Americans now call conservatism much of the world calls liberalism or neoliberalism.*" Also, the article *Conservatism in the United States*[8] notes that "…*Since the 1950s conservatism in the United States has been chiefly associated with the Republican Party …* Most U.S. conservatives prefer Republicans over Democrats…" We know that Republican Party is generally considered more conservative than the Democratic Party.

We argue that $\beta_D > \beta_R$ in the energy and natural resources sector in the United States. Since the Republican Party is more conservative than the Democratic Party, the Democratic decision-makers are more difficult to be influenced by contributions.

From the decision-makers' utility function, the agency's welfare is determined by two parts: their ideology and monetary contributions. We argue that the Republican Party receives more contributions than the Democratic Party as their decision making process is more determined by the monetary part.

As a result, we have the first hypothesis to be tested:

Hypothesis 1 The Republican Party receives more contributions than the Democratic Party.

We allow for the unbalanced panel data. It is appropriate to carry out a pooled OLS estimation in order to test our hypothesis. We are using the following regression model:

[8] Conservatism in the United States, available at http://www.answers.com/topic/conservatism-in-the-united-states

$$Amount_i = a_0 + a_1 EU_i + a_2 MN_i + a_3 OG_i + a_4 RR_i + a_5 ST_i + a_6 WM_i + a_7 Party_i + \varepsilon_i$$

The independent variables we choose in this model are based on the total amount raised for each industry. Electric utility(EU), Mining(MN), Oil & gas(OG), Railroads(RR), Steel(ST), Waste management(WM) are the top six industries in terms of contributions. We are not able to put all industries into the model because of the collinearity problem.

To further test the hypothesis, we also estimate fixed effects and random effects models. However, the fixed effect regression model omitted the Party variable because it does not change across time. The Random Effects model assumes that the entity's error term $\varepsilon_{i,t}$ is not correlated with the predictors which allows for time-invariant variable $Party_{i,t}$ to play a role as explanatory variable. The random effects model we are using is as follows:

$$Amount_{i,t} = b_0 + b_1 EU_{i,t} + b_2 MN_{i,t} + b_3 OG_{i,t} + b_4 RR_{i,t} + b_5 ST_{i,t} + b_6 WM_{i,t} + b_7 Party_{i,t} + Z_{i,t} + \varepsilon_{i,t}$$

Where $Z_{i,t}$ stands for the individual-specific random effects: it measures the difference between the average amount each individual *i* received in a single year and the average amount in the entire data set. It is "random" because the individual has been randomly selected from a larger population within the data set.

5.3 Testable Implication 2

In the equilibrium under complete information the aggregate payoff of the grand-coalition comprising both interests groups and their common agent is maximized. Thus the equilibrium of the lobbying game is efficient because it maximizes the social welfare.

Although the optimal policy always reflects both groups' preferences, it is shifted towards the decision-makers' own ideal point. As a result, the contributions have no effect on equilibrium policy. The public anticipates this and votes independently of contributions.

However, as we mentioned before, $\beta_D > \beta_R$, the Republican party are relatively more affected by the stream of monetary contributions. As a whole,

the contributions are generally expected to have no obvious impact on the election status, though likely a slight impact on the Republican Party. This is because it is more motivated by money than the Democratic Party.

Hypothesis 2 The contributions have no obvious effect on the election status.

We first try to run the similarly pooled OLS regression to test for hypothesis 2 by treating the six election statuses as independent dummies. Nonetheless, the estimation results reject almost all of them due to the collinearity problems. Same thing occurs when we implement the Fixed Effects and Random Effects tests. Finally, we introduce a simple panel multivariate probit model into our paper, in which we can use the six dummy variables of Election Status as the dependent variable instead of putting 'Amount' as the dependent variable. The basic idea is:

$$Election\ status_{i,t} = \beta' Amount_{i,t} + \varepsilon_{i,t}$$

We run three regressions for this. The first one is for the whole data set in order to test for the effect of the contributions on the election results as a whole. Consider a 6-equation multivariate probit model:

$$b_{1i,t}+b_{2i,t} + b_{3i,t}+b_{4i,t} + b_{5i,t}+b_{6i,t} = \alpha + \beta_{im} Amount_{im,t} + \varepsilon_{im,t}\ ,$$

$$m = 1, 2, 3, 4, 5, 6$$

Where b_1 represents disqualified, b_2 represents lost in general election, b_3 represents lost in primary election, b_4 represents not up for election, b_5 represents withdrew and b_6 represents won in the election.

Then, we run two other regressions separately for Democrats and Republican candidates. For Democrats we only consider four election statuses, the regression model is:

$$b_{2i,t} + b_{3i,t}+b_{4i,t}+b_{6i,t} = \alpha + \beta_{im} Amount_{im,t} + \varepsilon_{im,t}, m = 2, 3, 4, 6$$

For Republicans, we consider five election statuses, the regression model is:

$$b_{2i,t} + b_{3i,t}+b_{4i,t} + b_{5i,t}+b_{6i,t} = \alpha + \beta_{im} Amount_{im,t} + \varepsilon_{im,t}, m = 2, 3, 4, 5, 6$$

6. Empirical Analysis

6.1 Analysis for Hypothesis 1 Testing Results

Appendix Table 3 gives the results of pooled OLS estimation of regressing the total amount that candidates received from six different industries, as well as their political party. a_1 represents that the recipient is a Democrat while a_2 represents Republicans.

The R-squared of the estimation is 0.99, which means 99% of the variation in the data set could be estimated by the regression model. This percentage is high enough to indicate a great fitness of the model. a_2 is rejected because of the collinearity. The estimated coefficient for a_1 is -3612.355 with p-value equals to 0.003. The small p-value reveals that the estimation is statistically significant. Because in our data, the recipient is either a Democrat or Republican, the interpretation of the estimated coefficient for a_1 while holding other independent variables constant is that Democrats expect to receive $3612.355 less than if he or she is a Republican. In this case, our hypothesis cannot be rejected.

The estimations for other independent variables are also significant with 0.000 p-value. Electric Utility and Oil & Gas industries are the two industries receiving most of the contribution, which are consistent with our statistical result.

Additionally, the pooled OLS estimation does not allow for individual heterogeneity and assume same parameters for each individual. In order to make our estimation more rigorous, we further test for heteroskedasticity. Appendix Table 4 shows the result for the heteroskedasticity test. The probability above chi-squared is 0.2615 and greater than 0.05, which means we must accept the null at 95% level of significance. As a result, there is no heteroskedasticity in our data; the result for pooled OLS estimation is efficient.

Another estimation of random effects is also conducted. Given the result in Appendix table 5, we can see that the result for random effects we get is similar. The coefficient for a_1 is also negative, though slightly more so at $-4116.45. With a p-value of 0.007 it is also statistically significant. Generally speaking, the Republican Party receives more contributions than the Democratic Party in the Energy sector in Pennsylvania.

6.2 Analysis for Hypothesis 2 Testing Results

Appendix Table 6 gives the result for the multivariate probit regression within the whole group. The estimated coefficients between the six Election Status dummies and the Amount variable are extremely small, 'Disqualified' has a coefficient of -0.0000506, 'Lost in general elections' has a coefficient of 5.84e-07, 'Lost in primary election' has a coefficient of -1.083-06, 'Not up for election' has a coefficient of 6.23e-07, 'Withdrew' has a coefficient of -0.0000114, and 'Won' has a coefficient of -2.34e-07 respectively. Although the p-value is statistically insignificant, we can still say that the estimated coefficients are statistically insignificant different from zero, which mean we cannot find an obvious relationship between the election status and the lobbying contributions.

Also, the likelihood ration test of the relationships between each pair of the election status variables are zero with Prob > chi^2 = 0.0000, which means we have to reject the null. This is because the election candidates cannot have two statuses in a single year. The election status has excludability.

To conclude, the relationship between the value of contributions and electoral outcomes are not obvious, which is consistent with the first part of Hypothesis 2.

Appendix Table 7 displays results for the multivariate probit model regression conditional on the Democratic Party. The result is virtually the same as with the full data set except we have one statistically significant coefficient (2.48e-06) for election status b_2 with 0.050 p-value. Even though the estimation is significant; the small value reveals a weak correlation between the amount and the election result.

Similar regression results within the Republican group are shown in Appendix Table 8. We still get the extremely small estimated coefficient for the relation between lobbying contributions and the election status.

Overall, our regression results suggest a weak link between lobbying expenditure and election status. We show that there is no obvious relationship between the value of contributions and the electoral outcome of the politicians. However, further work will be needed to prove the second part of our hypothesis, which is the value of contributions have a slight effect on the Republican Party.

7. Conclusion

In this paper we study the relationship between the lobbying contributions and the election outcomes in the energy sector in Pennsylvania. Based on the common agency model which predicts the optimal policies under the influence of polarized interest groups we test two hypotheses: first, the Democratic Party receives more lobbying contributions than the Republican Party; second, the lobbying contribution is irrelevant to the electoral outcomes as a whole, though weakly correlated to the election outcomes of Republicans group. Our empirical estimations are able to prove the first hypothesis and the first part of the second hypothesis using a panel data on Pennsylvania in period 2002-2012.

The main weaknesses in our analysis stem from a weakly balanced panel data set as well as the sample size. In our model, we discuss the change of ideal points of the interest groups and the decision-maker. But we do not study how the polarization of the interest group affects the lobbying contributions. Further research could focus on the relationship between the election outcomes, and the lobbying capital for Republicans under the condition that Republican Party is more motivated by money. Further investigation could also be pursued in other sectors or other states using the method we proposed in this paper.

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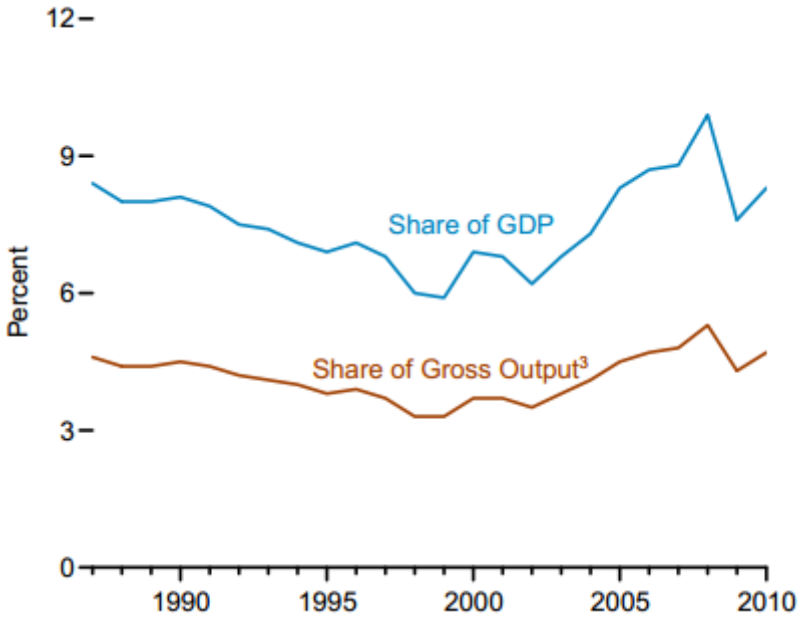
Appendix A: Figures

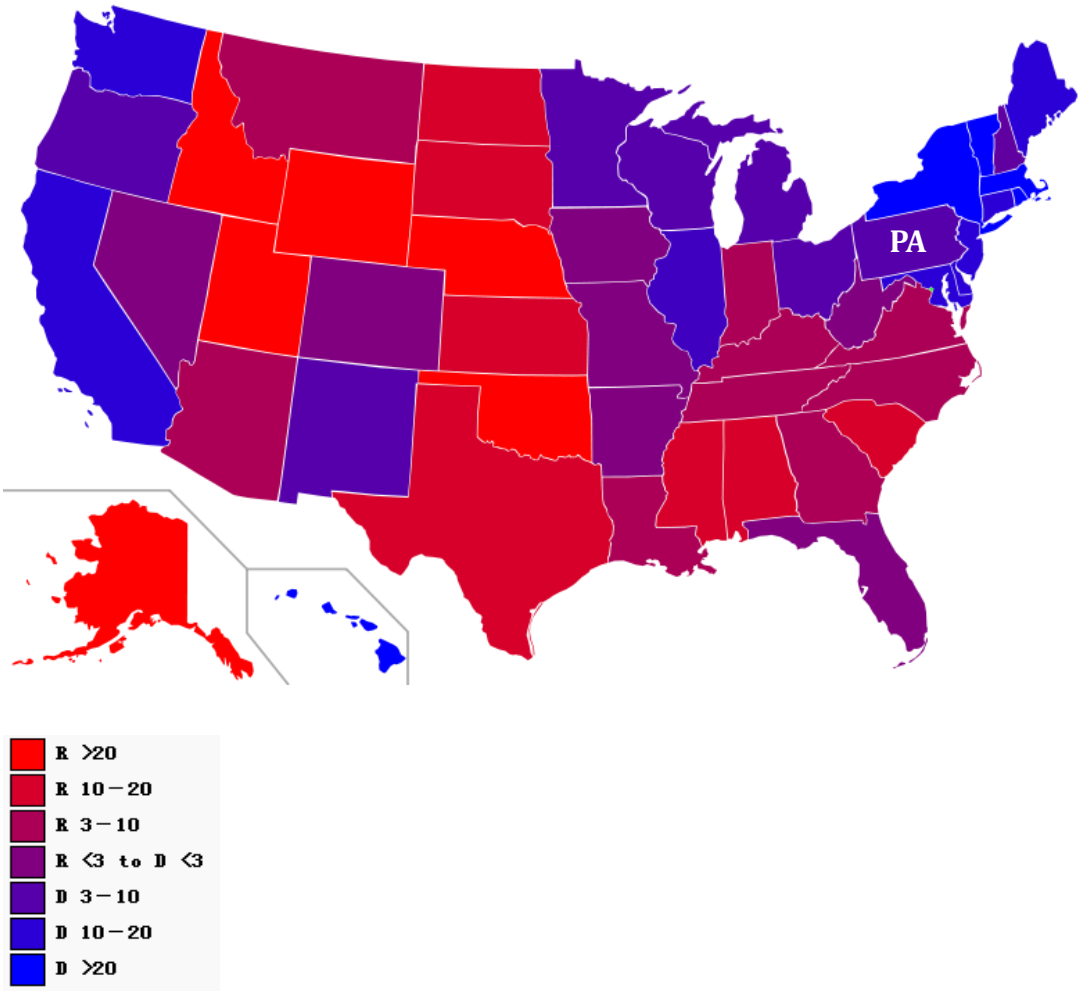
Figure 1: Energy Expenditures as Share of Gross Domestic Product and Gross Output, 1987-2010[9]



[9] U.S. Energy Information Administration / Annual Energy Review 2011, page 12, available at http://www.eia.gov/totalenergy/data/annual/pdf/aer.pdf

Red and Blue States Map[10]

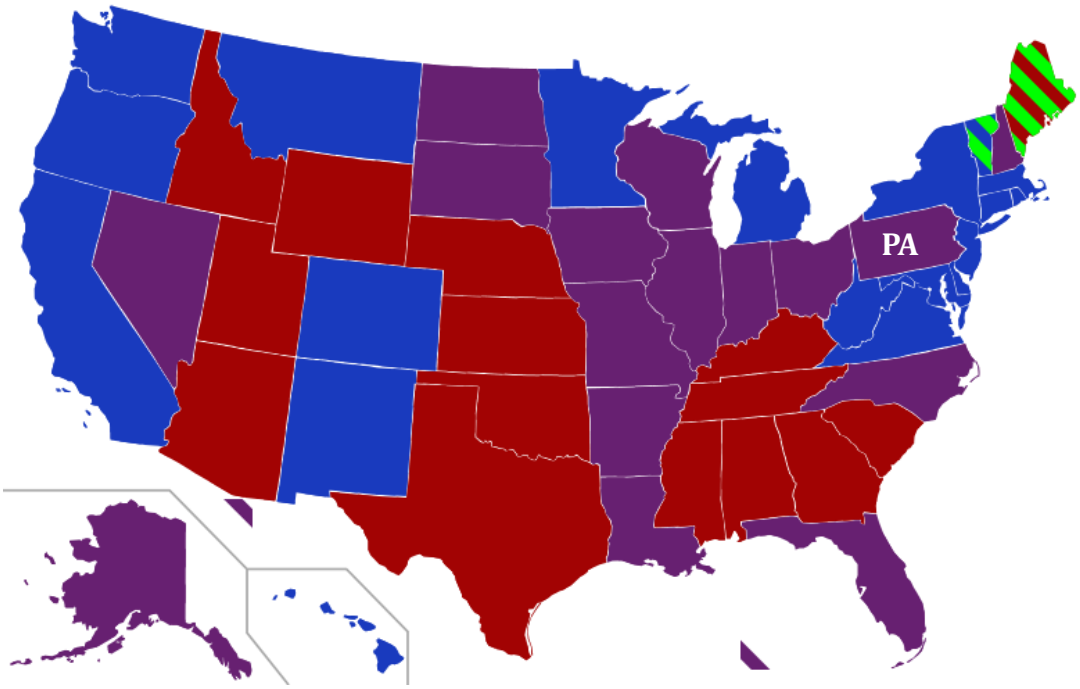
Figure 2: Average Margins of Presidential Victory in the five presidential elections from 1992 to 2008[11]



[10] Red states and blue states, Wikipedia - the free encyclopedia, available at http://en.wikipedia.org/wiki/Red_states_and_blue_states

[11] File:Red and Blue States Map (Average Margins of Presidential Victory).svg, Wikipedia - the free encyclopedia, available at http://en.wikipedia.org/wiki/File:Red_and_Blue_States_Map_(Average_Margins_of_Presidential_Victory).svg

Figure 3: The current Senate party membership by state[12]



[12] File:113th United States Congress Senators.svg, Wikipedia - the free encyclopedia, available at http://en.wikipedia.org/wiki/File:113th_United_States_Congress_Senators.svg

Figure 4: Inflation Rate Graph (2003-2013)[13]

[13] Current US Inflation Rates: 2003-2013, available at http://www.usinflationcalculator.com/inflation/current-inflation-rates/

Figure 5: Dropped Variables

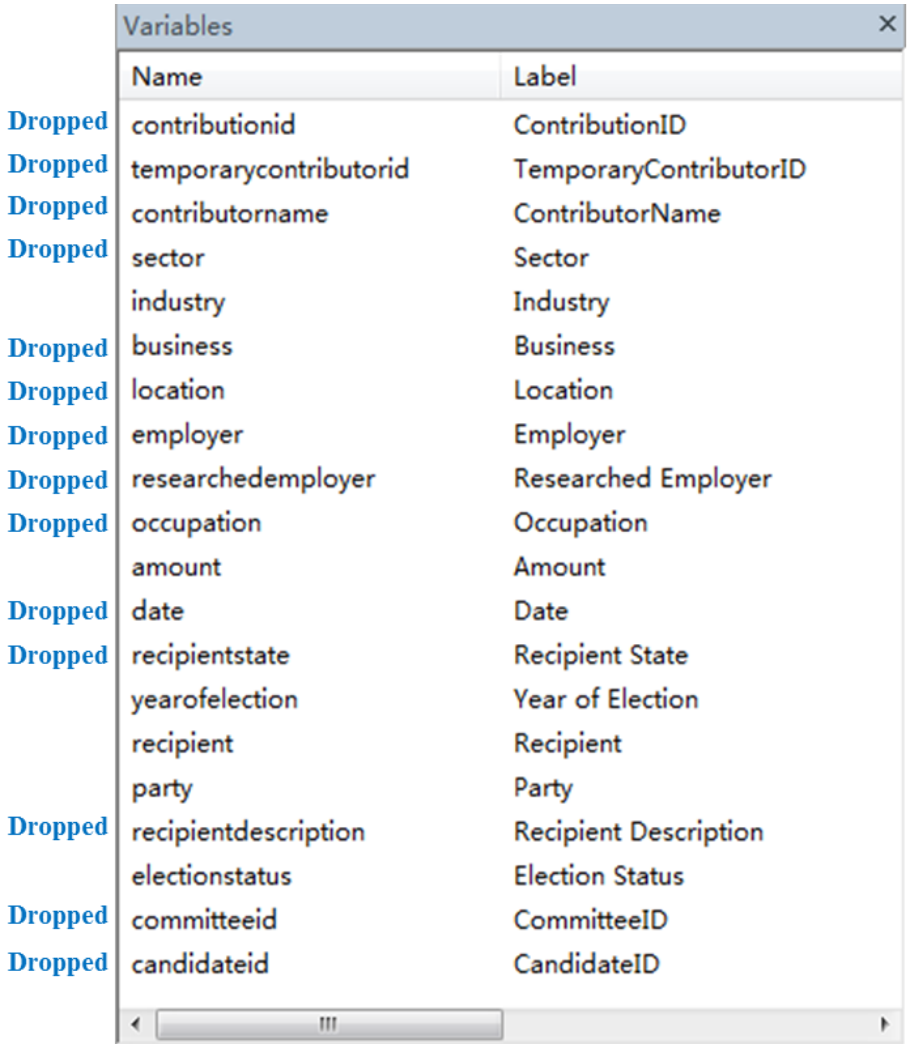
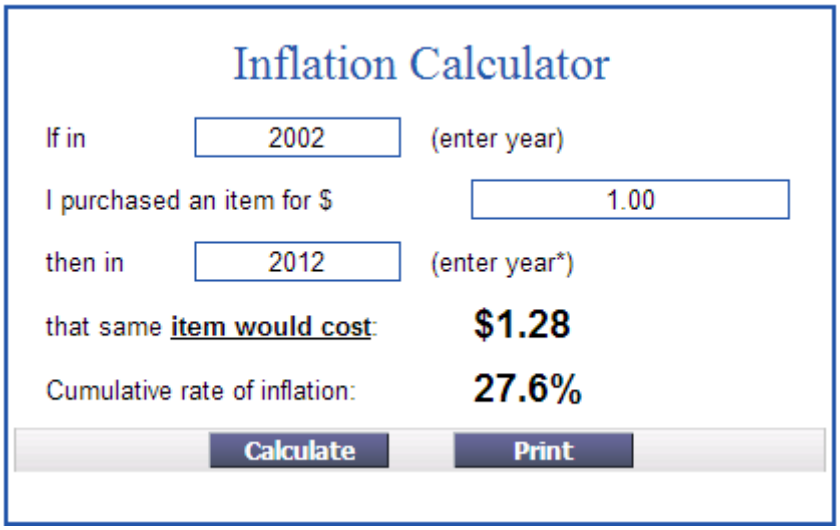


Figure 6: Inflation Calculator (Convert 2002 dollar to 2012 dollar)



Appendix B: Tables

Table 1: Descriptive Statistics

	Mean	Standard Deviation
Recipient name	-	-
Electric Utilities ($)	4631.3830	13459.1400
Hunting ($)	662.6225	562.6106
Mining ($)	6341.2620	27677.4300
Miscellaneous Energy ($)	1317.4980	8661.8430
Oil & Gas ($)	6500.8380	50615.6600
Railroads ($)	3378.9020	15138.7700
Steel ($)	4014.5770	10574.1300
Waste Management ($)	3127.4990	13350.3900
Water Utilities ($)	1362.9210	4864.5150
Amount ($)	12206.5700	72703.6000
Party	-	-
a1:Democratic	0.4282	0.4950
a2:Republican	0.5718	0.4949
Election Status	-	-
b1:Disqualified	0.0006	0.0248
b2:Lost-General Election	0.0877	0.2830
b3:Lost-Primary-Electon	0.0558	0.2297
b4:Not Up For Election	0.1031	0.3041
b5:Withdrew	0.0074	0.4358
b6:Won	0.7454	0.4358
Year of election	2006.8420	3.3253

Table 2: Democrats' Platform VS Republicans' Platform (2012 Election)[14][15]

Platforms	Democrats	Republicans
Energy Independence	The Democrats call for a **"sustainable energy independent future"** and an **all-of-the-above policy**. The platform names the fuel sources wanted in the mix, "including wind, solar, biofuels, geothermal, hydropower, nuclear, oil, clean coal, and natural gas." The Democrats also call for building a **"clean energy economy"** with extension of incentives: "It's not enough to invent clean energy technologies here; we want to make them here and sell them around the world."	The Republicans praise the abundant U.S. energy resources, "tapped and untapped, traditional and alternative," and calls for an **"all-of-the-above diversified approach."** The party's platform **emphasizes energy industry jobs** and what it'll do differently from the Obama administration: "Unlike the current Administration, we will not pick winners and losers in the energy marketplace."
Climate Change	The Democrats **label climate change a major threat**. The platform emphasizes the need for the U.S. to take lead on the issue internationally, and calls for **reducing U.S. greenhouse gas emissions "through regulation and market solutions."**	The Republicans **don't even mention** global climate change.

[14] Where do the Dems and GOP stand on energy and the environment?, available at http://trib.com/business/energy/where-do-the-dems-and-gop-stand-on-energy-and/article_ffb39b30-6a64-5fef-a2fc-a9bb4cd7fcc0.html

[15] Democratic, Republican Platforms Reveal Stark Policy Differences - Voice of America, available at http://www.voanews.com/content/comparing-the-democratic-and-republican-party-platforms/1501610.html

Environmental Protection Agency(EPA) & Environmental Regulations	The Democrats call **protection of the environment a top priority**. The platform proudly announces what is to come in a Democratic administration: "**We will reinvigorate the EPA** so that we can work with communities to **reduce air and water pollution and protect our children** from environmental toxins, and never sacrifice science to politics."	The Republicans go into detail about how it would **halt the EPA** and its "war on coal" and says **private ownership guarantees environmental stewardship**. The Republicans put greater focus on the **support of new and expanded oil refineries industries.**
Renewable Energy	The Democrats list **renewables as a key part** in their version of the all-of-the-above energy development approach	The Republicans calls for a **"pathway toward a market-based approach" for renewable sources** and advocate a **long-term tax credit** for all renewable energy sources.

Table 3

reg amount electricutilities mining oilgas railroads steel wastemanagement a1 a2 (note: a2 omitted because of collinearity)

Source	SS	df	MS
Model	6.7741e+12	7	9.6774e+11
Residual	489112949	40	12227823.7
Total	6.7746e+12	47	1.4414e+11

Number of obs	48
F(7, 40)	79142.05
Prob > F	0.0000
R-squared	0.9999
Adj R-squared	0.9999
Root MSE	3496.8

amount	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
electricut~s	1.082175	.016887	64.08	0.000	1.048045	1.116305
mining	.9049734	.0291006	31.10	0.000	.8461589	.963788
oilgas	1.163938	.0106577	109.21	0.000	1.142398	1.185478
railroads	.7491424	.065443	11.45	0.000	.6168771	.8814077
steel	.9805106	.0358416	27.36	0.000	.9080719	1.052949
wastemanag~t	.9462682	.034429	27.48	0.000	.8766845	1.015852
a1	-3612.355	1148.706	-3.14	0.003	-5933.976	-1290.735
a2	(omitted)					
_cons	3306.902	885.0657	3.74	0.001	1518.117	5095.687

Table 4

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of amount

         chi2(1)      =     1.26
         Prob > chi2  =   0.2615
```

Appendix Table 5

xtreg amount electricutilities mining oilgas railroads steel wastemanagement a1 a2,re (note: a2 omitted because of collinearity)

```
Random-effects GLS regression                   Number of obs      =        48
Group variable: recipient1                      Number of groups   =        31

R-sq:  within  = 1.0000                         Obs per group: min =         1
       between = 0.9999                                        avg =       1.5
       overall = 0.9999                                        max =         4

Random effects u_i ~ Gaussian                   Wald chi2(7)       = 683133.22
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000
```

amount	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
electricut~s	1.095314	.0188741	58.03	0.000	1.058322	1.132307
mining	.8986955	.0334574	26.86	0.000	.8331202	.9642707
oilgas	1.169298	.012334	94.80	0.000	1.145124	1.193472
railroads	.7311609	.0700194	10.44	0.000	.5939255	.8683963
steel	.9712831	.0414789	23.42	0.000	.8899859	1.05258
wastemanag~t	.9497145	.03717	25.55	0.000	.8768625	1.022566
a1	-4116.454	1516.927	-2.71	0.007	-7089.576	-1143.332
a2	(omitted)					
_cons	2816.067	1093.322	2.58	0.010	673.1963	4958.939
sigma_u	2840.7808					
sigma_e	1766.4978					
rho	.72114736	(fraction of variance due to u_i)				

Appendix Table 6

mvprobit(b1= amount)(b2= amount)(b2= amount) (b3= amount) (b4= amount) (b6=amount)

Multivariate probit (MSL, # draws = 5) — Number of obs = 1630
Log likelihood = -1871.9373 — Wald chi2(6) = 6.93
Prob > chi2 = 0.3270

		Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
b1							
	amount	-.0000506	.000119	-0.43	0.671	-.0002838	.0001827
	_cons	-3.059402	.4025359	-7.60	0.000	-3.848358	-2.270446
b2							
	amount	5.84e-07	4.97e-07	1.18	0.240	-3.90e-07	1.56e-06
	_cons	-1.390875	.0464547	-29.94	0.000	-1.481925	-1.299826
b3							
	amount	-1.08e-06	1.57e-06	-0.69	0.488	-4.15e-06	1.98e-06
	_cons	-1.609009	.0551869	-29.16	0.000	-1.717174	-1.500845
b4							
	amount	6.23e-07	4.62e-07	1.35	0.178	-2.83e-07	1.53e-06
	_cons	-1.285273	.0442308	-29.06	0.000	-1.371964	-1.198582
b5							
	amount	-.0000114	.0000153	-0.75	0.454	-.0000414	.0000185
	_cons	-2.390521	.1320796	-18.10	0.000	-2.649392	-2.131649
b6							
	amount	-2.34e-07	3.90e-07	-0.60	0.548	-9.97e-07	5.30e-07
	_cons	.667438	.0321391	20.77	0.000	.6044466	.7304294
	/atrho21	.0175805	.0820614	0.21	0.830	-.143257	.1784179
	/atrho31	.0007738	.076895	0.01	0.992	-.1499375	.1514852
	/atrho41	.0666405	.0716177	0.93	0.352	-.0737277	.2070087
	/atrho51	.1392178	.1361409	1.02	0.306	-.1276134	.406049
	/atrho61	-.059713	.0729677	-0.82	0.413	-.202727	.0833011
	/atrho32	.2632399	.0609258	4.32	0.000	.1438276	.3826522
	/atrho42	.2087641	.0505014	4.13	0.000	.1097831	.307745
	/atrho52	.2669754	.1199402	2.23	0.026	.031897	.5020538
	/atrho62	-.775338	.0490724	-15.80	0.000	-.8715182	-.6791578
	/atrho43	.2114836	.0520343	4.06	0.000	.1094983	.3134689
	/atrho53	.2424742	.1229813	1.97	0.049	.0014352	.4835132
	/atrho63	-.6892972	.0563464	-12.23	0.000	-.7997341	-.5788603
	/atrho54	.1832067	.123686	1.48	0.139	-.0592134	.4256267
	/atrho64	-1.002147	.0654724	-15.31	0.000	-1.130471	-.8738237
	/atrho65	-.4407385	.1358488	-3.24	0.001	-.7069972	-.1744797

rho21	.0175786	.0820361	0.21	0.830	-.142285	.1765485
rho31	.0007738	.0768949	0.01	0.992	-.148824	.150337
rho41	.066542	.0713006	0.93	0.351	-.0735944	.2041016
rho51	.1383253	.133536	1.04	0.300	-.1269251	.3851128
rho61	-.0596421	.0727081	-0.82	0.412	-.1999946	.0831089
rho32	.2573234	.0568915	4.52	0.000	.142844	.3650085
rho42	.2057832	.0483628	4.25	0.000	.1093442	.2983843
rho52	.2608082	.1117817	2.33	0.020	.0318861	.4637309
rho62	-.6500227	.0283379	-22.94	0.000	-.7021447	-.5909716
rho43	.2083861	.0497747	4.19	0.000	.1090628	.3035896
rho53	.2378314	.1160251	2.05	0.040	.0014352	.4490528
rho63	-.5975303	.0362283	-16.49	0.000	-.6638881	-.5218366
rho54	.1811841	.1196257	1.51	0.130	-.0591443	.40166
rho64	-.7624944	.0274069	-27.82	0.000	-.8111803	-.7033116
rho65	-.4142564	.112536	-3.68	0.000	-.6087904	-.1727305

Likelihood ratio test of rho21 = rho31 = rho41 = rho51 = rho61 = rho32 = rho42 = rho52 = rho62 = rho43 = rho53 = rho63 = rho54 = rho64 = rho65 = 0:
chi2(15) = 1011.06
Prob > chi2 = 0.0000

Appendix Table 7

mvprobit (b2= amount) (b3= amount) (b4= amount) (b6=amount) if a1==1

Multivariate probit (MSL, # draws = 5) — Number of obs = 698
Wald chi2(4) = 3.89
Log likelihood = -719.60875 — Prob > chi2 = 0.4213

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
b2						
amount	2.48e-06	1.27e-06	1.96	0.050	-4.39e-09	4.97e-06
_cons	-1.569165	.0778737	-20.15	0.000	-1.721795	-1.416535
b3						
amount	1.99e-07	2.29e-06	0.09	0.931	-4.29e-06	4.69e-06
_cons	-1.5927	.0814836	-19.55	0.000	-1.752405	-1.432995
b4						
amount	6.42e-07	1.75e-06	0.37	0.713	-2.78e-06	4.07e-06
_cons	-1.276165	.0683438	-18.67	0.000	-1.410117	-1.142214
b6						
amount	-1.23e-06	1.13e-06	-1.08	0.278	-3.45e-06	9.92e-07
_cons	.7307176	.0498706	14.65	0.000	.632973	.8284621
/atrho21	.3485971	.0985102	3.54	0.000	.1555206	.5416736
/atrho31	.3174731	.0877228	3.62	0.000	.1455397	.4894066
/atrho41	-.8364508	.0834458	-10.02	0.000	-1.000002	-.6729
/atrho32	.2837681	.0821582	3.45	0.001	.122741	.4447952
/atrho42	-.7748316	.0901972	-8.59	0.000	-.9516149	-.5980483
/atrho43	-1.067247	.1034789	-10.31	0.000	-1.270062	-.864432
rho21	.3351308	.0874463	3.83	0.000	.1542788	.4942538
rho31	.3072203	.0794431	3.87	0.000	.1445207	.4537453
rho41	-.6839246	.0444138	-15.40	0.000	-.7615949	-.5868843
rho32	.2763889	.075882	3.64	0.000	.1221284	.4176112
rho42	-.6497302	.0521205	-12.47	0.000	-.7405133	-.5356593
rho43	-.7884218	.0391555	-20.14	0.000	-.8538144	-.6985341

Likelihood ratio test of rho21 = rho31 = rho41 = rho32 = rho42 = rho43 = 0:
chi2(6) = 411.396 Prob > chi2 = 0.0000

Appendix Table 8

mvprobit (b2= amount) (b3= amount) (b4= amount) (b5= amount)(b6=amount) if a2==1

```
Multivariate probit (MSL, # draws = 5)          Number of obs   =        932
                                                Wald chi2(5)    =       3.01
Log likelihood = -1078.3516                     Prob > chi2     =     0.6986
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
b6						
amount	-3.64e-07	4.61e-07	-0.79	0.430	-1.27e-06	5.41e-07
_cons	.7055251	.0463446	15.22	0.000	.6146914	.7963587
b2						
amount	2.98e-07	6.43e-07	0.46	0.643	-9.62e-07	1.56e-06
_cons	-1.268099	.0565716	-22.42	0.000	-1.378977	-1.15722
b3						
amount	-1.32e-06	1.85e-06	-0.71	0.477	-4.95e-06	2.31e-06
_cons	-1.612666	.0713301	-22.61	0.000	-1.75247	-1.472862
b4						
amount	6.17e-07	4.41e-07	1.40	0.162	-2.47e-07	1.48e-06
_cons	-1.285544	.0529658	-24.27	0.000	-1.389355	-1.181733
b5						
amount	-7.84e-06	.0000119	-0.66	0.511	-.0000312	.0000155
_cons	-2.354726	.1534232	-15.35	0.000	-2.65543	-2.054022
/atrho21	-1.015085	.0898136	-11.30	0.000	-1.191117	-.8390535
/atrho31	-.7676701	.0987773	-7.77	0.000	-.9612701	-.5740702
/atrho41	-1.028599	.0887742	-11.59	0.000	-1.202593	-.854605
/atrho51	-.5318733	.1843734	-2.88	0.004	-.8932386	-.170508
/atrho32	.3623893	.0858419	4.22	0.000	.1941423	.5306363
/atrho42	.3230119	.0723838	4.46	0.000	.1811423	.4648815
/atrho52	.2970871	.1573058	1.89	0.059	-.0112265	.6054008
/atrho43	.3833394	.0862976	4.44	0.000	.2141992	.5524796
/atrho53	.2172043	.1578395	1.38	0.169	-.0921554	.526564
/atrho54	.3153868	.1654396	1.91	0.057	-.0088688	.6396424
rho21	-.7678571	.0368591	-20.83	0.000	-.8309248	-.6853074
rho31	-.6455726	.0576105	-11.21	0.000	-.7448428	-.5183422
rho41	-.7733459	.0356815	-21.67	0.000	-.8344439	-.6934676
rho51	-.4868117	.1406796	-3.46	0.001	-.7129896	-.1688746
rho32	.3473169	.0754869	4.60	0.000	.1917394	.4858673
rho42	.3122278	.0653274	4.78	0.000	.1791867	.4340544
rho52	.2886447	.1441997	2.00	0.045	-.0112261	.5408815
rho43	.365604	.0747625	4.89	0.000	.2109823	.5023763
rho53	.2138518	.1506211	1.42	0.156	-.0918954	.4827502
rho54	.3053297	.1500162	2.04	0.042	-.0088685	.564656

```
Likelihood ratio test of  rho21 = rho31 = rho41 = rho51 = rho32 = rho42 = rho52
> rho43 = rho53 = rho54 = 0:
              chi2(10) =  655.967   Prob > chi2 = 0.0000
```