Imperfect Information, Monitoring Costs of Stochastic Political Markets and State Debt Ratings

Skip Krueger*
Department of Public Administration
University of North Texas

Robert W. Walker
Department of Political Science
Texas A&M University

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Abstract

Borrowing a stochastic political markets notion from Perry and Robertson (1998), we extend the Depken and LaFountain (2006) state bond ratings model to include the cost of monitoring governments that might change their future commitment to debt repayment. We suggest that credit markets face an inherent risk of future policy change when considering the purchase of a debt instrument. An enacting government coalition issuing debt cannot make a credible commitment to maintain the existing debt repayment policy. In the face of this commitment problem, investors (and the rating agencies that serve those investors) look to recent political turnover to estimate the possibility that some future government coalition will remain substantially similar to the enacting coalition. Political turnover is perceived by the credit markets as a potential for future coalitions to act opportunistically regarding debt repayment. States with recent political turnover, then, require greater monitoring by rating agencies and investors. The net present value of the future cost of this additional monitoring, we argue, is manifested as lower ratings of state debt. We incorporate this idea into a model of state bond ratings from 1995 through 2000 for over 40 states.

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Email: skrueger@unt.edu, rwalker@politics.tamu.edu.

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1 Introduction

One of the fundamental concepts of democratic governance is the peaceful transition from one ruling coalition to another. Inherent in this concept is that policy choices can, should, and will change at least occasionally. As clearly beneficial as such change is for the maintenance of a democratic system, change also can be costly and disruptive, at least in the short run. We attempt to evaluate one such cost by studying the impact that institutions and the turnover of elected leaders have on debt ratings of state-issued governmental debt in the United States.

Economists and political scientists have long studied government-issued debt – and the capital market generally – for clues about the interaction between public policy and economic activity. Most of the studies in the economic literature have focused on the impact that government finance policies and socio-economic trends have on the cost of government borrowing. In the political science literature, on the other hand, scholars have focused their investigations on the impact that a variety of institutional factors have on government borrowing. The three primary institutional factors that have been the focus of attention are tax rate limits, debt issuance limits and balance budget requirements. In general, scholars have found that institutions like these limit the ability of policymakers to act opportunistically and manipulate borrowing costs and the overall amount of debt issued. A few studies have focused on the impact that political market factors like divided government, party competition, and partisan identification have on borrowing patterns. While we believe these studies make important contributions to the understanding of the economic cost of democracy, we think they are incomplete.

In this study, we suggest that elections inherently create uncertainty about future policy direction for investors (Hayek 1937, Hayek 1945, Stigler 1961). In the formal political economy literature, the model of Alesina, Roubini and Cohen (1997) stresses the centrality of elections as mechanisms for resolving uncertainty. An election need not necessarily lead to a policy change, but the chance that it could creates uncertainty for the investor (Perry and Robertson 1998). We suggest this political risk is mitigated for the investor in two ways. First, investors look at recent political turnover to estimate the risk of policy change in the future. Governments with fewer recent changes in party control of the executive or legislative branch are rewarded with higher bond ratings. Second, institutional rules can moderate the opportunism of future coalitions by pre-committing the future coalition to the policy choice of the enacting coalition.

We examine these theoretical implications using data on state bond ratings from 1995 to 2000 for a sample of 44 U.S. states.[1] We suggest that bond ratings are a function of variables controlling

[1]Aronson and Marsden (1980), Carleton and Lerner (1969) and Parry (1983) specifically attempted to replicate

for the state of government finances, the socio-economic milieu, institutional constraints on future political coalitions, and various aspects of the political market. With this model, we can examine political turnover in state legislatures and governors offices and the effects of turnover on ratings for state debt.

We opt to study debt ratings by Standard & Poor's, Moody's, and Fitch's for two reasons. First, our theory is focused on the capital market. Several studies have looked at the total amount of debt owed by a government, and we agree the subject is worthy of study. However, governments take on and retire debt in good markets and bad, and thus, we believe that many of the capital market reactions to political variables that are of particular interest in this study might be obscured in a model of total debt. In Clingermayer and Woods (1995) study of state debt per capita, for example, only four of the nine variables that most closely match the political market variables of our study were statistically significant. This is the so-called stock or flow debate (Bahl and Duncombe 1993, 31): We believe that for our purposes, the flow concept is more appropriate because stocks do not always respond to capital market changes, and our interest is in the capital market.

Second, we believe that ratings are a better measure for the purposes of this study than actual interest rates. Many scholars, primarily in the economic literature, have studied the net interest cost (NIC) of new issues across governments and across time (Bierwag, Kaufman and Leonard 1984; Kidwell, Sorensen and Wachowicz 1987; Bland 1984; Bland 1985; Kidwell, Koch and Stock 1984). This approach is particularly useful for evaluating the impact of factors directly related to the particular debt issue. Such factors have typically included the number of bids received, total maturity of the issue, whether the issue has a call option, and whether the issuer bought bond insurance. New issuance can be a problematic measure, however, if governments opt not to issue new debt when interest rates are high generally or are high for that particular government. In other words, the choice to issue new debt, as the stocks studies indicate, is a function of many of the same factors that determine the rate. Thus, a selection bias almost surely exists in the new-issue NIC studies.

Lowery and Alt (2001) avoid this selection bias by utilizing a survey of key capital market participants that asks these bond traders to estimate an interest rate for each state if it were to issue general obligation bonds at the time of the survey. This Relative Value Survey provides an opportunity to evaluate capital market reactions to all states, regardless of their actual participation in the capital market that year. While this approach to the flows literature is compelling, we believe that the study of ratings of state debt is particularly valuable because it eliminates much of the

Moodys credit ratings with modest success. The job of estimating the determinants of credit ratings is complicated by the fact that the agencies have a long history of maintaining secrecy regarding their rating algorithms.

minor random interest rate fluctuation that makes interest rates models noisy.

Despite different measures of the dependent variable, most studies of government debt share a common set of explanatory variables. Scholars have studied the impact of government finances (Parry 1983; Aronson and Marsden 1980; Bahl and Duncombe 1993; Sharp 1986; Clingermayer and Wood 1995; Lowery and Alt 2001), socio-economic factors (Parry 1983; Aronson and Marsden 1980; Bierwag, Kaufman and Leonard 1984; Kidwell, Sorensen and Wachowicz 1987; Bahl and Duncombe 1993; Sharp 1986; Clingermayer and Wood 1995; Lowery and Alt 2001), political institutions (Bahl and Duncombe 1993; Wagner 2004; Sharp 1986; Clingermayer and Wood 1995; Lowery and Alt 2001), and political market indicators (Clingermayer and Wood 1995; Lowery and Alt 2001; Perry and Robertson 1998). Government finance indicators typically include the ratio of debt to revenue or population, the ratio of expenditures to the population, intergovernmental aid as a proportion of total revenue, and the existing (and persistence) of budget deficits. Typical socio-economic indicators studied in the past have included the percentage of blacks in the population, income per capita, population size, and population growth. The typical political institutions that have been studied in the past have been the existence of debt limits, tax limits, and balance budget requirements. Finally, the political market factors studied in the past have included political corruption, the existence of divided government, the existence of a divided legislature, the party in control, and overall ideological measure of the states residents.

Variables in each of these categories have been demonstrated to be important in previous studies, and we will thus utilize at least some variables from each category to control for these factors. Our focus, however, will be on those factors that link the uncertainty of future political policies to current debt ratings. With this in mind, we develop a theory of political institutions, political turnover, and risk.

2 Theory

We argue that the issuance of debt by government and its purchase by an investor constitutes a transaction in the Williamson tradition (1989). To the extent that government finances can be complex to evaluate for individual investors, rating agencies reduce this information asymmetry and thus reduce the transaction costs associated with issuing public debt. Its for this reason that many of the studies in the economic literature on the net interest cost of new issues include variables for factors related to the issue itself (such as number of bids received, length of time to maturity, whether the bonds are callable, and issue size) while the rating of the issue is included to capture the variables not related to the specific issue, such as socio-economic forces, political institutions, and political market factors (for example, Bierwag, Kaufman, and Leonard 1984, Kidwell, Sorensen, and Wachowicz 1987, Bland 1985, and Kidwell, Koch and Stock 1984).

When investors consider the purchase of government debt, they are concerned with, among other things, the probability of full payments for the duration of the payment schedule. The future ability of a government to continue payments, then, is of critical importance. But so too, we suggest, is a government's willingness to continue to repay its debt in the future. While actual default may be an option only in the extreme, governments can and do change their taxing and spending priorities in ways that can threaten the long-term viability of repayment. The decision to issue debt to meet some policy choice is made in the short-term, but the commitment to repay the loan is long term. Elections and the concomitant possibility of political turnover necessitate the possibility that some future political coalition will not be as supportive as the enacting coalition of the original policy preference that resulted in the issuance of debt.

Thus, governments face a commitment problem they wish to reduce their borrowing costs to the extent possible, but cannot commit to following the same policy for the duration of the bond repayment schedule. This commitment problem creates a risk for the investor there is always the chance in any government that policy will change and the risk profile of that governments debt will change. A naïve model of the risk between the policy of the enacting coalition and possible policy change by the future coalition might then price all risk equally based on election cycles.

Not all elections lead to turnover, of course, and competitive bidding of interest costs ensures that risk will not be overpriced. But if investors wish to improve their risk assessment over the naïve model (in which all elections matter), they must find a way to sort the risk across units of government. On way that investors and their bond rating agencies can do this is by evaluating policy-relevant political turnover. We suggest that rating agencies evaluate recent changes in control of state governments to assess the possibility of similar changes in the future. States that have recently experienced turnover of partisan control of the governorship or the legislature could be assumed to be at a greater risk for future political turnover. And if turnover in partisan control can be assumed to lead to policy changes, then recent political turnover is an important indicator of future policy risk.

Recent political turnover need not actually lead to policy change in the future for investor transaction costs to increase. The impact is in increased monitoring costs. Recent turnover indicates a need on the part of investors and their rating agencies to watch those governments more carefully for possible policy changes that might impact debt repayment. A lower bond rating assigned to a high-turnover government, then, represents the net present value of those future monitoring costs.

Governments are not without recourse in this situation. They can and many have put financial policies in place that restrict the opportunism of future coalitions. We believe that institutions that limit a states ability to participate in behaviors that increase the risk of default can reduce investor risk. The three key institutions that have the most relevance for this purpose are limitations on the total amount of debt a state can issue, limitations on taxes, and balanced budget requirements. These institutions signal the investment community that a particular state is willing to commit future coalitions to current policy choices, at least in ways that investors care about. This is not to say that states never break their own rules; evidence suggests that they do. But as Lowery and Alt (2001) point out, these exceptions are less severe in states that have more restrictive policies in place.

By tying the hands of future coalitions (however loosely), these institutional arrangements allow the investment community to reduce their future monitoring costs for the government that has adopted such restrictive rules. Lower future monitoring costs lead to lower current transaction costs, and bond ratings increase.

Conceptually, we believe that turnover and restrictive financial policies are linked. States that have high turnover rates and no restrictive financial policies should have the lowest debt ratings. States with high political turnover but financial policies that restrict future coalitions, we believe, are rewarded by the rating agencies with higher scores. But even states without significant turnover will be rewarded for restrictive financial policies because even the enacting coalition might find it to its benefit to renege from commitments made to bondholders once the loan has been made.

3 Research Hypotheses

As discussed above, we utilize Depken and LaFountain's (2006) model of state bond ratings as our base model. That model includes six variables in three of the four factor areas. In the government finance factors area, we include variables measuring the average state tax burden as a percentage of personal income, debt as a percentage of total revenue, and real debt per capita. In the socio-economic factors area, we include variables for income per capita and unemployment.

In the political market factors area, we utilize Depken and LaFountain's (2006) measure of political corruption. In addition, we measure turnover in state governmental leadership by tabulating the number of times that a state goes from unified partisan control to shared partisan control, or vice versa. In addition, we measure a variable that measures whether not the state had a divided government measured as a dummy variable with 1 capturing divided government. While we also desire to study the interaction between fiscal institutions and turnover, these institutions are sufficiently sticky that much more data is required to clearly delineate their effects. For the remainder of the paper, we will focus on turnover and divided government.

4 Measuring and Modelling Risk

Measuring bond ratings poses an interesting methodological problem. Because different combinations of rating agencies rate different bonds, there is no single accepted way to create measures that are consistent across space and time. To further complicate matters, the three major rating agencies utilize different grades and scales.[2] Our approach is based on the simple idea that all three rating agencies are providing different indices that reflect the same unobservable variable – risk. Our goal is to utilize the information contained in each bond rating to provide us with additional information about the unobservable true market risk which we will label θ^*_{it} for each state i in year t.

Though interested in θ^*_{it}, we cannot observe it, but must instead make use of (as many as) three ordered ratings, y_{itb}, $b = \{Moody's, Fitch, S\&P\}$. Intuitively, we have a single unidimensional latent construct – risk – and this latent variable manifests itself in up to three ordered indicators – bond ratings – that are related to each other and the inverse of that risk. To measure risk, we simply formalize the idea that y_{itb} from one or more of b agencies for state i in year t is a function of parameters Λ_b and underlying risk θ^*_{it},

$$y_{itb} = F(\Lambda_b, \theta^*_{it}). \tag{1}$$

The parameters Λ_b have a regression interpretation that should be familiar. Each rating agency b has its own intercept and a particular slope relating changes in θ^*_{it} to the probabilities of various ordered categories. Indeed, if we define F to be the cumulative normal distribution Φ and define $\Lambda_b = \{\alpha_b, \beta_b\}$, this is a conventional ordered probit model,

$$y_{itb} = \alpha_b + \theta^*_{it}\beta_b + \epsilon_{itb}. \tag{2}$$

with the requirement that

$$Pr(y_{itb} = k_b) = \Phi(\alpha_{b,k_b} - \theta^*_{it}) - \Phi(\alpha_{b,k_b-1} - \theta^*_{it}), \tag{3}$$

and $\alpha_{b,k_b} = \infty$ and $\alpha_{b,0} = -\infty$ to ensure proper probabilities for the discrete values k_b of y_{itb}. The substantive difference with the standard ordered probit model is that we are interested in

[2] Moody's uses a scale containing 35 possible ranks; Standard & Poor's and Fitch have 25 and 19 ratings, respectively.

θ^*_{it} and learn about it by employing multiple ordered scales that contain information about risk. Providing some intuition for the parameters, we actually observe eight discrete ratings of state bonds from Moody's in 238 overall scores, six of Fitch's ratings in 194 overall scores, and seven of S&P's ratings in 248 reported scores. As in the ordered probit model, we estimate cutpoints ($\alpha_{b,k}$) equal to the number of ratings minus one. Summing up, there are eighteen cutpoints to estimate.[3] Further, because each rating may react differently to variation in risk, there are a further three agency-specific parameters linking risk to the ordered scales. In the end, there are twenty one parameters to estimate on 680 discrete ratings; a straightforward computational task.

The problem arises because we wish to estimate $\hat{\theta}^*_{it}$ and there are 255 of these to estimate. To estimate the underlying risk, we employ a Markov Chain Monte Carlo framework for imputing the unobservable risk, estimating $\hat{\theta}_{it}$. Previous studies have employed single ratings, thus throwing away information concerning the true quantity of interest, or have somehow scaled these ordered but qualitative ratings into quantitative estimates, e.g. Depken and LaFountain (2006). Because we wish to avoid throwing away information and prefer a flexible scaling technique to measure the underlying risk, we argue that factor analytic techniques combine with imputation of latent quantities to provide the most appropriate testing grounds for our theoretical claims regarding political uncertainty and its pecuniary costs.

Mechanically, Markov Chain Monte Carlo techniques provide us with a simulation methodology for uncovering the latent scores. Because computing time is relatively cheap, we were able to draw 1000 samples of $\hat{\theta}_{ij}$ by allowing a 250,000 iteration burn-in and a further ten million samples keeping every 10000^{th} draw of the factor scores. We now show the striking similarities with previous measures [D*L] obtained from the Bayesian factor analysis.

Figure 1 consists of two descriptive comparisons. First, in the left panel, we show a density plot of the Pearson correlations between the average rate calculated by Depken and LaFountain (2006) and 1000 samples imputed from our MCMC factor analysis. As is clear from the plot, the mean correlation between the two measures is approximately .93; the two measures linearly share 86 percent of their variation. In the right panel of Figure 1, we show a simple scatterplot relating the mean imputed factor score from our Bayesian ordered factor analysis on the x-axis and the average ratings recorded by Depken and LaFountain (2006) on the y-axis. It is apparent that the two measures are capturing the same general phenomenon and that our factor analysis has performed as we desired.[4] Having rendered face validity for our measure of risk, we now

[3] To clarify, there are seven Moody's grades to differentiate, five Fitch's grades to distinguish, and six S&P ratings to recover. We cannot simultaneously identify a constant and $k_b - 1$ cutpoints, but each could be recovered from the other by simple algebra.

[4] A host of diagnostics indicating posterior convergence are available upon request.

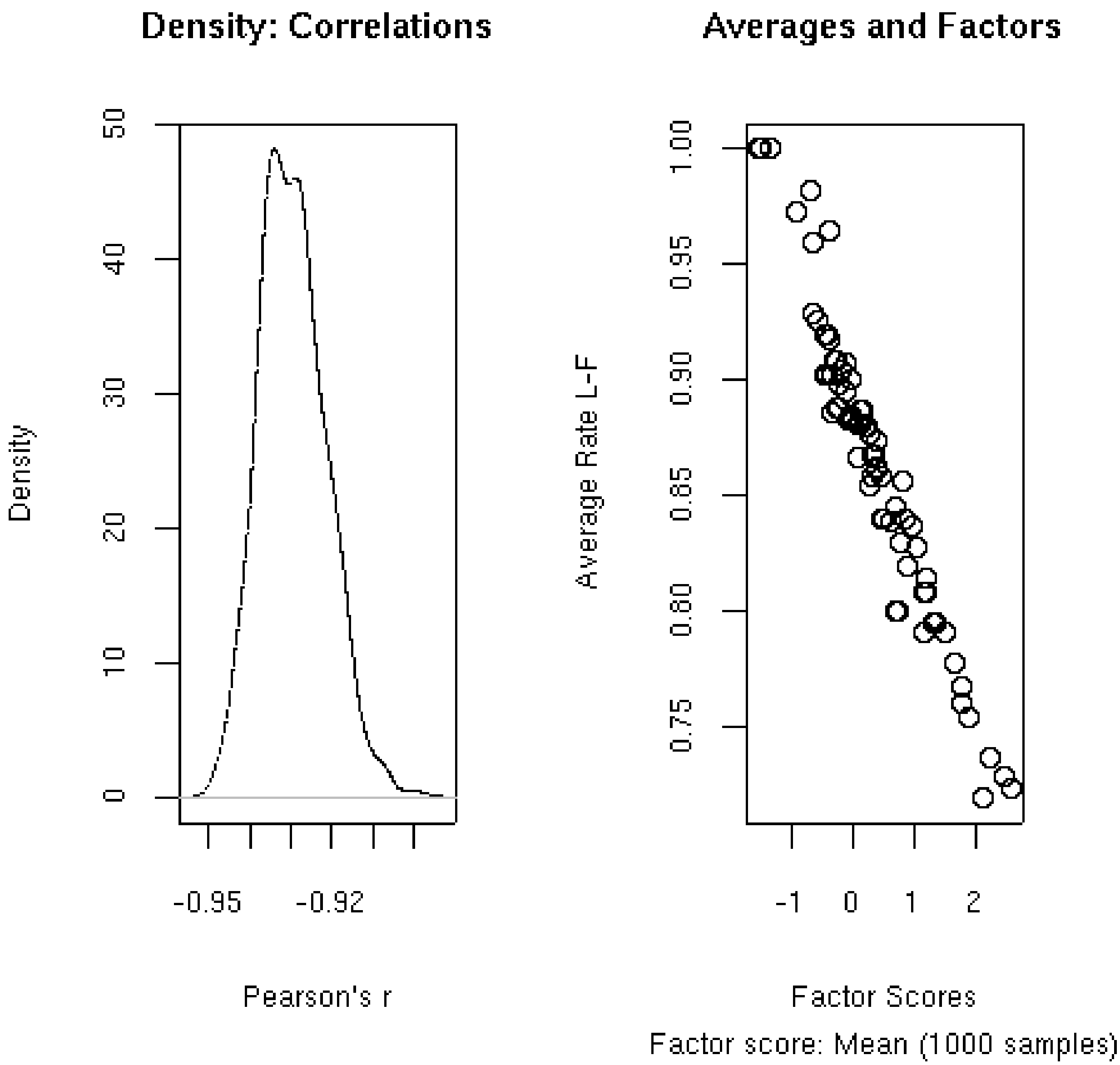

Figure 1: Comparing Measures of Bond Ratings

motivate our models of the determinants of risk.

We have considered two approaches to hypothesis testing. The first is to specify the conditional expectation of θ^*_{it} as depending on regressors X_{it} and parameters β, such as,

$$\theta^*_{it} = X_{it}\beta. \tag{4}$$

Collecting everything we have presented, we can create a fully structural estimator of risk that models the explicit dependence between risk and exogenous covariates in the expected mean of θ^*_{it} (4) and the relationship between risk and observed ordinal ratings captured in Λ in (1). A second related alternative is to split the measurement of θ^*_{it} from the estimation of covariate effects. Because we measure a large number of draws from the posterior distribution of θ^*_{it} and have evidence that we have converged on a posterior distribution, we can simply summarize the sampling distribution of $\hat{\beta}$ obtained from estimating the parametric model. In the end, there is little practical difference between the estimates, but estimation of the full structural models for each model of interest requires replicating the generation of θ^*_{it} alongside the estimation of the vector $\hat{\beta}$. As a result, we have chosen the latter path.

5 Results

With a method and data in hand, we have the necessary groundwork to test the research hypotheses. In Table 1, we simply add a measure of turnover [the frequency of turnover] to the baseline specification reported by Depken and LaFountain (2006). Our first approach measures turnover as the cumulative number of changes to and from divided government during the sample period. For example, Michigan's Republican governor, John Engler, worked alongside a Republican legislature until 1998 when the Democrats took control of the lower house. Turnover becomes one, but does not stay this way for long as the Republicans returned to control of both Houses in 2000. Turnover takes the value of two in 2000. Though there are reasons to believe that this proxy only captures a part of our claims about coalition change, the results are encouraging.

5.1 Turnover

Table 1 displays a linear regression relating the mean [over 1000 posterior draws for each $\hat{\theta}^*_{it}$] to a series of explanatory variables.[5] In order, we find the the intercept is statistically significant and

[5] To demonstrate that the effects do not depend critically on the measure of the dependent variable, we utilize the tobit specification in Depken and LaFountain (2006) and find a significant effect for this measure of turnover. The results are reported in Table 5.

different from zero with high confidence. Because of the latent metric, the intercept has something close to a z-score interpretation implying that a extraordinarily low level of risk [over 3 standard deviations below the mean] would accompany a state with no turnover, no corruption, no state tax burden, no debt, zero per capita income, and no unemployment. While this scenario is completely unrealistic, the prediction is not surprising. Turning to our central interest, turnover has a statistically significant and positive impact on risk. Though the effects are not tremendous [in substantive terms] because a change from the minimum to the maximum on turnover only results in $\frac{1}{3}$ of a standard deviation increase in latent risk. That said, for the mean case, there is some statistical evidence in support of our claims.

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	−3.4808	0.6658	−5.23	0.0000
Turnover	0.1617	0.0977	1.66	0.0992
Corruption	0.6667	0.1634	4.08	0.0001
State Tax Burden	0.0960	0.0405	2.37	0.0185
$\frac{Debt}{Revenue}$	0.0112	0.0036	3.10	0.0022
per capita Income	−0.0200	0.0118	−1.70	0.0906
per capita Debt	0.0385	0.0791	0.49	0.6271
Unemployment	0.4154	0.0510	8.14	0.0000
1996	0.1992	0.1770	1.13	0.2616
1997	0.2920	0.1699	1.72	0.0870
1998	0.4169	0.1765	2.36	0.0190
1999	0.4908	0.1871	2.62	0.0093
2000	0.4879	0.1973	2.47	0.0141

Table 1: Turnover and Mean Risk: *Risk Measures are the average of 1000 draws from the posterior distribution of* $\hat{\theta}^*_{it}$. *Turnover is the current number of changes to and from unified government in the six year sample period.*

The control variables take the expected signs and many are statistically relevant. As reported by Depken and LaFountain (2006), we find that corruption statistically and substantively important increases risk. Higher state tax burdens increase risk and decrease state bond rating; higher debt burdens [as a percentage of revenue] increase risk. Lower per capita incomes also increase risk and higher levels of unemployment increase risk. Finally, the coefficients on year effects show a secular increase in risk, that levels off in the year 2000. To provide a more detailed analysis of these results, we now focus our attention on the effects of turnover in greater detail.

Figure 2 displays the density of t-statistics on the effect of this measure of turnover on 1000 estimates of θ^*_{it}. Though the effect shown in Table 1 falls just to the right of the vertical line in Figure 2, we see that at least one-half of the t-statistics cannot be differentiated from zero. That said, it is important that no estimate fall to the negative side of zero. Though this evidence casts some doubt on our central claims, we believe that the central difficulty arises from measuring turnover. We now examine an alternative measure of turnover.

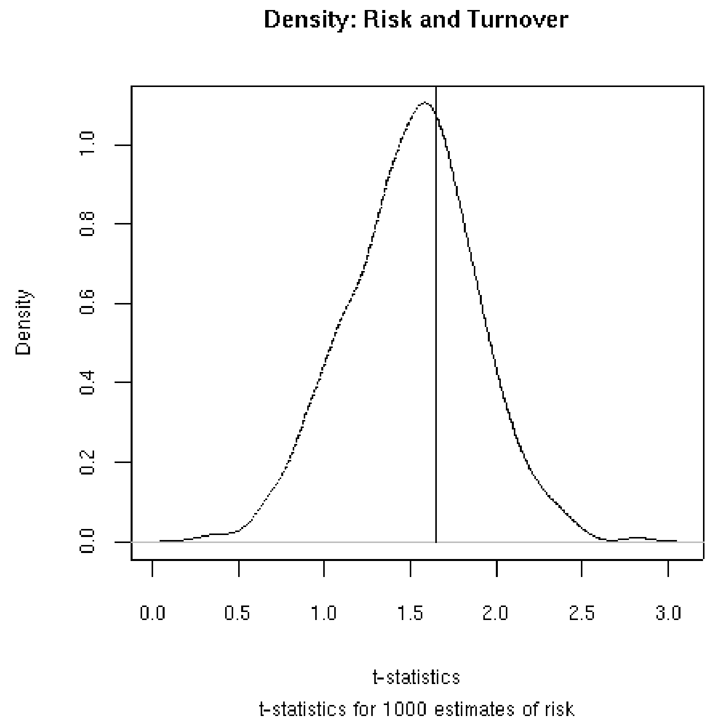

Figure 2: The Effect of Turnover on Risk: *Risk is measured as 1000 imputations from the estimated posterior distribution of* $\hat{\theta}^*_{it}$. *Turnover is the current number of changes to and from unified partisan government in the six year sample period. The density is of t-statistics over the 1000 estimates of risk for state* i *in year* t.

Table 2 displays the same model as before substituting a measure of the total number of changes to and from unified government during the sample period. Returning to the previous discussion of turnover in Michigan, Michigan receives a fixed score of two through time because there were two changes in unified/divided government between 1995 and 2000. Of course, there are problems with this approach, chiefly that some information that is not available at the times the ratings are generated is available in the model. With this objection in mind, we still believe there is some merit to this measurement as a proxy for the general competitiveness and predictability of state level political outcomes. We now turn to an interpretation of the effects.

As before, the expected risk is extraordinarily low, over 3 standard deviations from the mean, when all variables take the value of zero. This is sensible given the lack of meaningful zero for most of the independent variables and the fact that almost all have positive signs. Turning to

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	−3.6565	0.6703	−5.45	0.0000
Total Turnover	0.1619	0.0749	2.16	0.0317
Corruption	0.6595	0.1628	4.05	0.0001
State Tax Burden	0.0950	0.0402	2.36	0.0191
$\frac{Debt}{Revenue}$	0.0115	0.0036	3.20	0.0015
per capita Income	−0.0196	0.0117	−1.67	0.0958
per capita Debt	0.0431	0.0788	0.55	0.5852
Unemployment	0.4266	0.0514	8.30	0.0000
1996	0.2368	0.1754	1.35	0.1784
1997	0.3353	0.1671	2.01	0.0459
1998	0.4882	0.1723	2.83	0.0050
1999	0.5745	0.1811	3.17	0.0017
2000	0.5890	0.1894	3.11	0.0021

Table 2: Turnover and Mean Risk, Part II: *Risk Measures are the average of 1000 draws from the posterior distribution of* $\hat{\theta}^*_{it}$. *Turnover is the total number of changes to and from unified government in the six year sample period. The vertical line represents one-tailed significance at the .05 level of probability.*

the central variable of interest, we see that this measure of turnover is statistically significant and positively related to risk. All other things equal, states with higher turnover and associated political uncertainty about future governing coalitions pay a premium. We will return to this finding in more detail shortly.

Turning to the control variables, we find that corruption increases risk and that higher state tax burdens imply lesser abilities to pay and thus, higher risks with state bonds. Furthermore, as debt increases, relative to revenue, we see state bonds becoming riskier. States with higher per capita incomes, all other things equal, issue less risky bonds. While per capita debt cannot be differentiated from zero, higher unemployment again increases risk.[6]

To more deeply explore the relationship between this measure of turnover and risk, we generate a density of t-statistics for the 1000 estimates of risk from the measurement model and display it in Figure 3. First, every estimated effect is positively signed, as we would expect. Furthermore, we see that considerable mass lies to the right of the critical value. In fact, 76.1% lie to the right of the vertical line. Added to a baseline model, we find sufficient evidence to justify further inquiry on the effects of uncertainty and turnover on state bond risk. We further explore these findings alongside the implications of divided government for state bond ratings.

[6]To demonstrate some robustness to these findings, we replicate this finding using the tobit model of Depken and LaFountain (2006) in Table 2.

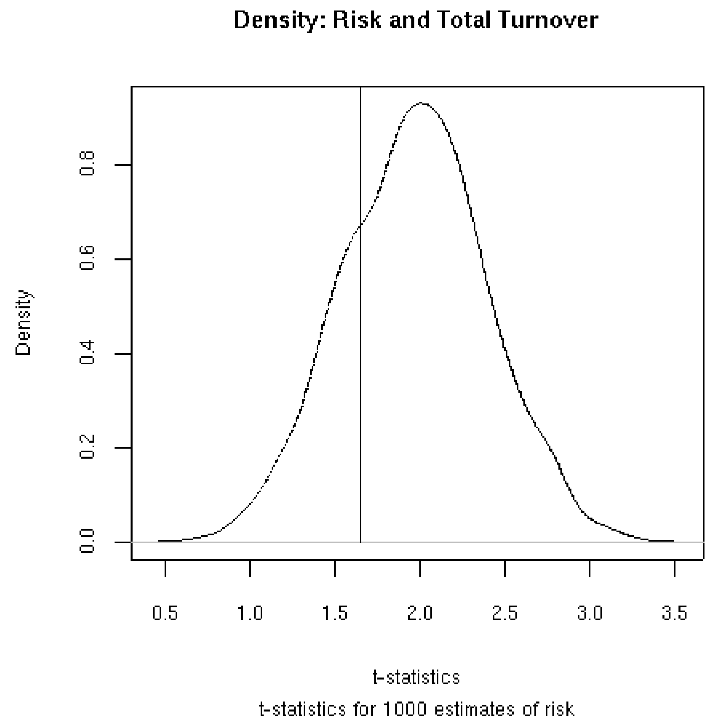

Figure 3: The Effect of Total Turnover on Risk: *Risk is measured as 1000 imputations from the estimated posterior distribution of* $\hat{\theta}^*_{it}$. *Turnover is the total number of changes to and from unified partisan government in the six year sample period. The density is of t-statistics over the 1000 estimates of risk for state* i *in year* t. *The vertical line represents one-tailed significance at the .05 level of probability.*

5.2 Divided Government and Turnover

We now include both turnover and divided government in a baseline model of bond ratings determination. Following the earlier presentation, we utilize both measures of turnover and combine this effect with an estimate of the effect of divided government.[7] With the specifications defined, we now turn to the estimated reported in Table 3.

The top row of Table 3 shows that divided government clearly increases the risk of a state's bonds. Indeed, the reported t-value suggests an extraordinarily low likelihood that the result arises from chance alone. Furthermore, the effect of divided government is consistent with our claims regarding uncertainty about future governing coalitions and increased risk. To further emphasize the robustness of the finding, we turn to the left panel of Figure 4.

[7]Divided government is measured as unified party control of both houses of a legislature with an executive of the opposing party.

	Estimate	Std. Error	t value	Pr(>|t|)
Divided Government	0.3699	0.1039	3.56	0.0004
Turnover	0.2329	0.0975	2.39	0.0177
Corruption	0.6960	0.1598	4.36	0.0000
State Tax Burden	0.1298	0.0407	3.19	0.0016
$\frac{Debt}{Revenue}$	0.0115	0.0035	3.26	0.0013
per capita Income	−0.0122	0.0117	−1.05	0.2969
per capita Debt	0.0020	0.0779	0.03	0.9798
Unemployment	0.3915	0.0503	7.78	0.0000
1996	0.1950	0.1729	1.13	0.2604
1997	0.2388	0.1666	1.43	0.1530
1998	0.3429	0.1736	1.98	0.0494
1999	0.4124	0.1841	2.24	0.0260
2000	0.3895	0.1947	2.00	0.0465
(Intercept)	−3.9803	0.6651	−5.98	0.0000

Table 3: Divided Government, Turnover, and Mean Risk: *Risk Measures are the average of 1000 draws from the posterior distribution of* $\hat{\theta}^*_{it}$. *Divided measures unified partisan control of the legislature with a governor of the opposing party. Turnover is the cumulative number of changes to and from unified government in the six year sample period. The vertical line represents one-tailed significance at the .05 level of probability.*

The left panel of Figure 4 displays the density of t-statistics for the effect of divided government for each of the 1000 measures of risk. The most striking finding is that no sample of risk measures from the measurement model yields a t-statistic less than positive two. Thus, it is clear that divided government has a remarkably consistent effect; divided government increases the risk of state bonds where it exists.

Returning to Table 3, we also see that turnover has a statistically significant and positive effect on risk. While the magnitude of the effect is slightly over half the effect of divided government, it is statistically different from zero and of reasonable substantive import. Because the maximum number of observed turnovers is two, a change from the minimum to the maximum yields a .5 standard deviation increase in risk [about $\frac{1}{8}$ of the total metric]. This effect is not substantively insignificant. Turning to the right panel of Figure 4 and comparing it to Figure 2, we see that the density has shifted to the right with considerably less mass to the right of the 5% critical value. However, unlike divided government, there are some samples of risk from the measurement model that fail to yield statistically significant increases on risk emanating from political turnover and concomitant uncertainty. Summing the results for the two primary variables of interest, we find that both divided government and turnover in partisan control have the theorized impact on risk. As the adage suggests, markets abhor uncertainty and charge the citizens of gov-

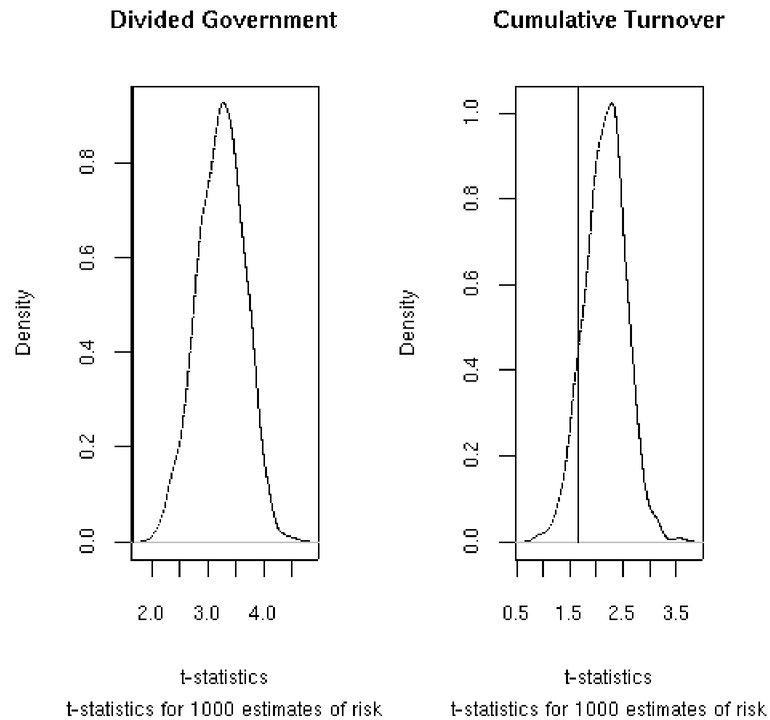

Figure 4: The Effects of Divided Government and Turnover on Risk: *Risk is measured as 1000 imputations from the estimated posterior distribution of* $\hat{\theta}^*_{it}$. *Turnover is the cumulative number of changes to and from unified partisan government in the six year sample period. Divided government captures a unified legislature of one party operating with a governor of the other. The density is of t-statistics over the 1000 estimates of risk for state* i *in year* t. *The vertical line represents one-tailed significance at the .05 level of probability.*

ernments that generate it a significant premium, given the well known relationship between bond ratings and interest rates (Ingram, Brooks, and Copeland 1983). We now briefly conclude this discussion with mention of the control variables in Table 3.

As before, corruption is both statistically and substantively significant in increasing risk. More corruption forces the taxpayers who tolerate it to pay a significant premium on state bonds. In addition, higher tax burdens and higher debt to revenue ratios increase risk. Income (per capita) has no statistically significant impact though it is intuitively signed; the same is true of per capita debt. Finally, unemployment increases risk by reducing the ability to repay by the state's population and we see the general increase in risk through time isolated by the annual fixed effects. In sum, there is evidence of the importance of turnover and divided government in increasing the risk of state bonds. We now turn to our alternative measure of political turnover, total turnover during the six year period of study.

Table 4 reports an identical model to Table 3 except for the measure of political turnover; we now employ the time-invariant measure. The pattern of effects is similar. For example, divided government is statistically significant and correctly signed and the effect of divided government is of virtually identical magnitude to the previous estimates. In addition, a glance at the left panel of Figure 5 reveals, once again, that the minimum t-statistic for the effect of divided government is just under 2.5. In short, the density of the t-statistic reported in the left panel of Figure 5 makes it clear that divided government increases risk and reduces bond ratings, as we have earlier suggested. With this in mind, we turn to the effect of total turnover.

	Estimate	Std. Error	t value	Pr(>|t|)
Divided Government	0.4410	0.1063	4.15	0.0000
Total Turnover	0.2670	0.0768	3.48	0.0006
Corruption	0.6882	0.1577	4.36	0.0000
State Tax Burden	0.1337	0.0401	3.34	0.0010
$\frac{Debt}{Revenue}$	0.0122	0.0035	3.49	0.0006
per capita Income	−0.0097	0.0116	−0.84	0.4029
per capita Debt	0.0026	0.0769	0.03	0.9730
Unemployment	0.4063	0.0500	8.13	0.0000
1996	0.2523	0.1698	1.49	0.1387
1997	0.2946	0.1620	1.82	0.0703
1998	0.4390	0.1672	2.63	0.0092
1999	0.5263	0.1757	3.00	0.0030
2000	0.5264	0.1839	2.86	0.0046
(Intercept)	−4.3714	0.6713	−6.51	0.0000

Table 4: Divided Government, Turnover, and Mean Risk, Part II: *Risk Measures are the average of 1000 draws from the posterior distribution of* $\hat{\theta}^*_{it}$. *Divided measures unified partisan control of the legislature with a governor of the opposing party. Turnover is the total number of changes to and from unified government in the six year sample period. The vertical line represents one-tailed significance at the .05 level of probability.*

This measure of turnover has a larger effect on risk than does the previous measure, though both are statistically differentiable from zero using mean levels of risk across all 1000 measures from the ordered factor analysis. The key difference between the two measures comes down to robustness. Comparing the right panel of Figure 5 and the right panel of Figure 4, we see that the density has shifted to the left in the former case. Put simply, this measure provides more robust and more substantively important evidence in support of our claims regarding turnover and risk. Indeed, all 1000 estimates are greater than the critical value at the .05 level in a one-tailed test [the minimum estimate is 1.74]. In short, this measure provides robust support for our theoretical assertions.

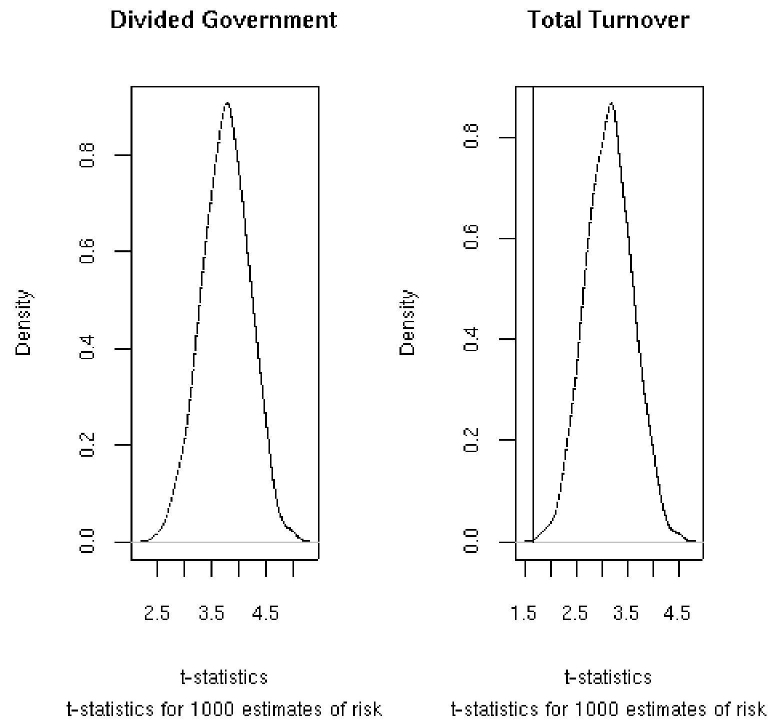

Figure 5: The Effects of Divided Government and Total Turnover on Risk: *Risk is measured as 1000 imputations from the estimated posterior distribution of* $\hat{\theta}^{*}_{it}$*. Turnover is the total number of changes to and from unified partisan government in the six year sample period. Divided government captures a unified legislature of one party operating with a governor of the other. The density is of t-statistics over the 1000 estimates of risk for state* i *in year* t*. The vertical line represents one-tailed significance at the .05 level of probability.*

As before, corruption, higher state tax burdens, higher ratios of debt to revenues, and unemployment increase risk. The consistency of these findings, the strength of the relationship between divided government and increased risk [and decreased bond ratings], and the considerable robustness of the effect of turnover on risk despite the measurement difficulties give us considerable confidence with which to expand this study. In short, the data limitations make the robustness and strength of these findings surprising and encouraging of further research.

6 Conclusions and Directions for the Future

We have argued that the uncertainty of future fiscal priorities imposes a pecuniary cost on citizens in states with considerable partisan turnover. We have related these arguments to broader literatures in political economy and demonstrated the underlying logic to tie them to broader themes. We have improved the measurement of risk using bond ratings by employing a Bayesian measurement model for multiple ordinal indicators and have provided evidence relating our measures to previous efforts. Employing two facets of uncertainty regarding future policies, we have measured turnover and divided government and shown that both have important statistical and substantive impacts increasing the risk [and thus the interest rate] that U.S. states pay on their bonds. Though we quibbled with previous efforts, we have also shown that our findings can generalize to other models [the Tobit models reported in Table 5 through 8 in the Appendix]. In short, this initial effort at tying state level political uncertainty to the risk of state bonds generates sufficient evidence to warrant a considerable expansion of the study.

As we broaden the study, we will first incorporate significant fiscal institutions. Though we alluded to them during the theoretical discussions, fiscal institutions tend not to change and without more variation in turnover, we cannot even begin to measure the effects of turnover, fiscal institutions, and their interactions. This is a task we have already begun. Though we cannot be certain of their robustness, across a host of models we find that supermajoritarian requirements for revenue increases have a statistically and substantively important effect on risk; supermajority rules for raising revenue increase the risk of the associated state bonds. For example, simply adding this variable to the final specification generates 976 rejections of the null hypothesis at the .05 level. Intuitively, we believe that this finding results from generating an overly inclusive coalition at the revenue stage, thus making unified government effectively divided by moving the veto pivot into the opposition party. In substantive terms, supermajority requirements are of nearly identical size to the effects of divided government. This finding is sufficient to motivate further inquiry.

Second, we have begun to investigate the reasons underlying the existence of three ratings agencies. We have some evidence that different rating agencies better differentiate different parts of the latent scale. From the standpoint of industrial organization and the information economies of scale that are likely in rating complicated state finances, it would seem that two rating agencies would exist for the necessary competition to insure quality information. The third agency is something of a puzzle. However, we contend that different agencies that specialize in lower, medium, and higher risk bonds is both plausible and borne out by initial diagnostics on the separation of the cutpoints from the ordered factor analysis. However, the preliminary nature of these findings precludes presenting them here.

Finally, we hope to expand this study to municipal bonds to extend our understanding of the political determinants of bond ratings and risks in government bonds. The sheer number of municipalities facilitates much more fine grained testing of political economy hypotheses regarding the pricing of governmental debt.

In sum, we have shown that uncertainty over the future composition of taxing and spending coalitions leads to risk premia on state government bonds. We have demonstrated important effects, both statistical and substantive, that support the view that political dynamics in the states have important effects on the real costs of government debt to citizens. Lying as it does at the heart of political economy, the political economy of state bonds merits considerable further understanding.

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This section presents a replication of our findings using the tobit estimations of Depken and LaFountain (2006). The tobit is chosen based on the claim that ratings are truncated from above at the highest possible rating though all state-years that receive this rating may not have similar levels of risk. While we are convinced that a measurement model of risk is more appropriate and better leverages the information in multiple indicators, we demonstrate that our conclusions also hold under these alternative measures of risk [or inverse risk because ratings range from low to high where risk ranges high to low].

Table 5: Tobit Replication of Table 1

Variable	**Coefficient**	**(Std. Err.)**
Equation 1 : model		
Turnover	-0.017*	(0.008)
Corruption Convictions (per capita)	-0.054**	(0.013)
Tax Burden	-0.007*	(0.003)
Debt to Revenue	-0.001**	(0.000)
Real Income (per capita)	0.002†	(0.001)
Real State Debt (per capita)	-0.004	(0.006)
Unemployment Rate	-0.034**	(0.004)
1996	-0.015	(0.015)
1997	-0.019	(0.014)
1998	-0.034*	(0.015)
1999	-0.037*	(0.015)
2000	-0.036*	(0.016)
Intercept	1.170**	(0.055)
Equation 2 : sigma		
Intercept	0.059**	(0.003)

Significance levels : $\dagger$: 10% $*$: 5% $**$: 1%

Table 6: Tobit Replication of Table 2

Variable	Coefficient	(Std. Err.)
Equation 1 : model		
Total Turnover	-0.015*	(0.006)
Corruption Convictions (per capita)	-0.053**	(0.013)
Tax Burden	-0.007*	(0.003)
Debt to Revenue	-0.001**	(0.000)
Real Income (per capita)	0.002†	(0.001)
Real State Debt (per capita)	-0.005	(0.006)
Unemployment Rate	-0.034**	(0.004)
1996	-0.019	(0.014)
1997	-0.023†	(0.014)
1998	-0.041**	(0.014)
1999	-0.045**	(0.015)
2000	-0.046**	(0.016)
Intercept	1.184**	(0.055)
Equation 2 : sigma		
Intercept	0.059**	(0.003)

Significance levels : † : 10% ∗ : 5% ∗∗ : 1%

Table 7: Tobit Replication of Table 3

Variable	Coefficient	(Std. Err.)
Equation 1 : model		
divgovt	-0.027**	(0.009)
Turnover	-0.022**	(0.008)
Corruption Convictions (per capita)	-0.056**	(0.013)
Tax Burden	-0.010**	(0.003)
Debt to Revenue	-0.001**	(0.000)
Real Income (per capita)	0.001	(0.001)
Real State Debt (per capita)	-0.002	(0.006)
Unemployment Rate	-0.032**	(0.004)
1996	-0.015	(0.014)
1997	-0.015	(0.014)
1998	-0.029*	(0.014)
1999	-0.031*	(0.015)
2000	-0.029†	(0.016)
Intercept	1.207**	(0.055)
Equation 2 : sigma		
Intercept	0.058**	(0.003)

Significance levels : † : 10% ∗ : 5% ∗∗ : 1%

Table 8: Tobit Replication of Table 4

Variable	**Coefficient**	**(Std. Err.)**
Equation 1 : model		
Divided Government	-0.032**	(0.009)
Total Turnover	-0.022**	(0.006)
Corruption Convictions (per capita)	-0.055**	(0.013)
Tax Burden	-0.010**	(0.003)
Debt to Revenue	-0.001**	(0.000)
Real Income (per capita)	0.001	(0.001)
Real State Debt (per capita)	-0.002	(0.006)
Unemployment Rate	-0.033**	(0.004)
1996	-0.020	(0.014)
1997	-0.020	(0.013)
1998	-0.037**	(0.014)
1999	-0.042**	(0.015)
2000	-0.041**	(0.015)
Intercept	1.237**	(0.055)
Equation 2 : sigma		
Intercept	0.058**	(0.003)

Significance levels : † : 10% ∗ : 5% ∗∗ : 1%