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Corruption and inflation: evidence Evidence from from US states

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Abstract

Purpose – The purpose of this paper is to show that states where corruption is greater also have higher levels of inflation.

Design/methodology/approach – Using a sample of all US states through the period 1992-2007 and various factors common across states that could impact the level of corruption or inflation, multiple regression techniques are used to determine corruption impact to inflation.

Findings – The study finds that corruption contributes, along with aid transfer, positively to inflation in the US states. The results are robust even after scaling the corruption variable to different determinants.

Originality/value – While there is some evidence on the relationship between corruption and inflation in cross-country dataset, there is no such evidence on it within country dataset. This paper, however, provides evidence on the relationship between corruption and inflation using state-level data of the US states.

Keywords Inflation, Corruption, Public economics

Paper type Research paper

1. Introduction

The relationship between corruption and inflation using data from many countries has lately received more attention. However, country level data include a great deal of noise resulting from the presence of historical, cultural, and political differences, among others. Substantial differences such as these have been used to negatively judge the findings of cross-country studies. To identify the true relationship between corruption and inflation, it would be best to have access to a data set in which these historical, cultural, political, institutional and other differences are minimized. However, such a data set would be hard to find. In its absence, we can examine this important relationship by making use of data from various regions within a country. One crucial shortcoming of this approach is that regional inflation data are not readily available and there is virtually no data regarding regional corruption rates.

Despite the paucity of data, William et al. (2000, 2004, 2009) collected consistent inflation data for all of the US states for the period 1960 to 2007, solving one of the two big problems related to data availability at the regional level. Regarding data on corruption, we have located some indirect estimates for all of US States. Researchers including Rajeev and Daniel (1989), Raymond and Roberta (2002) and Edward and Rayen (2006) have presented data on corruption in form of convicted public officials. The availability of data on these two crucial variables has allowed us to make an attempt to examine the relationship between corruption and inflation using data on US states. The data on US states are well suited to our purposes because of its availability, quality, and comparability. In addition, it has been desirable for

JEL classification – E62, H72, D73, H83

The author of this article has not made their research dataset openly available. Any enquiries regarding the dataset can be directed to the corresponding author.



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US states

economists to reexamine theories that have been proved in national contexts by applying them to states (Edward and Raven, 2006; Nobuo and Masayo, 2002; Raymond and Roberta, 2002).

The advantage in using this data for our purposes specifically is that as state authorities have no control over seigniorage, this variable will be purely and completely controlled for when testing other channels that may link corruption with inflation. Sugata and Kyriakos (2010) have suggested research on the inflationary effect of corruption through public financing by examining channels other than seigniorage. Our expectations for corruption's effects on inflation is influenced by other variables that are based on the possibility of obtaining funds through means other than seigniorage such as aid transfers. In particular, we intend to evaluate the interaction effect of corruption and aid transfers on the inflation levels in US states.

2. Literature review

To the best of our knowledge, this is the first state-level study that has been conducted to examine the relationship between corruption and inflation with an emphasis on public finance channels. Edward and Raven (2005) analyzed the causes and consequences of corruption on growth using data on convicted officials across US states. They examined three countrywide theories in relation to corruption. The first theory is Seymour (1960), who stated that higher levels of income and education are associated with less corruption. The second theory is that of Paulo (1995) and Ardagna et al. (2002), who stated that places with greater ethnic heterogeneity tend to be more corrupt. The third hypothesis is that places with larger bureaucracies as measured by government size and number of regulation exhibit higher levels of corruption. Finally, the authors looked at the effect of corruption on growth. The authors estimated various regressions for the period 1976 to 2002 and found results that support those obtained in cross-country studies. Specifically, they found significant results that support the first and second hypothesis, whereas they found weak evidence regarding the effect of government size and number of regulation on corruption levels in US States. Finally, they found that corruption as measured by the number of convicted officials reduces income growth.

Rajeev and Daniel (1989) indicate that bribes can lead to inefficiencies when officials purposely delay their duties to induce individuals to pay bribes, inducing individuals with higher discount rates to pay bribes while those who are unwilling or unable to pay bribes would face delays in or denial of services. However, such officials encounter the risk of detection and conviction. The authors therefore investigated the determinants that affect officials' decisions to accept bribes by examining the convictions of corrupt officials in all US states for the period 1970 to 1983, applying the fixed effect model. They found that the behavior of corrupt officials, taking into account the variations in the convictions of officials state by state, is affected by a number of factors. They found that high a probability of being convicted; more severe punishment, high relative earnings, and low employment all negatively contribute to officials making a decision to accept bribes. Per *et al.* (2003) investigated the effect of corruption and environmental policy on inbound foreign direct investment (FDI) in US states for the period 1987 to 1997. The authors used a linear fixed effects panel data for 48 states, applying the data of convicted state officials as a measure of corruption affecting each state's inbound FDI. They made use of two measurements of FDI:

- (1) gross value of plants, property, and equipment; and
- (2) employment in foreign-owned affiliates.

They found that corruption affects the supply of public goods as well as the stringency of environmental regulations. They also found that public expenditures along with the severity of environmental regulations affect FDI inflows.

Using US state data, Raymond and Roberta (2002) were able to investigate a further question in regard to corruption and decentralization. They investigated the effect of decentralization of a state's revenue and expenditure on corruption using federal aid transfer as a measurement of the mismatch between state expenditure generation and revenue generation. Theories predict that the relationship of revenue-expenditure decentralization and corruption take many forms, as vertical fiscal transfers may lead local officials to ignore the financial consequences of misspending. In addition, officials face lower accountability in centralized governments than those that are decentralized. Officials of a decentralized regime are held accountable for specific tasks, whereas what matters in centralized regimes is the aggregated outcome. The authors applied a number of corruption measurement techniques. When using the number of public official convicted as their corruption measurement, they controlled for the degree of enforcement of justice by including the percentage of police employment per state population. They also deflate the number of convictions by the number of prison inmates in the state. In respect to federal transfer, the authors indicated that federal aid is determined mainly according to state income, demographics and the preferences of particular programs. Thus, while they controlled for the first determinant by including the state income level, they found no strong evidence that would associate the other two determinants with the number of convicted officials. The authors found that there is a positive association between the proportion of expenditure obtained from federal transfer and number of officials convicted in each state.

3. Data

Collecting data on a subnational level is problematic for not only corruption and institutional indices but also macroeconomic variables. Our data were collected from the following sources: online websites, articles, CDs of statistics and government offices.

3.1 Corruption and inflation variables

Our measure of corruption (CONVICT) consists of the number of public officials (federal, state and local) convicted in a state for abuse of public office. These data are drawn from the report to Congress on the Activities and Operations of the Public Integrity Section for 2009 published by the US Department of Justice and are available online for the period 2000-2009. Data for the 1990s were requested of the Department of Justice by mail. This measure has certain shortcomings in that it treats all convicted officials equally regardless of the type of crime committed, and reflects only those corrupt officials who were caught rather than all corrupt officials. The measure, however, does not suffer from the perception bias that may affect people's opinions through such channels as the media, hearsay, education level, etc.

Our inflation measurements for each state was obtained from the Consumer Price Index (CPI), compiled and created by William *et al.* (2000). The lack of data in geographic variation regarding the cost of goods and services that has kept researchers from testing for or using such data motivated the authors to conduct the present study. William *et al.* (2000) constructed an annual price index for each US state for the period 1960 to 2007 using data on intermediate family budgets drawn from the Metropolitan Statistical Areas (SMSAs) and the Nonmetropolitan Urban Areas (NMURs). They also used data pertaining to those selected areas' CPIs, which are comparable only longitudinally. To make the CPIs cross-sectionally comparable, Berry *et al.* rescaled the CPI using intermediate family budgets for 1977 to unify that year's base CPI for each area, and rescaled the CPI values of all other years

rity V of Evidence from US states

to the 1977 CPI within each area. Sources of data, family budgets and adjusted CPIs are highly correlated, which implies the comparability of CPI values across states that are comparable. The authors conducted their analysis in two stages: first, they regressed the adjusted CPI values pertaining to personal income, population, the median housing value and regional dummies along with the national CPI, and then they used the coefficients derived from the first stage along with state-level values of independent variables to predict state-level CPI values.

3.2 Other variables

- Per capita GDP: All industry per capita by states. Source: US Department of Commerce.
- Personal income: Personal income per capita in constant (2000) values for each state. Source: Statistical Abstract of the United States, US Census Bureau.
- Law enforcement: Number of police officers in states calculated as a share of the state population. Source: US Census Bureau.
- Labor: State total unemployment estimate in thousands. Source: US Bureau of Labor Statistics.
- Education: Public high school graduates in each state in thousands. Source: US National Center for Education and Statistics.
- Population: Population in each state in thousands. Source: US Census Bureau.
- Aid: Federal to state and local governments in each state. Source: US Census Bureau, Federal Aid to States for fiscal year 2009.
- Democracy: Ideologies of each US state's citizens and political leaders was constructed by William *et al.* (1998) and updated in 2010. The indicator consists of three variables, one citizen ideology variable and two alternative government ideology variables. These variables range from 0 (the most conservative position) to 100 (the most liberal position) and cover the period from 1960 to 2010 for all 50 states.

4. Methodology

We estimate the effect of corruption on inflation across states through different models using the following equation:

$$Inflation_{it} = \alpha + B_1 Log(GDP \ per \ capita)_{it} + B_2 Log(Personal \ income_{it}) + B_3 Law \ enforcement_{it} + B_4 Education_{it} + B_5 Unemployment_{it} + B_6 \left(\frac{Export}{GDP}\right)_{it} + B_7 Democracy_{it} + B_7 Aid_{it} + B_8 Convicted \ Officials_{it} + B_9 (Convicted \ officials^* Aid)_{it} + \varepsilon_{it}$$
(1)

The models are the baseline, the fixed effect and the instrumental variable (IV) models. First, we test the relationship through simple panel estimation. Then, we control for individual differences and any serial correlation within each individual difference through the use of

the fixed effect and IV models. The question to be investigated is that of the temporal variations that occur between corruption and inflation. In addition, answering this question faces problems of potential multicollinearity across variables having to do with corruption. We think that the specifications of our models plus the fact that we have scaled our corruption variable, (number of convicted officials) to different indicators will control for the differences that exist from state to state. We incorporate the interaction term representing the relationship between convicted officials and federal aid to investigate the joint effects on inflation to states. In addition, we estimate a secondary regression by representing corruption as a share of state population, state government employees, and state prisoners.

We notice that an aggregation of the number of convicted officials at the national level correlates positively with the corresponding CPI and ICRG measures by 70 per cent and 27 per cent, respectively. The lower correlation obtained with the ICRG is because of the very low variation present from 1992 through 2007, but it still shows that measurement of the number of convicted officials matches it in terms of its sign. To conclude, our main challenge is to tell how, for instance, an increase of one in the number of convicted officials will affect inflation. Our expectation is that there is an effect in a positive direction, so that an increase in the number of convicted officials will increase inflation rate in a state, though, we believe that this relationship is probably not a direct one and that there is a channel that carries this effect.

5. Estimation

5.1 Pre-estimation tests

Our base line analysis examines the relationship between inflation and corruption using correlation tests. Table AI shows summary statistics. The table shows considerable difference between the mean and the median in the corruption variable. In contrast, (Table AI) indicates little dispersion for inflation across states. Table AII in the Appendix illustrates the correlation and t statistics among the variables. It indicates a striking correlation between the independent variables, which leads one to predict the possible presence of an endogeneity problem across the variables. However, we can also see from the table that inflation is correlated positively with Aid, Convicted Officials, and their interaction term. The signs of these correlations match our hypothetical expectations, though corruption is not significant in its correlation with inflation.

The interaction term shows a very significant level of correlation with inflation and there is also a very high correlation between corruption and federal aid [this is matches with the finding of Raymond and Roberta (2002)]; that is, highly corrupt states tend to have a higher level of federal transfer.

5.2 Panel estimate

The equation (1) will be estimated using a panel data estimate through these three models: the baseline, the fixed effect, and the IV models. The baseline model is used for purpose of setting the base results so as to compare them with the other models' results. The second model, the fixed effect, is used to control for individual differences among the states. The last model, the IV, represents the possibility of heterogeneity that may exist among our variables.

In Table I, there are two important results from our panel models' estimates that we want to present before explaining their results in detail. First, the results are highly consistent in terms of sign and significance in all three models. Second, our interaction term of convicted officials and federal aid is very significant and has the expected sign. The first column, presenting the baseline estimates, indicates that the model explains the 16 per cent variation

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JFEP	Variables	Baseline	Fixed effect	IV
	Constant	-14.57 (0.00)	-33.3 (0.00)	-36.34 (0.02)
	Log GDP per	0.158 (0.01)	0.942 (0.04)	0.25 (0.30)
	Log personal income	1.607 (0.00)	2.577 (0.00)	3.553 (0.01)
	Law enforcement	0.556 (0.15)	0.367 (0.27)	-0.396(0.39)
	Education	-0.003(0.85)	-0.016(0.28)	0.003 (0.86)
	Unemployment	-0.002(0.00)	-0.003(0.00)	-0.004(0.01)
	 Export/GDP per 	1.855 (0.07)	3.819 (0.01)	0.239 (0.81)
	Democracy	0.0009 (0.79)	-0.001 (0.71)	0.071 (0.05)
	Aid	-4.71E-05(0.30)	-5.36E-05 (0.17)	-5.64E-05(0.34)
	Convicted officials	-0.012(0.00)	-0.004(0.27)	-0.022(0.19)
	Convicted officials*Aid	8.34E-07 (0.00)	6.03E-07 (0.01)	1.53E-06 (0.00)
	R squared (%)	16	47	14
	AR(1)			(0.00)
	AR(2)			(0.56)
	Instruments			Once lag
	Observations	537	537	342
Table I.				
Panel estimation	Notes: p-value in brackets. In	nflation is the dependent var	iable	

in inflation rates found among the states. Regarding the models' coefficients, the baseline has a confusing negative sign representing the effects of corruption on each state's inflation rate; the coefficient is significant at a level of 1 per cent. The coefficient of the interaction term has the right sign with a very high significance, indicating that high corruption levels together with high levels of federal aid transfer are collectively and relatively responsible for higher inflation rates in US states. Regarding the fixed effect and the IV models, the issue with the negative sign of the corruption coefficient with very high significance is solved. That is, the sign of the coefficient is still negative but the coefficient of both models is insignificant.

The coefficient of the interaction term for the two models is very significant with the right sign, which is positive as it is in the baseline results. In all of the models, all the results regarding the coefficients of the interaction term reveal that corruption through aid transfer positively contributes to inflation in all US states. In terms of size effect, one standard deviation change in the interaction term of corruption and federal aid in pooled and fixed effect regressions results in 0.52 and 0.37 standard deviation increase in inflation, respectively.

The IV model gives an effect of higher magnitude for the interaction term of inflation in comparison with the other two models. That is, one standard deviation change in corruption/federal aid interaction term results in 0.95 standard deviations increases in inflation. In respect to R squared coefficient, the fixed effect model gives a higher value in terms of explaining the variations in inflation among the US states as compared to the other models, where their specifications yield reasonably similar R squared values. However, we should mention that the number of observations is less in the IV model than in the other two models, as the IV model uses instruments and controls for autocorrelation.

Regarding the control variables, the coefficients of these controls seem to find the differences among the US states and clearly reflect their economic effects. The coefficient of log GDP per capita has a positive effect and is significant in all the models except the IV. The coefficient of log personal income is very significant and has the right sign in all three models. These two income variables represent the economic intuition that high income has

	(0.00) (0.05) (0.05) (0.05) (0.05) (0.00) (0.00) (0.00) (0.00) (0.00) (0.00) (0.00) (0.00) (0.00) (0.07) (0.07) (0.07)		Evidence from
꼬	$\begin{array}{c} -33.56\ (0.00)\\ 0.902\ (0.05)\\ 2.643\ (0.05)\\ 2.643\ (0.05)\\ 2.643\ (0.05)\\ -0.000\ (0.54)\\ -0.000\ (0.54)\\ -0.000\ (0.96)\\ -2.00E\ 0.4\ (0.00)\\ -2.00E\ 0.4\ (0.00)\\ -2.91.3\ (0.30)\\ 7.40E\ 0.2\ (0.07)\\ 7.40E\ 0.2\ (0.07)\\ 7.80E\ 0.37\\ 537\end{array}$	state. The third colu	US states
FE	$\begin{array}{c} -32.36\ (0.02)\\ 1.036\ (0.27)\\ 2.37\ (0.29)\\ 0.348\ (0.35)\\ -0.015\ (0.45)\\ -0.015\ (0.45)\\ -0.010\ (0.74)\\ 4.258\ (0.12)\\ -12.45\ (0.34)\\ 5.00E\ 03\ (0.07)\\ 46\\ 537\end{array}$	e of population of the s	
FE	$\begin{array}{c} -34.02\ (0.00)\\ 0.939\ (0.04)\\ 2.638\ (0.00)\\ 0.32\ (0.32)\\ -0.008\ (0.5.6)\\ -0.002\ (0.00)\\ 3.873\ (0.01)\\ -2.00E.04\ (0.00)\\ 17.55\ (0.64)\\ 2.40E.02\ (0.04)\\ 48\\ 537\end{array}$	s. Column 2 is the shar	
Baseline	$\begin{array}{c} -14.78(0.00)\\ -14.78(0.00)\\ 1.825(0.00)\\ 0.539(0.17)\\ 0.0600(0.27)\\ 0.0000(0.293)\\ 0.943(0.36)\\ 0.943(0.36)\\ 0.0009(0.79)\\ -2.00E.04(0.00)\\ -644.4(0.00)\\ -644.4(0.00)\\ 1.5\\ 537\\ 537\end{array}$	re of prisoners of state	
Baseline	$\begin{array}{c} -15.83 \ (0.00) \\ -0.047 \ (0.45) \\ 1.942 \ (0.00) \\ 0.54 \ (0.17) \\ 0.0007 \ (0.96) \\ -0.0001 \ (0.96) \\ -24.44 \ (0.11) \\ 5.00E \ 03 \ (0.02) \\ 1.3 \\ 5.37 \end{array}$	uption variable as sha	
Baseline	$\begin{array}{c} -15.17\ (0.00)\\ -0.047\ (0.46)\\ 1.047\ (0.00)\\ 0.532\ (0.18)\\ 0.532\ (0.18)\\ 0.532\ (0.18)\\ 0.0001\ (0.62)\\ 0.0001\ (0.62)\\ 1.225\ (0.23)\\ -55.36\ (0.10)\\ 1.60E-02\ (0.03)\\ 1.60E-02\ (0.03)\\ 1.4\end{array}$	s. Column 1 is the corr government workers	
Variables	Constant Log GDP per Log personal income Law enforcement Education Unemployment Export/GDP per Democracy Aid Convicted officials Convicted officials Requared (%) Observations	Notes: <i>p</i> -value in brackets. Column 1 is the corruption variable as share of prisoners of states. Column 2 is the share of population of the state. The third column is the share of corruption to government workers	Table II. Panel estimation, different scaling of convicted corrupt officials

an inflationary effect on the economy. Although the coefficient of law enforcement is insignificant in all three models, this variable has been included to control for the biases associated with convicted officials that may be caused by differences in the effectiveness of law enforcement among US states. The coefficient of education is insignificant in all of the models, whereas the coefficient of unemployment is significant and has the expected sign. The models include the participation of the US states in national exports to control for variations in inflation that occur because of the opening of a state to trade operations. The coefficient of this variable has a positive sign in all of the models and is significant at 10 per cent in the baseline, 1 per cent in the fixed effect model, and insignificant in the IV model. The coefficient of aid transfer is insignificant in all of the models, which is common when this variable interacts with the other variables in the specification. In addition, the coefficient for democracy is insignificant in the baseline and the fixed effect models, but it is significant in the IV model. This variable has been included to control for the effects of political tension that may contribute to the likelihood of an official's perpetration of a violation. Some types of official convictions such as fraudulent voting practices and campaign financing crimes are political in nature, and so we include the democracy index to control for such convictions.

Finally, our results are also robust when we scale the corruption variables to a different kind of measurement. We re-run the baseline and the fixed effect models using the corruption measurement of convicted officials calculated as a share of a state's population, number of state prison inmates and state public employees. Table II shows that our interaction term remains consistent through the use of different methods of scaling of convicted official variables.

6. Conclusion

We have investigated the relationship between corruption and inflation by examining the misuse of federal transfers to states as a channel. Our state level corruption measure consists of the number of officials convicted for corruption. We find that state corruption contributes to higher levels of inflation. This result is robust throughout our differing model specifications. The effect of corruption on inflation takes place indirectly through state public financing, specifically federal transfer. In addition, our results are also robust when we scaled convicted officials to size of state population, number of state prisoners and number of state public employees.

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Appendix

	Mean	Median	Maximum	Minimum	SD	Observations
GDP_PER	177,950	110,565	1,539,444	12,336	217,178.6	800
Education	50.23	34.41	356.64	5.2	54.18	800
Unemployment	148.82	96.49	1,441.24	8.061	188.65	800
POLICE_OFFICERS	1,084.77	686	7,585	47	1,196.43	735
INFLATION	3	2.8	7.35	0.68	0.93	800
Federal aid	5,967.03	3,682.22	49,976.12	437.49	7,321.28	750
CONVICTED	17.78	8	144	0	23.15	745

Note: Definition and Source: GDP: gross domestic product by states, Statistical Abstract of United States, different CDs. Education: number of high school graduated by state, US National Center for Education Statistics. Unemployment: Total unemployment as per cent of civilian labor force, US Bureau of Labor Statistics. Police Officers: number of police officers employed by state, US Census Bureau. Inflation: percentage change in CPI by states constructed by Berry *et al.* (2000) and revised on 2009. Federal aid: Federal to State and Local Government by State. Source: US Census Bureau. Convicted officials: number of public officials (federal-state-local) convicted in a state, US Department of Justice

Table AI. Summary statistics

Downloaded by Iowa State University At 08:23 29 January 2019 (PT)

Downloaded by Iowa State University At 08:23 29 January 2019 (PT)

Correlation/t-statistic	INFLATION	GDP_PER	EDUCATION	UNEMP	POLICE	AID	CONVICTED	AID*CONVICTED
INFLATION	1							
GDP_PER	0.133							
EDUCATION	0.083	0.968	1					
UNEMP	0.006	0.895	-0.935	1				
	0.176	52.417	660.69	Ι				
POLICE	0.014	0.808	0.806	0.81	1			
	0.369	35.773	35.55	36.071	I			
AID	0.177	0.954	0.906	0.848	0.757	1		
	4.69	83.414	56.028	41.755	30.265	I		
CONVICTED	0.005	0.767	0.775	0.773	0.686	0.754	1	
	0.133	31.227	32.041	31.787	24.602	29.944	I	
AID*CONVICTED	0.113	0.896	0.855	0.842	0.735	0.932	0.823	
	2.983	52.644	43.0159	40.717	28.301	67.027	37.809	I

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Table AII.Correlation and
t-statistic

JFEP	State	Inflation	Corruption	State	Inflation	Corruption
	AL	2.91	20.6	MT	3.24	4.2
	AK	3.29	3.73	NE	2.71	1.33
	AZ	3.3	12.13	NV	3.31	3.53
	AR	2.85	6.266	NH	2.76	1.13
	CA	3.35	87.66	NJ	2.92	35.46
	CO	3.79	5.92	NM	3.25	3.78
	СТ	2.66	10.2	NY	3.04	74.13
	DE	2.77	3.53	NC	3.02	14.46
	FL	2.88	73.33	ND	2.62	5.33
	GA	2.98	19.73	OH	2.76	50.2
	HI	3.41	5.2	OK	2.81	10.2
	ID	3.3	3.6	OR	3.78	3.33
	IL	2.81	60.66	PA	3.11	48
	IN	2.76	12.06	RI	2.72	2.66
	IA	2.73	3.8	SC	2.92	10
	KS	2.67	3.86	SD	2.68	3.8
	KY	2.96	20.53	TN	2.93	22.73
	LA	2.91	31.06	TX	2.86	52.2
	ME	2.83	3.46	UT	3.72	2.53
	MD	2.85	14.13	VT	2.9	1.13
	MA	3.14	19.35	VA	2.92	26.06
	MI	2.87	19.8	WA	3.72	8.66
Table AIII.	MN	2.79	6.21	WV	2.82	5.93
	MS	2.89	20.06	WI	2.83	10.2
Average of inflation	MO	2.66	16.66	WY	3.15	1.53
and corruption of US state for the period 1992-2007			'S states is constructed e is the federal, state, ar			<i>et al.</i> (2000, 2004,

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