REPLICATION STUDY: Gore (The Accounting Review, 2009)

Michel L. Hand, Kawika Pierson, and Fred Thompson  
Center for Governance and Public Policy Research  
Atkinson Graduate School of Management  
Willamette University  
900 State Street  
Salem, Oregon 97301

Correspondence should be addressed to: Fred Thompson, e-mail fthompso@willamette.edu,  
503-370-6228
ABSTRACT
Gore’s article explores the determinants and implications of cash reserves. We first attempted to replicate Gore’s finding of a positive relationship between environmental uncertainty and municipal fund balances (1999) using the same data, the same specifications, and the same econometric software. We then tested the robustness of her original findings by adding years and observations. We show that the empirical results reported in this article are largely replicable and that its results are robust to substantial data extensions. Nevertheless, we believe that Gore reaches normative conclusions, that municipalities hold “excess cash reserves,” which are not justified by her empirical results.

Keywords: Reserves • Volatility • Replication

JEL Classification Numbers: H71 • H72
REPLICATION STUDY: Gore (*The Accounting Review, 2009*)

1. **Introduction**

   The Government Finance Officer’s Association recommends that municipalities maintain reserves at least equal to about 16 percent of revenues, plus more to deal with revenue volatility, infrastructure upkeep and vulnerability to extreme events. Kriz (2002) and Dothan and Thompson (2009) argue that they should (as a normative matter) increase reserves (fund balances) in line with revenue volatility. Indeed, Kriz concluded that if the representative Minnesota municipality wished “to sustain a three percent expenditure growth rate with a 75 percent confidence level, it would need savings equal to 91 percent of total revenues” (Kriz 2002: 5).

   Angela Gore’s 2009 article in *Accounting Review* is especially important because it shows that local-government fund balances do apparently vary directly with revenue volatility and that jurisdictions that spend more on administration tend to maintain higher reserves. These finding are critical to the developing field of public financial management. Consequently, we wished to pursue them further, especially since we had reservations about Gore’s data set, specification of response and predictor variables, and functional forms tested. Unfortunately, her data set and codes were unavailable. Consequently, we set out to replicate her work, as a first step as precisely as possible, using the same data, the same specifications, and the same econometric software\(^1\) (Stata). Next, we extended the time horizon of her analysis to include all of the years of data available.

---

\(^1\) We can’t actually be sure that Gore used Stata, but one of her references (Rogers 1993) is a technical document describing how to run clustered robust standard errors using Stata, so it is somewhat likely.
We also briefly address her article’s fundamental hypothesis: that municipalities over save, i.e., hold more cash than is needed to “provide a constant level of services to citizens, regardless of revenue volatility” (Gore 2009, 183).

2. Replication of Sample Selection and Data Cleaning

Starting from the government finance database\(^2\) (Pierson et al. 2014), which has data from the Census’s annual survey of state and local governments for years between 1967 and 2011, we restricted our sample to governments with data from years between 1997 and 2003.

Gore does not explicitly identify the government type codes that she includes in her data set, but it appears that her analysis comprehends both municipalities (type 2) and townships (type 3). Table 1 shows the breakdown of the data by year and type of government. It is clear from this table that using only one government type is too restrictive.

Table 1: Goes about here

Including both municipalities and townships allows us to come close to Gore’s count of 80,125 observations. Unfortunately there is no reasonable way to replicate this number precisely. Gore may have been working from Census data that had yet to be finalized since the more recent data from the census includes additional data points.

Gore next drops “4,043 observations with missing data for cash or operating expenses, and 57 observations with apparent errors such as negative debt.” We adopt Gore’s definition of cash and securities and drop 6,547 observations that have missing values for this variable. We also drop 505 observations with missing data for total operating expenditure.

It is unclear how Gore calculates total debt from the census data, especially considering the fact that none of the top-level debt outstanding line items in our data have negative entries. Given this lack of direction we chose the highest-level variable, total debt outstanding, since it

\(^2\) http://www.willamette.edu/mba/research_impact/2014/public_datasets.html
most closely matches Gore’s language. This leaves us with 83,025 observations, very close to Gore’s 76,025.

The final data cleaning procedure is described by Gore as: “A total of 66,612 observations without four years’ consecutive data, the minimum number of observations necessary to estimate the regression models, are also deleted.” When we tried to apply this exactly by requiring four consecutive years of data we ended up with only 3,003 city-years eligible for our sample, far less than Gore’s 9,413. This led us down several paths before we realized that she describes this step on her table 2 in much less restrictive terms as “Less observations for municipalities with less than four years of data.” When we required our data to have four previous observations but did not require the years to be consecutive we ended up with 9,681 in-sample city-years, within a few hundred of Gore.

Her table 3 listing sample summary statistics reports winsorized summary statistics. She states that she “winsorizes all of the continuous variables to remove the top and bottom 1 percent” in her section describing her regression results. When we perform a winsorization at the 1 percent level separately on both the full sample and the smaller sample we get the results, shown in tables 2 and 3, which are very close to her results. Sample medians are reported in table Error! Reference source not found.Error! Reference source not found.4 and are also close to those reported by Gore.

---

3 This causes a few problems when we replicate Gore’s growth variable, since not every city-year in the sample has a population figure from exactly five years prior, which is what Gore says she uses. Our solution is to use the five-year population change if it is available, but to substitute a four-year change or a three-year change in the worst case.

4 A process of setting outlier values to the value of some percentile of the data, “clipping” them but leaving them in the sample.
One particularly troublesome variable, even after winsorizing the sample, is the revenue diversification index Gore calls “limited revenue.” This variable is described by Gore as “the product of the fraction of total revenue from each source [property taxes, general sales taxes, and individual income taxes].” This is almost certainly not correct, either mathematically or conceptually, since only 212 city-years in our sample have revenue from all three sources, and therefore almost every value for this variable is equal to zero. There is no way to reconcile this result with the summary statistics Gore provides or the descriptions of limited revenue in her paper. We chose to use her construction of limited revenue even though it is not possible to replicate any of her results for that variable.

2.1. Replication of Results

Table 5 displays our results from a regression that is identical to Gore’s table 4 model 1.

Specifically we estimated:\(^5\)

\[
\frac{Cash/Expenditures_{it}}{Expenses_{it}} = \alpha_0 + \alpha_1 CVrevenue_{it} + \alpha_2 Debt per capita_{it-1} + \alpha_3 Limited revenue_{it} + \alpha_4 Size_{it} + \alpha_5 Growth_{it} + \alpha_6 State revenue_{it} + \Sigma \alpha_k Quarter_{kt} + \Sigma \alpha_m State_{mt} + \Sigma \alpha_s Year_{st}
\]

\(^5\) This model matches Gore’s model from page 188 of her paper, but in her table 4 the subscript of the debt variable indicates that it is not lagged one year. When we estimated the regression using unlagged debt per capita the slope estimate changed signs but was still not significant. None of our other slope estimates changed in sign or significance during that test.
The CVrevenue variable is Gore’s measure of revenue volatility. Her paper describes it as: “the ratio of the standard deviation of total revenue/mean total revenue, over the prior four years ending at year t [for each local government].” Since our replication found that Gore did not require four sequential years of data we measured the mean and standard deviation of total revenue using every year of data available for each city.

Table 5: Goes about here

Our regression results are qualitatively the same as Gore’s for 6 of the 8 estimates we make. Our estimate of the impact of lagged debt per capita has the same sign as Gore’s estimate but our estimate is not statistically significant. The biggest difference between the two sets of results is that in our replication the limited revenue variable was perfectly collinear with a combination of the other regression variables and needed to be omitted. This reinforces our finding that Gore’s description of her limited revenue variable was not rich enough to allow others to replicate her results. Aside from this, our replication of Gore’s model for the months of cash holdings by local governments confirms her findings for the period between 1997 and 2003. Indeed, our coefficient for the revenue volatility measure is practically identical to hers.

Next we replicated Gore’s table 5 model 1, where she uses the residuals from the first regression (actual reserves less predicted reserves) to estimate the ratio of administrative expenses to total operating expenses. Specifically we estimated:

\[
\text{Administrative}_{it} = \alpha_0 + \alpha_1 \text{Excess cash}_{it-1} + \alpha_2 \text{Debt per capita}_{it} + \alpha_3 \text{Size}_{it} + \sum \alpha_k \text{State}_k + \sum \alpha_l \text{Year}_t
\]  

(2)

where excess cash is a one year lag of the residuals from the earlier regression.
Table 6 shows our results from replicating this regression. Even though our lagged residuals eliminate far more data than Gore’s do, we again qualitatively replicate her results for every variable except per capita debt.

Table 6: Goes about here

2.2. Sample Extension by Including More Years of Data

Gore’s sample only includes census data between 1997 and 2003, but because the government finance database has observations between 1967 and 2011 it is reasonable to test whether Gore’s findings hold when the same statistical tools are applied using more years of data.

In total we were able to include 389,365 city-years of data after applying the same data cleaning steps that Gore used. Table 7 displays our results.

Table 7: Goes about here

These results are very similar to Gore’s, and to our first replication. The sign of the slope we estimate for debt per capita is now positive, and is marginally significant (p-value = 0.053), but Gore’s paper is not focused on the impact that per capita debt has on cash holdings and so we feel that this difference isn’t important for our replication.

We also replicated the model of administrative expenses as a fraction of total expenses using the lagged residuals from the first regression. The results of that replication are shown in table 8, and once again confirm Gore’s findings.

Table 8: Goes about here

3. DISCUSSION AND CONCLUSIONS

Frankly, in many cases, we would not have handled the data, specified response and predictor variables, or tested functional forms the way Gore has. Nevertheless, the empirical results she

---

6 We found it very difficult to only eliminate 2,000 city-years when lagging the regression residuals, and Gore does not give any details of how her data managed this.
reports in her 2009 article are largely replicable and its main results are robust to substantial data extensions.8 There is a strong relationship between fiscal uncertainty and reserves. Municipalities with greater revenue volatility and growth and undiversified revenue sources tend to hold larger reserves, and larger jurisdictions and those receiving relatively more state revenue tend to hold less. There is also a statistically significant relationship between administrative expenses and reserves, i.e., high residuals are correlated with high administrative expenses and executive salaries; low residuals with low administrative expenses and executive salaries.

We believe that both of these findings are highly noteworthy. Because her hypothesis that municipalities are over saving is the mirror image of the conventional view found in the literature, which argues that governments are, if anything, excessively improvident, her supporting the over saving hypothesis (and consequent search for an agency-theoretic explanation) would be even more meaningful, if valid.

7 As an anonymous reviewer for this journal observed: “It should be pointed out that the two-part procedure of first estimating cash reserves as a function of policy variables, and then taking the residuals and estimating them on ‘shirking’ variables, is ineffective. All the variables should be included in a single stage regression. Nothing is gained by doing the estimation in two parts. In fact, doing so introduces a mistake in the number of degrees of freedom used to calculate standard errors, since it ignores the fact that the residuals were derived from a previous regression.”

8 And, while this point is beyond the scope of a replication study, we can attest to the robustness of her main result with respect to data (jurisdictional type), variable specifications (diversity, mean growth and variance, jurisdictional size, etc.), and econometric software. Indeed, in a majority of cases, we obtained arguably stronger results. As we worked through the process of replication it seemed, at times, as if she were trying to get results that contradicted her expectations.
However, we believe that Gore fails to sustain this hypothesis. Instead, her argument involves a rather circular logic. The positive residuals from her first model, which shows a relationship between environmental uncertainty and fiscal reserves, do not necessarily indicate excess cash; that these residuals are correlated with administrative costs and salaries could just as easily have a benign interpretation as a harmful one. For example, Meier and O’Toole (2002, see also O’Toole and Meier 2011) offer the contrary hypothesis, that administrative expenses or managerial compensation are reasonable proxies for managerial competence and that more competent managers would save more for a rainy day. It is axiomatic that a finding does not strengthen a hypothesis if the finding in question is equally consistent with a contrary hypothesis.

To distinguish between these hypotheses, a normative standard or optimum against which cash holding could be assessed is needed. Gore does not provide one; others do (Kriz 2002; Dothan and Thompson 2009; see also Rameriz 2011). If Kriz is correct, the average municipality is seriously under saving (i.e., is improvident). If Dothan and Thompson are correct the average municipality is saving approximately the right amount, but about a third less than would be optimal. In both cases, therefore, the Meier and O’Toole hypothesis looks better than Gore’s.

Ultimately, however, we cannot say whether municipalities tend to hold excess reserves, too little, or just the right amount, and neither, we suspect, can anyone else at this time. Nevertheless, before we did this analysis, we believed that the likelihood a municipality would under save was much larger than the likelihood it would over save. Replicating Gore’s work has caused us to revise our \textit{a priori} probabilities downward considerably. That remains an important contribution on her part.
APPENDIX 1: CODES FOR REPLICATION STUDY

Cleaning to match Gore (omit the first two lines and add FYEnds to run for the entire database)

```stata
drop if Year4 < 1997
drop if Year4 > 2003
drop if Type_Code == 0
drop if Type_Code == 5
drop if Type_Code == 4
drop if Type_Code == 1
```

```stata
tabulate Type_Code Year4
```

*Drop 4,043 observations with missing data for cash or operating expenses, and 57 observations with apparent errors such as negative debt*

Cash is \((W31 + W61)\)
Operating expenses are total of \(E\)

```stata
generate GoreCash = Bond_Fd_Cash___Sec + Oth_Nonin_Fd_Cash___Sec
```

```stata
drop if GoreCash == 0
```

```stata
generate GoreOperating = General_Current_Oper
```

```stata
drop if GoreOperating == 0
```

```stata
generate GoreDebt = Total_Debt_Outstanding
```

* A total of 66,612 observations without four years' consecutive data, the minimum number of observations necessary to estimate the regression models, are also deleted. *

```stata
sort ID Year4
```

```stata
generate OneYearofData = 1
```

```stata
generate TwoYearsofData = 1 if (ID[_n] == ID[_n-1])
```

```stata
generate ThreeYearsofData = 1 if (ID[_n] == ID[_n-2])
```

```stata
generate FourYearsofData = 1 if (ID[_n] == ID[_n-3])
```

**Creating Gore's variables**

```stata
generate GoreE23 = Fin_Admin_Direct_Exp - Fin_Admin_Cap_Outlay
```

```stata
generate GoreE29 = Cen_Staff_Direct_Exp - Cen_Staff_Cap_Outlay
```

```stata
generate GoreE89 = General_NEC_Direct_Exp - VetBonus - General_NEC_Cap_Outlay
```
generate Gore_Administrative = (GoreE23 + GoreE29 + GoreE89)/GoreOperating

generate GoreInterest = Total_Interest_on_Debt
generate Gore_YearsOfCash = GoreCash/(GoreOperating+GoreInterest)

generate Gore_MonthsOfCash = Gore_YearsOfCash*12

generate Gore_ChangeInPropertyTaxes = ( Property_Tax[_n] - Property_Tax[_n-1] ) / Population if (ID[_n] == ID[_n-1])

generate Gore_ChangeInTotalTaxes = ( Total_Taxes[_n] - Total_Taxes[_n-1] ) / Population if (ID[_n] == ID[_n-1])

To make coefficient of variation of revenue:

gen Stdev_Revenue = .
gen Mean_Revenue = .

quietly: levelsof(State_Code), local(states)
foreach s of local states {
quietly: levelsof(ID) if State_Code == `s', local(cities)
foreach c of local cities {
quietly: sum Total_Revenue if ID == `c'
quietly: replace Mean_Revenue = r(mean) if ID == `c'
quietly: replace Stdev_Revenue = r(sd) if ID == `c'
}
}

generate CV_Revenue = Stdev_Revenue / Mean_Revenue

generate Gore_DebtPerCapita = GoreDebt / Population

Gore growth presents a problem given the previous data cleaning steps... handled reasonably

generate Gore_Growth = (Population[_n] - Population[_n-5]) / Population[_n-5] if (ID[_n] ==ID[_n-5])


More Gore variables

generate Gore_TotalTaxRev = Property_Tax + Total_Gen_Sales_Tax + Individual_Income_Tax
gen GoreRevDiv1 = Property_Tax / Gore_TotalTaxRev
gen GoreRevDiv2 = Total_Gen_Sales_Tax/ Gore_TotalTaxRev
gen GoreRevDiv3 = Individual_Income_Tax/ Gore_TotalTaxRev

generate Gore_LimitedRevenue = GoreRevDiv1 * GoreRevDiv2 * GoreRevDiv3

gen Gore_Size = ln(Population)

gen Gore_StateRevenue = Total_State_IG_Revenue / (Total_Revenue - Total_Insur_Trust_Rev )

Get summary statistics

summarize Gore_MonthsOfCash Gore_DebtPerCapita Gore_LimitedRevenue Gore_Size Gore_Growth Gore_StateRevenue Gore_Administrative, detail

summarize Gore_MonthsOfCash Gore_DebtPerCapita Gore_LimitedRevenue Gore_Size Gore_Growth Gore_StateRevenue Gore_Administrative if FourYearsofData == 1, detail

Winsorize

winsor Gore_MonthsOfCash, gen(WGore_MonthsOfCash) p(0.01)
winsor Gore_DebtPerCapita, gen(WGore_DebtPerCapita) p(0.01)
winsor Gore_LimitedRevenue, gen(WGore_LimitedRevenue) p(0.01)
winsor Gore_Size, gen(WGore_Size) p(0.01)
winsor Gore_Growth, gen(WGore_Growth) p(0.01)
winsor Gore_StateRevenue, gen(WGore_StateRevenue) p(0.01)
winsor Gore_Administrative, gen(WGore_Administrative) p(0.01)

summarize WGore_MonthsOfCash WGore_DebtPerCapita WGore_LimitedRevenue WGore_Size WGore_Growth WGore_StateRevenue WGore_Administrative

winsor Gore_MonthsOfCash if FourYearsofData == 1, gen(W2Gore_MonthsOfCash) p(0.01)
winsor Gore_DebtPerCapita if FourYearsofData == 1, gen(W2Gore_DebtPerCapita) p(0.01)
winsor Gore_LimitedRevenue if FourYearsofData == 1, gen(W2Gore_LimitedRevenue) p(0.01)
winsor Gore_Size if FourYearsofData == 1, gen(W2Gore_Size) p(0.01)
winsor Gore_Growth if FourYearsofData == 1, gen(W2Gore_Growth) p(0.01)
winsor Gore_StateRevenue if FourYearsofData == 1, gen(W2Gore_StateRevenue) p(0.01)
winsor Gore_Administrative if FourYearsofData == 1, gen(W2Gore_Administrative) p(0.01)

summarize W2Gore_MonthsOfCash W2Gore_DebtPerCapita W2Gore_LimitedRevenue W2Gore_Size W2Gore_Growth W2Gore_StateRevenue W2Gore_Administrative if FourYearsofData == 1

Generate dummy variables

tabulate Year4, gen(Yr)
tabulate State_Code, gen(St_)

gen FYEndQuarter = .
replace FYEndQuarter = 1 if FYEndDate == "0101"
replace FYEndQuarter = 1 if FYEndDate == "0110"
replace FYEndQuarter = 1 if FYEndDate == "0115"
replace FYEndQuarter = 1 if FYEndDate == "0125"
replace FYEndQuarter = 1 if FYEndDate == "0131"
replace FYEndQuarter = 1 if FYEndDate == "0201"
replace FYEndQuarter = 1 if FYEndDate == "0203"
replace FYEndQuarter = 1 if FYEndDate == "0206"
replace FYEndQuarter = 1 if FYEndDate == "0207"
replace FYEndQuarter = 1 if FYEndDate == "0211"
replace FYEndQuarter = 1 if FYEndDate == "0215"
replace FYEndQuarter = 1 if FYEndDate == "0219"
replace FYEndQuarter = 1 if FYEndDate == "0222"
replace FYEndQuarter = 1 if FYEndDate == "0224"
replace FYEndQuarter = 1 if FYEndDate == "0225"
replace FYEndQuarter = 1 if FYEndDate == "0228"
replace FYEndQuarter = 1 if FYEndDate == "0229"
replace FYEndQuarter = 1 if FYEndDate == "0301"
replace FYEndQuarter = 1 if FYEndDate == "0302"
replace FYEndQuarter = 1 if FYEndDate == "0303"
replace FYEndQuarter = 1 if FYEndDate == "0306"
replace FYEndQuarter = 1 if FYEndDate == "0307"
replace FYEndQuarter = 1 if FYEndDate == "0309"
replace FYEndQuarter = 1 if FYEndDate == "0310"
replace FYEndQuarter = 1 if FYEndDate == "0311"
replace FYEndQuarter = 1 if FYEndDate == "0313"
replace FYEndQuarter = 1 if FYEndDate == "0315"
replace FYEndQuarter = 1 if FYEndDate == "0316"
replace FYEndQuarter = 1 if FYEndDate == "0317"
replace FYEndQuarter = 1 if FYEndDate == "0318"
replace FYEndQuarter = 1 if FYEndDate == "0320"
replace FYEndQuarter = 1 if FYEndDate == "0321"
replace FYEndQuarter = 1 if FYEndDate == "0324"
replace FYEndQuarter = 1 if FYEndDate == "0325"
replace FYEndQuarter = 1 if FYEndDate == "0326"
replace FYEndQuarter = 1 if FYEndDate == "0328"
replace FYEndQuarter = 1 if FYEndDate == "0329"
replace FYEndQuarter = 1 if FYEndDate == "0330"
replace FYEndQuarter = 1 if FYEndDate == "0331"
replace FYEndQuarter = 2 if FYEndDate == "0401"
replace FYEndQuarter = 2 if FYEndDate == "0415"
replace FYEndQuarter = 2 if FYEndDate == "0417"
replace FYEndQuarter = 2 if FYEndDate == "0430"
replace FYEndQuarter = 2 if FYEndDate == "0507"
replace FYEndQuarter = 2 if FYEndDate == "0531"
replace FYEndQuarter = 2 if FYEndDate == "0601"
replace FYEndQuarter = 2 if FYEndDate == "0630"
replace FYEndQuarter = 3 if FYEndDate == "0731"
replace FYEndQuarter = 3 if FYEndDate == "0831"
replace FYEndQuarter = 3 if FYEndDate == "0930"
replace FYEndQuarter = 3 if FYEndDate == "0931"
replace FYEndQuarter = 4 if FYEndDate == "1001"
replace FYEndQuarter = 4 if FYEndDate == "1031"
replace FYEndQuarter = 4 if FYEndDate == "1130"
replace FYEndQuarter = 4 if FYEndDate == "1220"
replace FYEndQuarter = 4 if FYEndDate == "1229"
replace FYEndQuarter = 4 if FYEndDate == "1230"
replace FYEndQuarter = 4 if FYEndDate == "1231"
replace FYEndQuarter = . if FYEndDate == "BBBB"

tabulate FYEndQuarter, gen(Q)

There is a lag in the debt per capita variable <- tests of means determined that she likely didn't use this version in her table of summary statistics, but we still need to use it in the regression

gen Gore_LagDebt = Gore_DebtPerCapita[_n-1]
winsor Gore_LagDebt, gen(WGore_LagDebt) p(0.01)
winsor Gore_LagDebt if FourYearsofData == 1, gen(W2Gore_LagDebt) p(0.01)

Run the cash regression
regress W2Gore_MonthsOfCash CV_Revenue W2Gore_LagDebt W2Gore_LimitedRevenue W2Gore_Size W2Gore_Growth W2Gore_StateRevenue Yr* St_ * Q* if FourYearsofData == 1, vce(cluster ID)

no debt lag
regress W2Gore_MonthsOfCash CV_Revenue W2Gore_DebtPerCapita W2Gore_LimitedRevenue W2Gore_Size W2Gore_Growth W2Gore_StateRevenue Yr* St_ * Q* if FourYearsofData == 1, vce(cluster ID)

Save regression residuals
predict Gore_Excess_Cash, r

gen Gore_LagExcessCash = Gore_Excess_Cash[_n-1]

Run the second regression
regress W2Gore_Administrative Gore_LagExcessCash W2Gore_DebtPerCapita W2Gore_Size Yr* St_* if FourYearsofData == 1, vce(cluster ID)

Other data restriction approaches:

generate OnePrior = 1 if ( (ID[_n] == ID[_n-1]) & (Year4[_n-1] == Year4[_n] - 1) )

generate TwoPrior = 1 if ( ( OnePrior == 1) & (Year4[_n-2] == Year4[_n-1] - 1) & (ID[_n] == ID[_n-2]) )

generate ThreePrior = 1 if ( ( TwoPrior == 1) & (Year4[_n-3] == Year4[_n-2] - 1) & (ID[_n] == ID[_n-3]) )

generate FourPrior = 1 if ( ( ThreePrior == 1) & (Year4[_n-4] == Year4[_n-3] - 1) & (ID[_n] == ID[_n-4]) )

Any Data from five years before?


Enough data to do a standard deviation?

Data file @ http://www.willamette.edu/mba/research_impact/2014/public_datasets.html
REFERENCES


**Table 1: Sample Size Tabulated by Government Type and Year**

<table>
<thead>
<tr>
<th></th>
<th>1997</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipalities</td>
<td>19,372</td>
<td>3,439</td>
<td>3,447</td>
<td>3,489</td>
<td>1,172</td>
<td>19,429</td>
<td>1,166</td>
<td>51,514</td>
</tr>
<tr>
<td>Townships</td>
<td>16,629</td>
<td>893</td>
<td>884</td>
<td>2,223</td>
<td>716</td>
<td>16,504</td>
<td>714</td>
<td>38,563</td>
</tr>
<tr>
<td>Total</td>
<td>36,001</td>
<td>4,332</td>
<td>4,331</td>
<td>5,712</td>
<td>1,888</td>
<td>35,933</td>
<td>1,880</td>
<td>90,077</td>
</tr>
</tbody>
</table>

*Note: A tabulation of sample sizes by year and government type*
<table>
<thead>
<tr>
<th>Variable</th>
<th>Gore (Full)</th>
<th>Gore (Small)</th>
<th>Replication (Full)</th>
<th>Replication (Small)</th>
<th>Percent Difference (Full)</th>
<th>Percent Difference (Small)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>12.82</td>
<td>10.44</td>
<td>17.19</td>
<td>14.15</td>
<td>34</td>
<td>36</td>
</tr>
<tr>
<td>Debt per capita</td>
<td>0.54</td>
<td>1.36</td>
<td>0.53</td>
<td>1.37</td>
<td>-2</td>
<td>1</td>
</tr>
<tr>
<td>Limited Revenue</td>
<td>0.25</td>
<td>0.27</td>
<td>0</td>
<td>0</td>
<td>-100</td>
<td>-100</td>
</tr>
<tr>
<td>Size</td>
<td>7.54</td>
<td>9.64</td>
<td>7.41</td>
<td>9.37</td>
<td>-2</td>
<td>3</td>
</tr>
<tr>
<td>Growth</td>
<td>0.03</td>
<td>0.02</td>
<td>0.06</td>
<td>0.06</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>State revenue</td>
<td>0.20</td>
<td>0.15</td>
<td>0.20</td>
<td>0.15</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Administrative</td>
<td>0.25</td>
<td>0.17</td>
<td>0.30</td>
<td>0.22</td>
<td>20</td>
<td>29</td>
</tr>
</tbody>
</table>

| Count             | 76,025      | 9,413        | 83,025             | 9,681              | 9.21                      | 2.85                      |

*Note: This table shows our sample means alongside Gore’s and calculates the percentage difference as (Replication – Gore) / Gore.*
Table 3: Winsorized Sample Standard Deviations Compared to Gore’s (2009) Table 3

<table>
<thead>
<tr>
<th>Variable</th>
<th>Full</th>
<th>Small</th>
<th>Full</th>
<th>Small</th>
<th>Percent Difference</th>
<th>Full</th>
<th>Small</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>11.28</td>
<td>8.38</td>
<td>19.95</td>
<td>12.45</td>
<td>77</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td>Debt per capita</td>
<td>1.16</td>
<td>1.71</td>
<td>1.01</td>
<td>1.81</td>
<td>-13</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Limited Revenue</td>
<td>0.06</td>
<td>0.05</td>
<td>0</td>
<td>0</td>
<td>-100</td>
<td>-100</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>1.88</td>
<td>1.78</td>
<td>1.93</td>
<td>1.85</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Growth</td>
<td>0.08</td>
<td>0.05</td>
<td>0.14</td>
<td>0.14</td>
<td>75</td>
<td>180</td>
<td></td>
</tr>
<tr>
<td>State revenue</td>
<td>0.18</td>
<td>0.13</td>
<td>0.18</td>
<td>0.13</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Administrative</td>
<td>0.17</td>
<td>0.12</td>
<td>0.21</td>
<td>0.14</td>
<td>24</td>
<td>17</td>
<td></td>
</tr>
</tbody>
</table>

*Note: This table shows our sample standard deviations alongside Gore’s and calculates the percentage difference as (Replication – Gore) / Gore.*
### Table 4: Sample Medians Compared to Gore’s (2009) Table 3

<table>
<thead>
<tr>
<th>Variable</th>
<th>Gore Full</th>
<th>Gore Small</th>
<th>Replication Full</th>
<th>Replication Small</th>
<th>Percent Difference Full</th>
<th>Percent Difference Small</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>9.25</td>
<td>8.34</td>
<td>11.19</td>
<td>10.93</td>
<td>21</td>
<td>31</td>
</tr>
<tr>
<td>Debt per capita</td>
<td>0.04</td>
<td>0.88</td>
<td>0.04</td>
<td>0.87</td>
<td>0</td>
<td>-1</td>
</tr>
<tr>
<td>Limited Revenue</td>
<td>0.27</td>
<td>0.29</td>
<td>0</td>
<td>0</td>
<td>-100</td>
<td>-100</td>
</tr>
<tr>
<td>Size</td>
<td>7.35</td>
<td>9.82</td>
<td>7.28</td>
<td>9.59</td>
<td>-1</td>
<td>-2</td>
</tr>
<tr>
<td>Growth</td>
<td>0.00</td>
<td>0.00</td>
<td>0.04</td>
<td>0.04</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>State revenue</td>
<td>0.14</td>
<td>0.11</td>
<td>0.14</td>
<td>0.11</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Administrative</td>
<td>0.21</td>
<td>0.14</td>
<td>0.25</td>
<td>0.19</td>
<td>19</td>
<td>36</td>
</tr>
</tbody>
</table>

*Note: This table shows our sample medians alongside Gore’s and calculates the percentage difference as (Replication – Gore) / Gore.*
<table>
<thead>
<tr>
<th>Variable</th>
<th>Gore Slope</th>
<th>Gore T</th>
<th>Replication Slope</th>
<th>Replication t</th>
<th>Same Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>19.95</td>
<td>10.01</td>
<td>30.80</td>
<td>13.33</td>
<td>Yes</td>
</tr>
<tr>
<td>CV Revenue</td>
<td>7.92</td>
<td>6.00</td>
<td>7.39</td>
<td>4.38</td>
<td>Yes</td>
</tr>
<tr>
<td>Debt per Capita t-1</td>
<td>-0.24</td>
<td>-2.72</td>
<td>-0.05</td>
<td>-0.39</td>
<td>-</td>
</tr>
<tr>
<td>Limited Revenue</td>
<td>21.74</td>
<td>8.91</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Size</td>
<td>-0.94</td>
<td>-10.07</td>
<td>-1.44</td>
<td>-10.87</td>
<td>Yes</td>
</tr>
<tr>
<td>Growth</td>
<td>12.46</td>
<td>7.00</td>
<td>4.20</td>
<td>2.90</td>
<td>Yes</td>
</tr>
<tr>
<td>State Revenue</td>
<td>-3.89</td>
<td>-3.06</td>
<td>-8.77</td>
<td>-5.26</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Quarter dummies Included Included
Year dummies Included Included
State dummies Included Included
Adj. R² 0.21 0.19
Sample Size 9,413 9,576

Note: Results of a replicated regression modeling months of cash reserves according to equation 1. The standard errors used to calculate t-statistics for both Gore’s regressions and our replication are robust and clustered by government. The slopes we show in **bold** are significant at the 5 percent level or better.
Table 6: Regression Results Following Gore’s Table 5 Model 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Gore Slope</th>
<th>T</th>
<th>Replication Slope</th>
<th>T</th>
<th>Same Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.44</td>
<td>19.97</td>
<td>0.50</td>
<td>22.15</td>
<td>Yes</td>
</tr>
<tr>
<td>Excess Cash t-1</td>
<td>0.01</td>
<td>7.87</td>
<td>0.001</td>
<td>4.30</td>
<td>Yes</td>
</tr>
<tr>
<td>Debt per Capita</td>
<td>-0.01</td>
<td>-5.36</td>
<td>0.0003</td>
<td>0.24</td>
<td>-</td>
</tr>
<tr>
<td>Size</td>
<td>-0.02</td>
<td>-14.24</td>
<td>-0.02</td>
<td>-11.11</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Year dummies: Included
State dummies: Included
Adj. R²: 0.25 0.22
Sample Size: 7,379 4,791

Note: Results of a replicated regression modeling months of cash reserves according to equation 2. The standard errors used to calculate t-statistics for both Gore’s regressions and our replication are robust and clustered by government. The slopes we show in **bold** are significant at the 5 percent level or better.
Table 7: Regression Results Following Gore’s Table 4 Model 1 Using All of the Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Gore</th>
<th>Replication</th>
<th>Same Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>19.95</td>
<td>26.97</td>
<td>Yes</td>
</tr>
<tr>
<td>CV Revenue</td>
<td>7.92</td>
<td>1.27</td>
<td>5.46</td>
</tr>
<tr>
<td>Debt per Capita t-1</td>
<td>-0.24</td>
<td>0.184*</td>
<td>1.93</td>
</tr>
<tr>
<td>Limited Revenue</td>
<td>21.74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>-0.94</td>
<td>-2.24</td>
<td>-47.83</td>
</tr>
<tr>
<td>Growth</td>
<td>12.46</td>
<td>1.85</td>
<td>9.71</td>
</tr>
<tr>
<td>State Revenue</td>
<td>-3.89</td>
<td>-4.03</td>
<td>-10.03</td>
</tr>
<tr>
<td>Quarter dummies</td>
<td>Included</td>
<td>Included</td>
<td></td>
</tr>
<tr>
<td>Year dummies</td>
<td>Included</td>
<td>Included</td>
<td></td>
</tr>
<tr>
<td>State dummies</td>
<td>Included</td>
<td>Included</td>
<td></td>
</tr>
<tr>
<td>Adj. R²</td>
<td>0.21</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>Sample Size</td>
<td>9,413</td>
<td>389,365</td>
<td></td>
</tr>
</tbody>
</table>

Note: Results of a replicated regression modeling months of cash reserves according to equation 1, but including all of the available data. The standard errors used to calculate t-statistics for both Gore's regressions and our replication are robust and clustered by government. The slopes we show in bold are significant at the 5 percent level or better. A * signifies significance at the 10 percent level, but not the 5 percent level.
Table 8: Regression Results Following Gore’s Table 5 Model 1 Using All of the Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Gore Slope</th>
<th>Gore T</th>
<th>Replication Slope</th>
<th>Replication t</th>
<th>Same Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.44</td>
<td>19.97</td>
<td>0.77</td>
<td>107.12</td>
<td>Yes</td>
</tr>
<tr>
<td>Excess Cash t-1</td>
<td>0.01</td>
<td>7.87</td>
<td>0.0012</td>
<td>30.88</td>
<td>Yes</td>
</tr>
<tr>
<td>Debt per Capita</td>
<td>-0.01</td>
<td>-5.36</td>
<td>-0.005</td>
<td>-6.52</td>
<td>-</td>
</tr>
<tr>
<td>Size</td>
<td>-0.02</td>
<td>-14.24</td>
<td>-0.04</td>
<td>-72.40</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Year dummies: Included
State dummies: Included
Adj. R²: 0.25 0.22
Sample Size: 7,379 387,222

Note: Results of a replicated regression modeling months of cash reserves according to equation 2, but including all of the available data. The standard errors used to calculate t-statistics for both Gore’s regressions and our replication are robust and clustered by government. The slopes we show in **bold** are significant at the 5 percent level or better.