O’Neill School of Public and Environmental Affairs

Cash Reserves and Short-Term Debt Under Liquidity Constraints

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Introduction

- **Research Question:** What is the effect of cash reserves on short-term borrowing?

- **Theory:** Liquidity constraints play a crucial role in determining the relationship between cash reserves and short-term borrowing (Kling, 2018). Depending on the stringency of the constraint, cash and debt might behave like substitutes or complements.

- **Empirical Analysis:** Mexico's fiscal system provides a setting with liquidity-constrained state governments facing liquidity shocks from timing errors (exogenous variation!) on federal IG transfers.

Findings Preview: cash and debt behave like complements!

- **Estimated Effect:** ↑ 1 SD on Cash Reserves (% DR) ≈ ↑ 3.75% of DR in outstanding short-term debt. **Effect Size:** 0.6 SD of outstanding short-term debt.
- **Implication:** Consistent with a theory of short-term borrowing under liquidity constraints.

Mechanisms and Liquidity Management

- **Cash Reserves:** stronger effects for less capitalized states (Eff size = 0.8 SD)
- **Temporal Heterogeneity:** stronger effects closer to the beginning/end of fiscal year. Cash-flow management of non-deferrable expenses.
- **Credit risk:** larger effects for lower rated governments. Evidence on the stringency of liquidity constraints.

Theoretical Motivation: Liquidity Constraints

Without Liquidity Constraints

- Cash and debt behave like substitutes.
- Pecking order theory: Organizations prefer internal over external financing. Debt carries interest and opens the door to the scrutiny of third parties (Jensen, 1986; Myers, 1984).
- Implication: finance liquidity gaps with cash reserves.

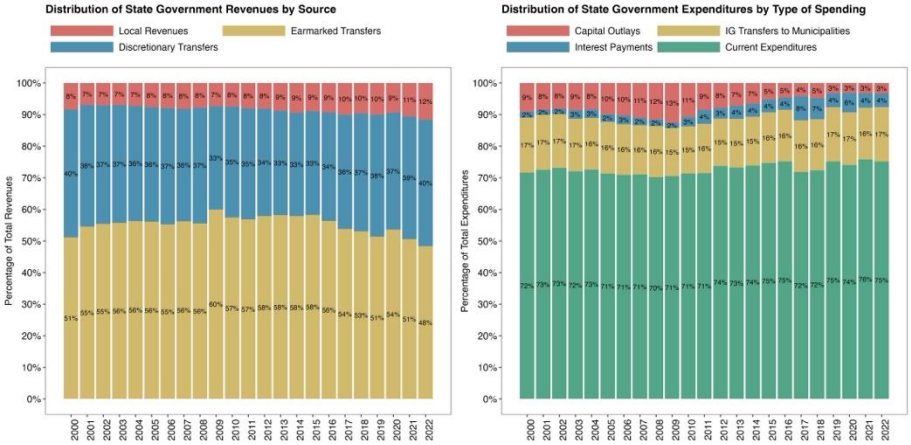
Under Liquidity Constraints

- Relationship is ambiguous (Empirical question!).
- Cash reserves have an operational and precautionary role (Kling, 2018).
- Governments maintain cash reserves to preserve creditworthiness (Marlowe, 2011) and signal solvency to access financial markets.
- Implication: finance liquidity gaps with short-term debt.

Empirical Setting: State Governments in Mexico

- **States:** 31 states + Mexico City.
- **Fiscal Federalism in Mexico:** shared-revenue system with centralized tax collection.
- State tax revenues: % of states GDP.

Fiscal Structure of Mexican State Governments, 2000-2022



- 90% of revenues come from IG transfers. 50% earmarked and 40% discretionary.
- High levels of current expenditures (75%) and IG transfers to local governments (17%).
- Less than 10% of spending space for capital projects, debt service, and to improve fiscal stance.

Notes: The panel on the left shows the distribution of revenues by source. Earmarked transfers (Aportaciones) include funds to finance education payroll (FONE) and infrastructure development (FAM, FAETA), health care (FASSA), social development and welfare programs (FAIS), security and policing (FASP). Discretionary transfers (Participaciones) include FGP transfers. The panel on the right shows the composition of state expenditures by type of spending. Current expenditures include payroll expenses, operating expenses and services, and transfers to state agencies and local governments. **Source: INEGI.**

Fiscal Federalism in Mexico: Liquidity Management Implications

- **Low fiscal flexibility:** for each dollar states have, they have spending discretion on 50 cents, but ≈ 90 cents must go to cover current expenses + transfers to local governments.
- **Persistent fiscal deficits:** avg 2000-2022: -3.5% of total revenues.
- **Few liquidity management tools:** Federal Funded Rainy-Day Fund depleted in 2019 and 2020. Only 5 states (and Mexico City) have state-level rainy day funds.
- **Short-Term Debt Fiscal Rules:** i) only for cash-flow management, ii) must be unsecured, and iii) debt ceiling: 6% of total fiscal revenues.
- **Implication:** state governments observe reduced space to generate excess cash-flows and have few tools under the belt to cope with liquidity shocks.

RQ: What is the effect of cash reserves on short-term borrowing?

- **Reduced Form Model:**

$$ShortTermDebt_{it} = \boldsymbol{\delta} CashReserves_{it} + \beta X_{it} + a_i + b_t + \epsilon_{it}$$

- Under liquidity constraints, sign of $\boldsymbol{\delta}$ is theoretically ambiguous.
- OLS estimation of $\boldsymbol{\delta}$ is likely biased due to endogeneity between cash and debt.
- ↑ Economic Activity → ↑ Own-Source Revenues→ ↑ Cash Holdings and ↓ ST debt.
- **Implication:** endogeneity bias is likely negative. OLS could underestimate $\boldsymbol{\delta}$.
- We need exogenous variation on cash holdings!

Thought Experiment

1. Your employer gives the schedule of the monthly disbursements of your paycheck.
2. However, your monthly payment depends on the level of sales observed each month.
3. Hence, each month you might observe deviations from your budgeted disbursement.
4. **The catch:** observed sales (and the deviations) neither depend on your decisions nor performance.
5. These deviations are hard to anticipate. For you: arguably, as good as random.
6. Would you finance these gaps with your savings (cash reserves) or with your credit card (short-term debt)?

Mexican state governments experience a similar setting

1. Before the FY begins, federal government discloses the estimated size of IG funds, along with a monthly calendar of disbursements. States incorporate this into their budgets.

2. However, actual disbursements depend on the observed level of centralized tax collection.

3. Each month states observe deviations from their budgeted transfers.

4. **The catch:** states have no say on the calendar nor participate on tax collection.

5. For states is arguably hard to anticipate both the magnitude and direction of contemporaneous deviations.

6. How does these exogenous liquidity shocks influence the decision to manage cash-flows via debt or cash reserves?

Policy Description: General Participations Fund (FGP)

- **General Participations Fund:** main discretionary revenues (DR) grant/fund→ 75% of total DR, 36% of total revenues.
- Funded with revenues from VAT, PIT, Use Taxes, and Oil Revenues.
- Distribution across states determined (mainly) by population. Highly stable over time.
- Distribution within the fiscal year determined by the federal government with no clear rules.
- States have no influence on the determination of the disbursement calendar.

Plausible Exogenous Variation: FGP Error

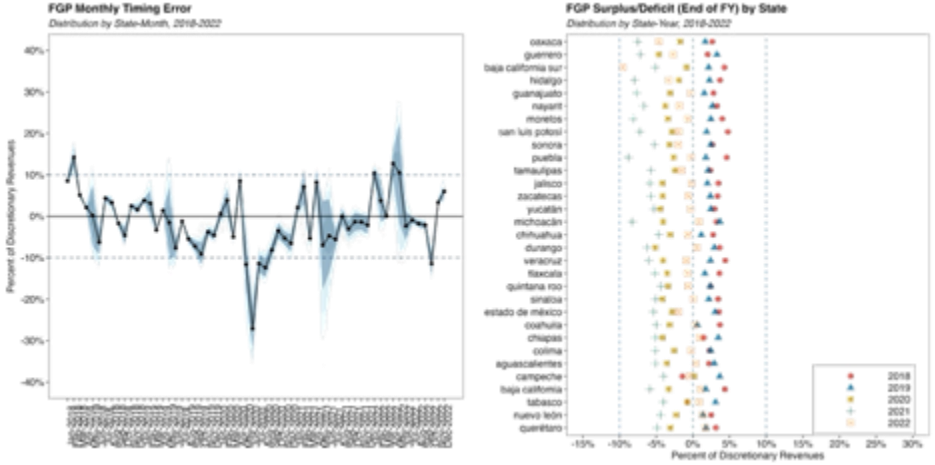
Definition: FGP Error

Difference between the budgeted amount and observed transfer. i = state. t = month, within the same fiscal year.

$$FGPError_{it} = FGPPaid_{it} - FGPBudgeted_{it}$$

FGP Error Distribution Over Time

Figure: FGP Monthly Timing Errors and End-of-Year Balance



Avg monthly FGP error:

- 2018 (+5% DR), 2019 (-5.4% DR), 2020 (-10.18% DR)

End-of-Year FGP Surplus/Def

- No apparent systematic variation by states.
- All states face similar shocks within the same fiscal year.

Notes: The panel on the left shows the distribution of the FGP timing error across time. The solid line represents the mean across states by month-year. The dark-shaded area shows the percentiles between 25%-75%, as well as the area within one standard deviation form the mean, while the light-shaded areas percentiles 1% to 99% (excluding outliers) and 5%-95%. The panel on the right shows the end-of-year cumulative difference between the FGP paid and FGP budgeted across years, expressed as percentage of discretionary revenues. The solid vertical line shows the sample mean. For illustrative purposes, dashed blue lines show the interval between +/ 10% of discretionary revenues..

Research Design

IV Design. Fixed-Effects 2SLS Estimator + Robust-Clustered Standard Errors (State Level)

First stage:

$$CashReserves_{it} = \beta FGPError_{it} + X_{it}\alpha + a_i + b_t + \epsilon_{it}$$

Reduced Form:

$$OutShortTermDebt_{it} = \delta \widehat{CashReserves}_{it} + X_{it}\alpha + a_i + b_t + \upsilon_{it}$$

Variable Scaling and Coefficient Interpretation

- Variables measured as stocks. Outstanding short-term debt and cash-holdings at end-of-Q.
- Dependent, endogenous, and instrumental variables expressed as % of average level of DR (2009-2016).
- Results expressed in units that measure annual space for liquidity management.

Identification

Relevance Assumption: FGP Timing Errors influence the level of cash reserves.

- **Descriptive Stats:** observing a quarterly timing error within one SD from the mean is equivalent to 12% of the average stock of cash reserves.
- **Formal test:** Cragg-Donald test for weak instruments (First stage F stat).

Exclusion Restriction: FGP Timing Errors only influence short-term debt through cash reserves.

- FGP annual shares had been historically stable.
- Centralized tax collection averages-out the influence of regional economic factors.
- Tax collection done by the federal government with no intervention with states.
- Monthly calendar is determined by the federal government with no clear rules.

Data

- **Financial Variables (Cash and Debt):** text-scraped from state-reported forms submitted to the Ministry of Finance. State-by-quarter variation. **Consistent data begins in 2018.**
- **Fiscal Variables (Revenues, Expenditures):** annual survey of state and local government finances. State-by-year variation.
- **Credit Ratings:** web-scraped from Fitch Ratings website. State-by-quarter variation.
- **Control Variables:** National Statistics Agency (INEGI) surveys on employment and IRS data on number of active taxpayers. State-by-quarter variation.
- **Final Sample:** quarterly observations for 30 states between 2018-2022.

Note: Tlaxcala and Mexico City are excluded from the analysis as they are subject to different fiscal rules.

Descriptive Statistics

	Mean	Std.Dev.	Min	P25	P50	P75	Max
DepVar: Short-Term Debt (% DR)	0.0519	0.0635	0.0000	0.0000	0.0244	0.0940	0.2890
EndVar: Cash Reserves (% DR)	0.2289	0.1548	-0.0157	0.1174	0.1897	0.3117	0.9322
InstVar: Timing Error (% DR)	-0.0043	0.0235	-0.1135	-0.0185	-0.0039	0.0075	0.0848
FGP Annual Difference (%DR, Lag = 1yr)	-0.0130	0.0655	-0.2141	-0.0641	-0.0114	0.0484	0.0964
Primary Balance (% Rev, Lag = 1yr)	-0.0623	0.1261	-0.7499	-0.0833	-0.0296	0.0006	0.0853
Current Expenditures (% Exp, Lag = 1 yr)	0.7375	0.0600	0.4278	0.7121	0.7515	0.7775	0.8212
Discretionary Revenues (% Rev, Lag = 1yr)	0.4766	0.0781	0.3016	0.4186	0.4731	0.5394	0.6562
Long Term Debt (% Debt, Lag = 1yr)	0.6726	0.5133	0.0000	0.2834	0.5727	0.8585	2.2558
Credit Rating	3.1273	1.0700	1.0000	3.0000	3.0000	4.0000	6.0000
FGP as Collateral (%)	0.5332	0.2163	0.0880	0.3317	0.5477	0.7500	1.0000
Unemployment Rate	0.0346	0.0129	0.0081	0.0259	0.0326	0.0401	0.0978
Taxpayers (% Population)	0.5574	0.1015	0.2840	0.4850	0.5565	0.6376	0.7356
Age < 18 (% Population)	0.0584	0.0040	0.0518	0.0554	0.0578	0.0606	0.0724
Age 19-35 (% Population)	0.0438	0.0022	0.0405	0.0425	0.0433	0.0449	0.0514
Age 36-65 (% Population)	0.0847	0.0047	0.0691	0.0814	0.0858	0.0882	0.0924

Notes: This panel shows the descriptive statistics of the main variables used for the analysis. N= 597 for all variables. The first two columns show the sample mean and standard deviation. P25, P50 and P75 show the 25, 50 and 75 percentiles, respectively. Credit rating is coded such that a higher number is associated with a higher credit rating. Considering the distribution of ratings I grouped them in 3 categories AAA,AA = 1, A = 2, and BBB,BB,NR = 3. Short-Term borrowing, cash reserves, FGP budget error, and fiscal balance measures are expressed as a percentage of the average discretionary revenues (DR) observed between 2009 and 2016. That is, outside the analysis period to avoid endogeneity concerns. All these fiscal variables correspond to one-year lagged measures.

Results

Table: Effects of Cash Reserves on Short-Term Debt

	(1)	(2)	(3)	(4)
Panel A: OLS Estimates				
Cash Reserves (% DR) $\hat{\delta}$	-0.152***	-0.043	0.067+	0.093*
	(0.030)	(0.031)	(0.036)	(0.036)
Panel B: 2SLS IV Estimates				
Cash Reserves (% DR) $\hat{\delta}$	0.194	0.325	0.211+	0.246*
	(0.149)	(0.200)	(0.107)	(0.107)
First Stage: Timing Error $\hat{\beta}$	1.565*	1.131*	1.661***	1.467***
	(0.573)	(0.454)	(0.415)	(0.365)
Cragg-Donald F-Statistic	7.4171	6.9449	30.0677	24.2066
Short-Term Debt (Mean)	0.0519	0.0519	0.0519	0.0519
Short-Term Debt (SD)	0.0635	0.0635	0.0635	0.0635
Cash Reserves (SD)	0.1548	0.1548	0.1548	0.1548
Num.Obs.	597	597	597	597
Controls	No	Yes	No	Yes
State FE	No	No	Yes	Yes
Quarter-by-Year FE	Yes	Yes	Yes	Yes

Notes: Panel A shows the results of estimating Equation 7 with an OLS estimator across several specifications. Panel B displays the results from estimating Equation 9 with a 2SLS estimator using the timing error as instrument for cash reserves. All the dependent, independent, and instrumental variables are expressed as a percentage of each state's average discretionary revenues (DR) from 2009-2016. Time FE = Quarter-Year FE. Standard errors clustered by state. Significance level: +p < 0.10, *p < 0.05 , ** p < 0.01 , *** p < 0.001

If cash reserves ↑ 1 SD_{cash} , then outstanding short-term debt:

- **OLS:** ↑ 1.43% DR. **Eff Size:** 0.22 SD_{debt}
- **IV :** ↑ 3.80% DR: **Eff Size:** 0.60 SD_{debt}
- **Endogeneity bias < 0:** addressing OVB in OLS leads to ↑ $\hat{\delta}$.
- IV estimates less sensitive to econometric specification.
- Strong instrument. Cragg Donald F-Stat > 24
- **First Stage:** a timing error equivalent to 1% of DR leads to an ↑ in cash reserves of to 1.46% DR.

Mechanisms

Level of Cash Reserves: the stringency of liquidity constraints could shift the relationship between cash and debt.

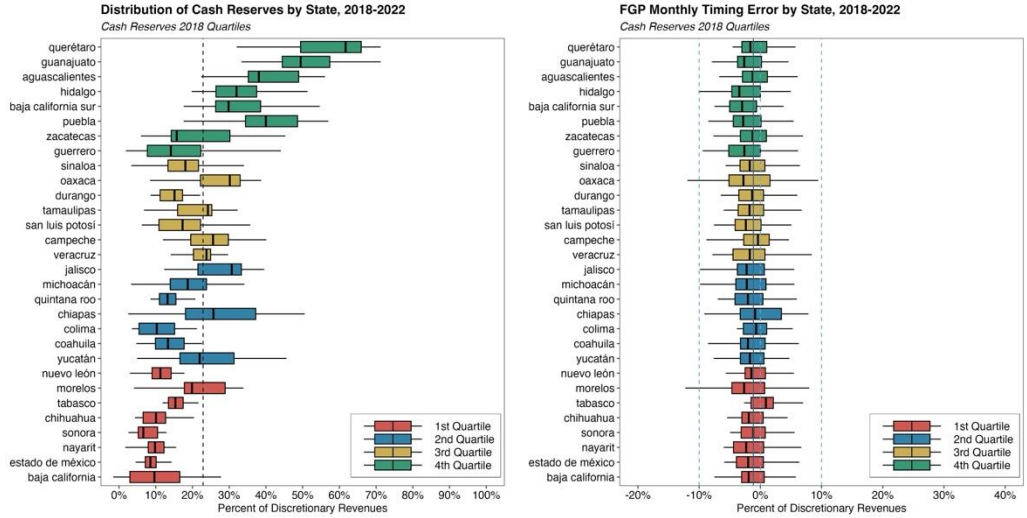
- Test for heterogeneity driven by the level of cash holdings in 2018.

Credit Quality: influence supply and demand of debt.

- Test for heterogeneity driven by credit quality.

Research Design: sample partition by specific strata (cash reserves quartiles, credit rating categories) and model estimation in independent samples.

Timing errors do not seem to vary with the level of cash reserves.



Notes: Both panels shows the distribution of cash reserves (left) and FGP timing errors (right) by state across quarter-years. Each boxplot depicts the distribution by state, excluding outlier observations. States are partitioned into groups depending on quartiles of the distribution of cash reserves in FY 2018. Variables expressed as percent of discretionary revenues. For illustrative purposes, dashed blue lines on the left panel show the interval between +/- 10% of discretionary revenues.

Mechanisms: Levels of Cash Reserves

Table: Effect of Cash Reserves on Short-Term Debt: Heterogeneity by Distribution of Cash Reserves

	1st Quartile	2nd Quartile	3rd Quartile	4th Quartile
Cash Reserves (% DR) $\hat{\delta}$	0.012	0.511+	0.701	-0.287
	(0.320)	(0.262)	(0.426)	(0.338)
First Stage: Timing Error $\hat{\beta}$	1.706**	1.677**	0.483	0.445
	(0.469)	(0.362)	(0.438)	(0.374)
Cragg-Donald F-Statistic	7.8162	4.6089	1.3406	0.8011
Short-Term Debt (Mean)	0.0699	0.0671	0.0457	0.0263
Short-Term Debt (SD)	0.0596	0.0693	0.0647	0.0506
Cash Reserves (SD)	0.0823	0.1045	0.0836	0.1849
Num.Obs.	158	140	139	160

Notes: These panels show the results from estimating Equation 9 across different subsets of the data set. In this case, with the states at each quartile of the cash reserves distribution observed in 2018. All coefficients correspond to the 2SLS specification with controls, state and quarter-by-year fixed effects. All the dependent, independent, and instrumental variables are expressed as a percentage of each state's average discretionary revenues (DR) from 2009-2016. Time FE = Quarter-Year FE. Standard errors clustered by state.
Significance level: +p < 0.10, *p < 0.05 , ** p < 0.01 , *** p < 0.001

- **Descriptive Stats:** States with less cash rely more on debt.
- **First Stage:** FGP Timing errors have more predictive power for states with less cash.
- Only estimates for second quartile are significant (10%).
- **IV 2nd Quartile:** ⬆ 5.3% DR.
- **Eff Size:** 0.77 SD_{debt}

Mechanisms: Credit Quality

Table: Effect of Cash Reserves on Short-Term Debt: Heterogeneity by Distribution of Cash Reserves

	AAA	AA	A	BBB,BB
Cash Reserves (% DR) $\delta\hat{}$	-0.041	0.134	0.293+	1.123*
	(0.086)	(0.084)	(0.159)	(0.368)
First Stage: Timing Error $\beta\hat{}$	1.527	1.335*	1.925*	1.551**
	(2.402)	(0.378)	(0.741)	(0.428)
Cragg-Donald F-Statistic	0.9127	4.3514	24.4371	5.5323
Short-Term Debt (Mean)	0.0029	0.0121	0.0522	0.0898
Short-Term Debt (SD)	0.0146	0.0261	0.0622	0.0627
Cash Reserves (SD)	0.24	0.1632	0.1148	0.0744
Num.Obs.	46	74	302	146

- **Descriptive Stats:** Lower rated states rely more on debt.
- **First Stage:** FGP Timing errors have more predictive power for lower rated states.
- Only estimates for A and BBB,BBB are significant (10% and 5%).
- **A:** ↑ 3.3% DR. **Eff Size:** 0.54 SD_{debt}
- **BBB,BB:** ↑ 8.3% DR. **Eff Size:** 1.33 SD_{debt}

Notes: These panels show the results from estimating Equation 9 across different subsets of the data set. In this case, with the states at each quartile of the cash reserves distribution observed in 2018. All coefficients correspond to the 2SLS specification with controls, state and quarter-by-year fixed effects. All the dependent, independent, and instrumental variables are expressed as a percentage of each state's average discretionary revenues (DR) from 2009-2016. Time FE = Quarter-Year FE. Standard errors clustered by state. Significance level: +p < 0.10, *p < 0.05 , ** p < 0.01 , *** p < 0.001

Instrument Validity

Temporal Heterogeneity and Anticipation: states might learn from past years and internalize within-year distribution of timing errors into their decision-making.

- Test for heterogeneity by calendar quarter.

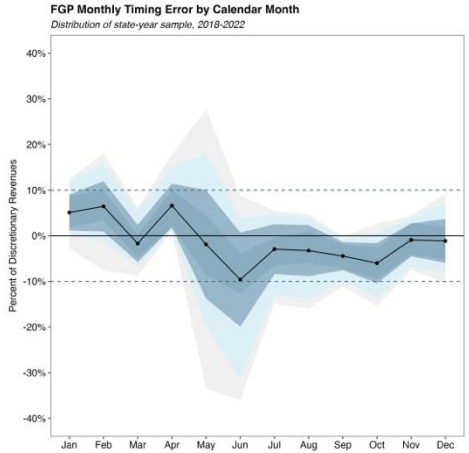
Exclusion Restriction: Timing errors only influence short-term debt via cash-reserves.

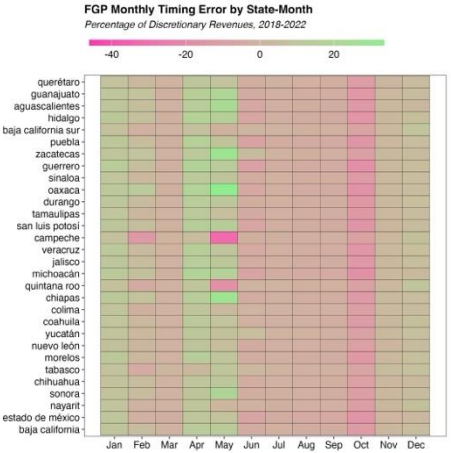
- Test whether timing errors have predictive power on measures of state economic activity.

Alternative Instrumental Variables: timing errors on other IG transfers: i) all discretionary transfers, ii) earmarked transfers, and iii) all IG transfers.

- Estimate model with alternative IV.

Instrument Validity: Distribution of FGP Timing Errors by Calendar Month





Timing errors are in average:

- Positive in Jan, Feb, Apr
- Negative the rest of the year.
- Lowest in Jun.

No systematic variation across states within months

- States get the same draw of monthly timing errors within the same fiscal year.

Notes: The panel on the left shows the distribution of the FGP timing error for each month, across state and years. The solid line represents the mean across states by month-year. The dark-shaded area shows the percentiles between 25%-75%, as well as the area within one standard deviation form the mean, while the light-shaded areas percentiles 1% to 99% (excluding outliers) and 5%-95%. The panel on the right shows the distribution of timing errors for each state and calendar month, across year. For illustative purposes, dashed blue lines show the interval between +/- 10% of discretionary revenues.

Instrument Validity: Temporal Heterogeneity and Anticipation Effects

Table: Effect of Cash Reserves on Short-Term Debt: Heterogeneity by Quarter

	Q1	Q2	Q3	Q4
Cash Reserves (% DR) $\hat{\delta}$	0.120	0.064	0.489	0.519+
	(0.182)	(0.103)	(0.471)	(0.305)
First Stage: Timing Error $\hat{\beta}$	1.377+	1.296**	1.827	2.737*
	(0.693)	(0.464)	(1.156)	(1.014)
Cragg-Donald F-Statistic	3.5495	11.3331	1.8524	6.33
Short-Term Debt (Mean)	0.0569	0.0422	0.0343	0.0746
Short-Term Debt (SD)	0.0605	0.0552	0.049	0.0787
Cash Reserves (SD)	0.141	0.1625	0.1674	0.1292
Num.Obs.	150	150	149	148

Notes: These panels show the results from estimating Equation 9 across different subsets of the data set. In this case, with observations from each quarter of the calendar year. All coefficients correspond to the 2SLS specification with controls, state and quarter-by-year fixed effects. All the dependent, independent, and instrumental variables are expressed as a percentage of each state's average discretionary revenues (DR) from 2009-2016. Time FE = Quarter-Year FE. Standard errors clustered by state. Significance level: +p < 0.10, *p < 0.05 , ** p < 0.01 , *** p < 0.001

- **Descriptive Stats:** Debt stocks are higher closer to the end/beginning of the fiscal year.
- **First Stage:** FGP Timing errors have more predictive power in Q2 and Q4
- Only estimates for Q4 are significant (10%).
- **Q4:** ↑ 6.7% DR. **Eff Size:** 0.85 SD_{debt}
- **Implication:** States smooth cash-flows via short-term debt and preserve cash-reserves.

Instrument Validity: Correlation with Local Economic Activity

Table: Instrument Validity: Effect of Timing Errors on Local Economic Activity

Dependent Variable	(1)	(2)	(3)	(4)
Unemployment Rate	0.084	0.044	0.031	0.006
	(0.076)	(0.036)	(0.023)	(0.024)
Active Taxpayers (% Population)	0.067	0.158	-0.024	0.000
	(0.460)	(0.226)	(0.041)	(0.031)
Industrial Activity Index	0.067	0.158	-0.024	0.000
	(0.460)	(0.226)	(0.041)	(0.031)
Quarterly Economic Activity Index	0.475*	0.381*	0.140	0.133
	(0.178)	(0.169)	(0.237)	(0.199)
Informal Labor (% Population)	-0.063	0.002	0.006	0.005
	(0.048)	(0.040)	(0.022)	(0.018)
Num.Obs.	597	597	597	597
Controls	No	Yes	No	Yes
State FE	No	No	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

Notes: These panels show the results from estimating Equation 9 across different subsets of the data set. In this case, with observations from each quarter of the calendar year. All coefficients correspond to the 2SLS specification with controls, state and quarter-by-year fixed effects. All the dependent, independent, and instrumental variables are expressed as a percentage of each state's average discretionary revenues (DR) from 2009-2016. Time FE = Quarter-Year FE. Standard errors clustered by state. Significance level: +p < 0.10, *p < 0.05 , ** p < 0.01 , *** p < 0.001

- FGP Timing Errors do not predict state economic activity.
- **Measures tested:** unemployment rate
- **Q4:** ↓ 6.7% DR. **Eff Size:** 0.85 SD_{debt}
- **Implication:** States smooth cash-flows via short-term debt and preserve cash-reserves.

Alternative IV: Effects of Cash Reserves on Short-Term Debt

IV: Discretionary Revenues Timing Error				
Cash Reserves (% DR) $\delta\hat{}$	-0.040	0.048	0.002	0.037
	(0.116)	(0.111)	(0.072)	(0.087)
First Stage: Timing Error $\beta\hat{}$	1.282**	0.837**	0.968***	0.829***
	(0.456)	(0.267)	(0.240)	(0.211)
Cragg-Donald F-Statistic	21.5163	15.9941	38.1511	28.4921
IV: Earmarked Revenues Timing Error				
Cash Reserves (% DR) $\delta\hat{}$	0.150	0.433	0.434	0.435
	(1.604)	(0.660)	(0.332)	(0.345)
First Stage: Timing Error $\beta\hat{}$	-0.163	-0.287	-0.303	-0.301
	(0.374)	(0.254)	(0.206)	(0.237)
Cragg-Donald F-Statistic	0.2911	1.5095	3.0999	3.3204
IV: IG Transfers Timing Error				
Cash Reserves (% DR) $\delta\hat{}$	-0.064	-0.103	-0.163	-0.163
	(0.259)	(0.340)	(0.273)	(0.351)
First Stage: Timing Error $\beta\hat{}$	0.576+	0.317	0.373+	0.287
	(0.316)	(0.228)	(0.197)	(0.189)
Cragg-Donald F-Statistic	8.41	4.2607	10.149	6.3185
Mean Dep Var	0.0519	0.0519	0.0519	0.0519
Std.Dev. Dep Var	0.0635	0.0635	0.0635	0.0635
Num.Obs.	597	597	597	597
Controls	No	Yes	No	Yes
State FE	No	No	Yes	Yes

Notes: This table show the results from estimating Equation ?? through 2SLS using different instrumental variables. First stage coefficients are also reported. All the dependent, independent, and instrumental variables are expressed as a percentage of each state's average discretionary revenues (DR) from 2009-2016. Time FE = Quarter-Year FE. Standard errors clustered by state. Significance level: +p < 0.10, *p < 0.05 , ** p < 0.01 , *** p < 0.001

Summary:

- **OLS:** ≈ ↑ 7−9 bps, 0.12-0.17x SD. Upper bound: 47 bps (0.9xSD).
- Endogeneity bias < 0
- **2SLS IV :** ≈ ↑
- Effect Size:
- IV estimates less sensitive to econometric specification.

Conclusions

- Broadly, the findings indicate that recipient governments observed mild reductions in their borrowing costs and increased their debt issuance on the primary market, with no significant spillovers to the secondary market.
- This indicates that federal aid produced crowd-in effects for local governments that enabled the provision of local services.
- This analysis provides some suggestive evidence on the liquidity management undertaken by local governments. It documents an increase in the issuance of short-term debt, at the expense of reductions on the issuance of longer-term bonds.

Thanks for your attention!

Scan to learn more about this project.

I am in the Job Market!

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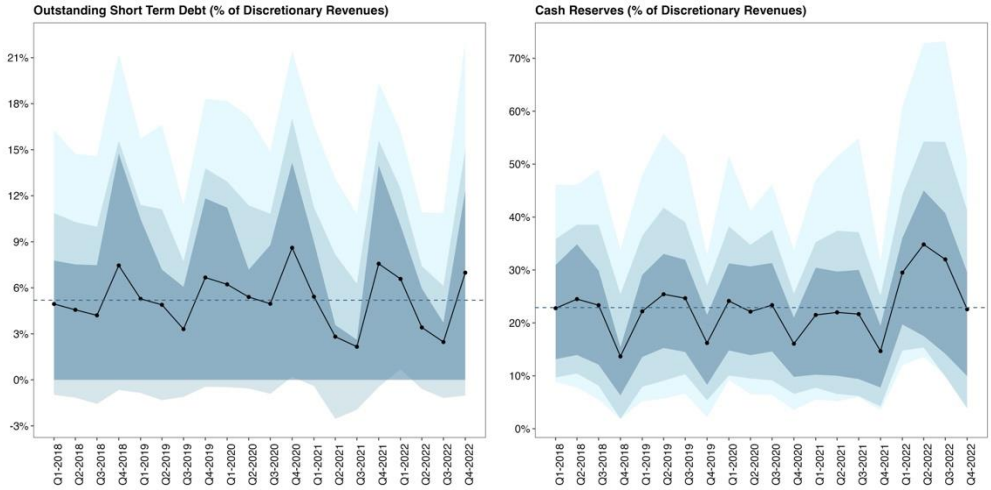
Appendix

Instrument Validity: Temporal Heterogeneity and Anticipation Effects



Notes: Each panel shows the distribution of the main dependent (outstanding short-term debt, left) and independent (cash reserves) variables, both expressed as percentage of discretionary revenues. The solid line represents the mean across states by year. The dark-shaded area shows the percentiles between 25%-75%, as well as the area within one standard deviation form the mean, while the light-shaded areas percentiles 1% to 99% (excluding outliers) and 5%-95%.

Robustness Checks: Heckman Selection Model

Table: Heckman Selection Model: Short-Term Borrowing and Cash Reserves

	(1)	(2)	(3)	(4)
Panel A: Second Stage (Outcome Model)				
Cash Reserves (% DR)	−0.0716***	−0.0109	0.0552**	0.0909***
	(0.0254)	(0.0258)	(0.0263)	(0.0268)
Panel B: First Stage (Selection Model)				
Timing Error (% DR)	19.0228**	19.0228**	19.0228**	19.0228**
	(8.1516)	(8.1516)	(8.1516)	(8.1516)
Mean Dep Var	0.0519	0.0519	0.0519	0.0519
Std.Dev. Dep Var	0.0635	0.0635	0.0635	0.0635
Num.Obs.	597	597	597	597
Controls	No	Yes	No	Yes
State FE	No	No	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

Notes: These panels show the results from estimating Equation 9 across different subsets of the data set. In this case, with observations from each quarter of the calendar year. All coefficients correspond to the 2SLS specification with controls, state and quarter-by-year fixed effects. All the dependent, independent, and instrumental variables are expressed as a percentage of each state's average discretionary revenues (DR) from 2009-2016. Time FE = Quarter-Year FE. Standard errors clustered by state. Significance level: +p < 0.10, *p < 0.05 , ** p < 0.01 , *** p < 0.001

Summary:

- **OLS:** ≈ ↑ 7−9 bps, 0.12-0.17x SD. Upper bound: 47 bps (0.9xSD).
- Endogeneity bias < 0
- **2SLS IV :** ≈ ↑
- Effect Size:
- IV estimates less sensitive to econometric specification.

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Cash Reserves and Short-Term Debt Under Liquidity Constraints

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Practice Presentation
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