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The Economic Effects of Public Financing: Evidence from Municipal Bond Ratings Recalibration

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Research Question

- **How does government spending affect the economy?**
- Identifying causal impact is challenging due to correlation of fiscal policy with other macroeconomic factors (e.g., monetary policy).
- Moody's changed its methodology to make municipal bond ratings comparable with other bonds (corporate and sovereign) in 2010.
- Exploit variation in ratings due to Moody's recalibration to measure the **causal impact of local government spending on employment and income**.

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Moody's Recalibration - 2010

- Before recalibration:
  - Moody's Municipal Rating Scale measures how likely an entity is to require extraordinary support from a higher level of government to avoid default.
  - Moody's Global Rating Scale measures likelihood of default and loss suffered in case of default (sovereign and corporate bonds).
- In April-May 2010 Moody's changed its methodology to align municipal ratings with the Global Scale.
  - All bonds recalibrated resulting in upgrades up to 3 notches or no change in rating.
  - Rating changes do not reflect changes in intrinsic quality of issuer.
  - Goal is to make municipal ratings comparable with ratings in other bonds.
  - Moody's (2010): Market participants should not view the recalibration of municipal ratings as ratings upgrades, but rather as a recalibration of the ratings to a different scale **does not reflect an improvement in credit quality or a change in our opinion**

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Identification Strategy

- **Treatment group**: issuers/local governments (counties, cities, towns, school districts, special districts) with an outstanding (uninsured) bond issue upgraded during recalibration.
- Use cross-sectional geographic variation and timing of recalibration to mitigate concerns of confounding effects from macro factors.
- Identifying assumption:
  - Rating changes due to recalibration are not related to differences in economic outcomes across treated and control municipalities.

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Related Literature

- Effect of Moody's recalibration on amount and yields of new issues of upgraded municipalities.
  - Cornaggia, Cornaggia, and Israelsen (2015).
- Effect of 2008 credit market shock on employment.
  - Chodorow-Reich (2014), Greenstone, Mas, and Nguyen (2014).
- Effects of government spending on economic outcomes.
  - Great Recession and ARRA (2009) has renewed debate on size of fiscal multiplier.
  - Traditional literature relies on time series variation - Ramey (2011).
  - Cross-sectional geographic variation - Chodorow-Reich et al. (2012), Wilson (2012), Shoag (2013), Nakamura and Steinsson (2014), Suarez-Serrato and Wingender (2014).
  - Economic returns of investment in school facilities in California financed with municipal bonds - Cellini, Ferreira, and Rothstein (2011).

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Main Findings

- **Local government increased access to finance - through the municipal bond ratings channel - has positive effects on local economy.**
  - Increase in government employment.
  - Increase in private employment - non-tradable, education and healthcare sectors.
  - Increase in income.
- Results likely driven by shocks to credit supply to municipalities, as changes in ratings due to recalibration are unlikely to be correlated with credit demand.

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Data

- Recalibrated bonds (April-May 2010) - Moody's.
- Municipal bond new issues (April 2007-March 2013) - Ipreo i-Deal.
- Local government employment by county (2007-2012) - Census of Government Employment and Payroll.
- Private sector employment by county (2007-2012) - County Business Patterns.
- Income (salaries and wages) by county (2007-2012) - IRS Statistics of Income.
- Controls: House price index (FHFA), number of households (Census).

Summary Statistics 2007-2012

	Mean	Median	Std. Dev.	Minimum	Maximum	Obs.
Panel A: New Issues Variables						
Issue Amount ($ million)	4.5	0.8	24.1	0.0	3 000.0	202,615
Offer Yield (%)	2.8	2.9	1.5	0.0	11.0	202,615
Panel B: County-Level Variables						
Dollar Volume	180.5	16.1	1,557.7	0.0	66,400.0	5,974
Offer Yield (%)	2.8	2.9	1.6	0.0	9.1	5,974
Government Employment (thousand)	4.5	0.7	14.7	0.0	380.7	8,791
Private Employment (thousand)	65.7	16.8	178.2	0.0	3 910.4	8,791
Tradable Employment (thousand)	3.4	0.2	14.5	0.0	417.5	8,791
Non-Tradable Employment (thousand)	11.3	2.7	29.8	0.0	685.6	8,791
Income ($ million)	3,266.9	790.1	8,677.0	11.0	197,206.3	8,791
Growth Government Employment	-0.004	0.000	0.137	-3.584	1.427	7,269
Growth Private Employment	-0.009	-0.006	0.057	-0.660	0.632	7,283
Growth Tradable Employment	-0.047	-0.032	0.537	-5.370	5.348	4,833
Growth Non-Tradable Employment	-0.148	-0.038	0.338	-3.835	3.288	7,196
Growth Income	0.026	0.027	0.054	-1.387	1.417	7,323
Recalibrated	0.050	0.000	0.084	0.000	1.000	8,791
Households (thousand)	58.4	20.2	142.0	0.5	3 133.8	8,791
House Price Index	252.7	243.5	87.2	101.4	684.5	8,791

Moody's Ratings Recalibration

Fraction of Local Governments Upgraded by County
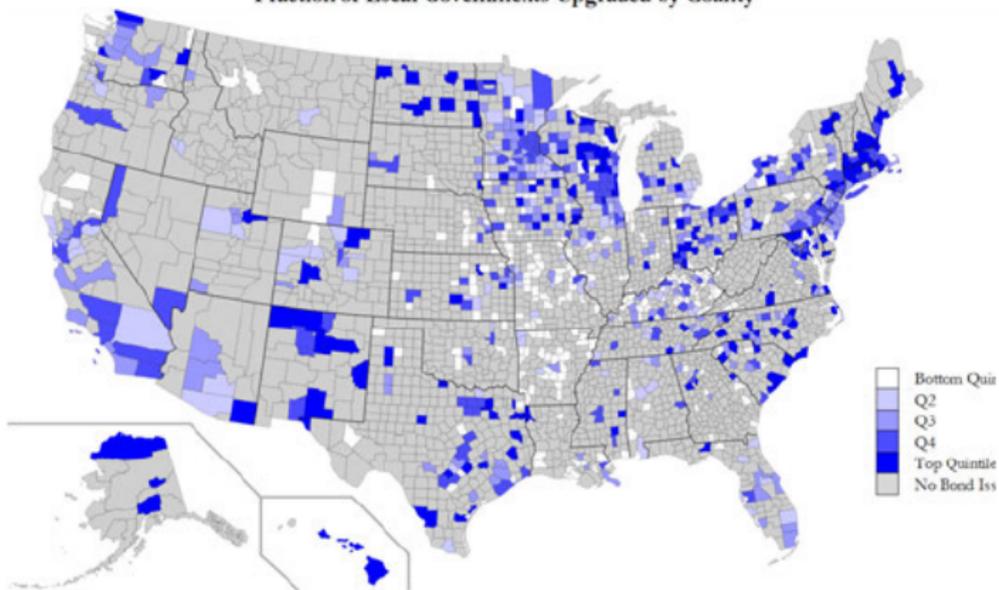
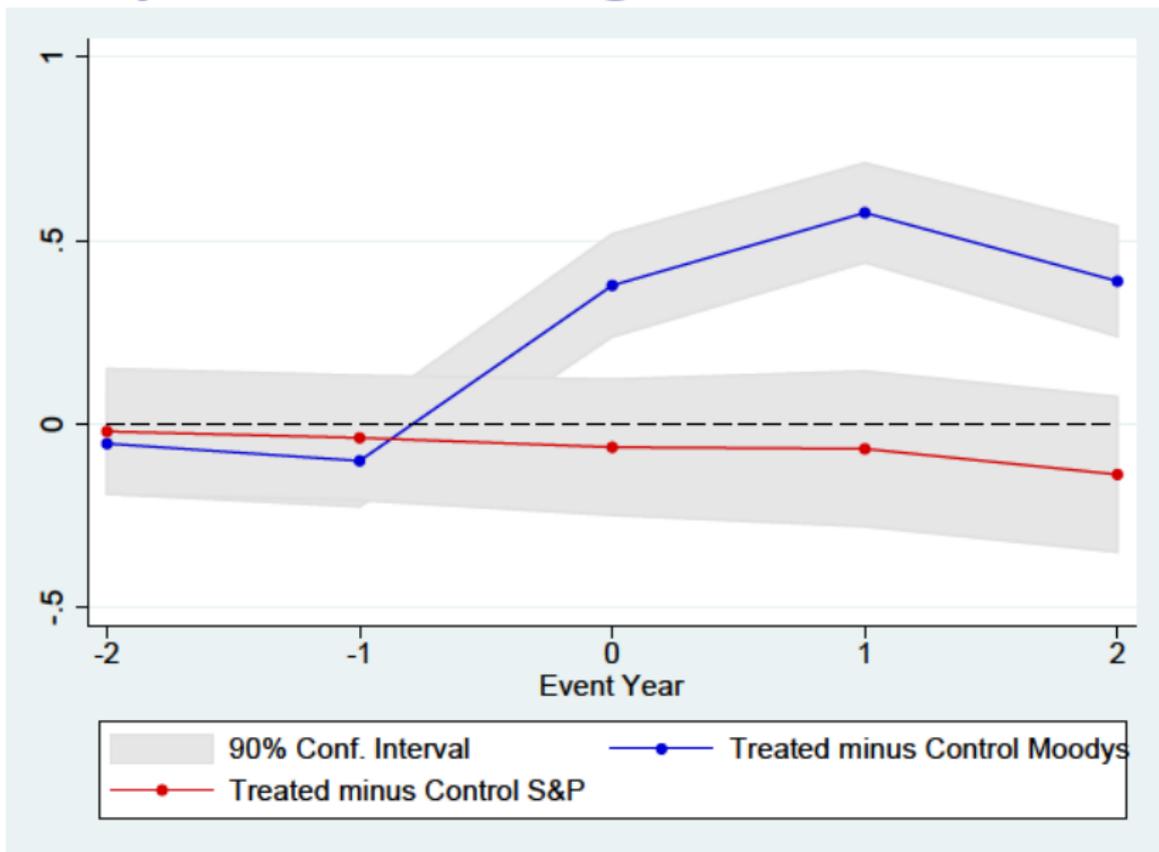# Difference-in-Differences Estimates - New Issues

- Regression:

$$Y_{ijt} = \beta_0 + \beta_1 \times \text{Recalibrated Dummy} \times \text{Post Dummy} + \beta_2 \times X_{ijt} + \mu_t + \theta_j + \varepsilon_{ijt}$$

  - Unit of observation - new bond issue (April 2007-March 2013).
  - Sample restricted to local governments that issue new (uninsured) bonds in the 3-year period before recalibration.
  - Recalibrated Dummy - equals 1 if issuer has an outstanding bond issue upgraded during recalibration.
  - Post Dummy - equals 1 between April 2010 and March 2013.

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Rating, Amount and Offer Yield

	Rating Moody's	Rating S&P	Issue Amount (log)	Offer Yield
Recalibrated Dummy × Post Dummy	0.502***	-0.067	0.113**	-0.141**
	(0.053)	(0.064)	(0.045)	(0.045)
Year-event fixed effects	Yes	Yes	Yes	Yes
Issuer fixed effects	Yes	Yes	Yes	Yes
R-squared	0.830	0.820	0.570	0.350
Observations	220,109	118,145	202,615	220,109

Moody's and S&P Ratings around Recalibration

Legend:
- 90% Conf. Interval
- Treated minus Control Moodys
- Treated minus Control S&P

X-axis: Event Year (-2, -1, 0, 1, 2)

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Difference-in-Differences Estimates - County Level

- Panel regression:

$$\log(Y_{it}) = \beta_0 + \beta_1 \times \text{Recalibrated} \times \text{Post Dummy} + \beta_2 \times X_{it} + \mu_t + \theta_i + \varepsilon_{it}$$

- Cross-sectional growth regression:

$$\Delta \log(Y_i) = \beta_0 + \beta_1 \times \text{Recalibrated} + \beta_2 \times \Delta X_{it} + \mu_t + \theta_i + \varepsilon_{it}$$
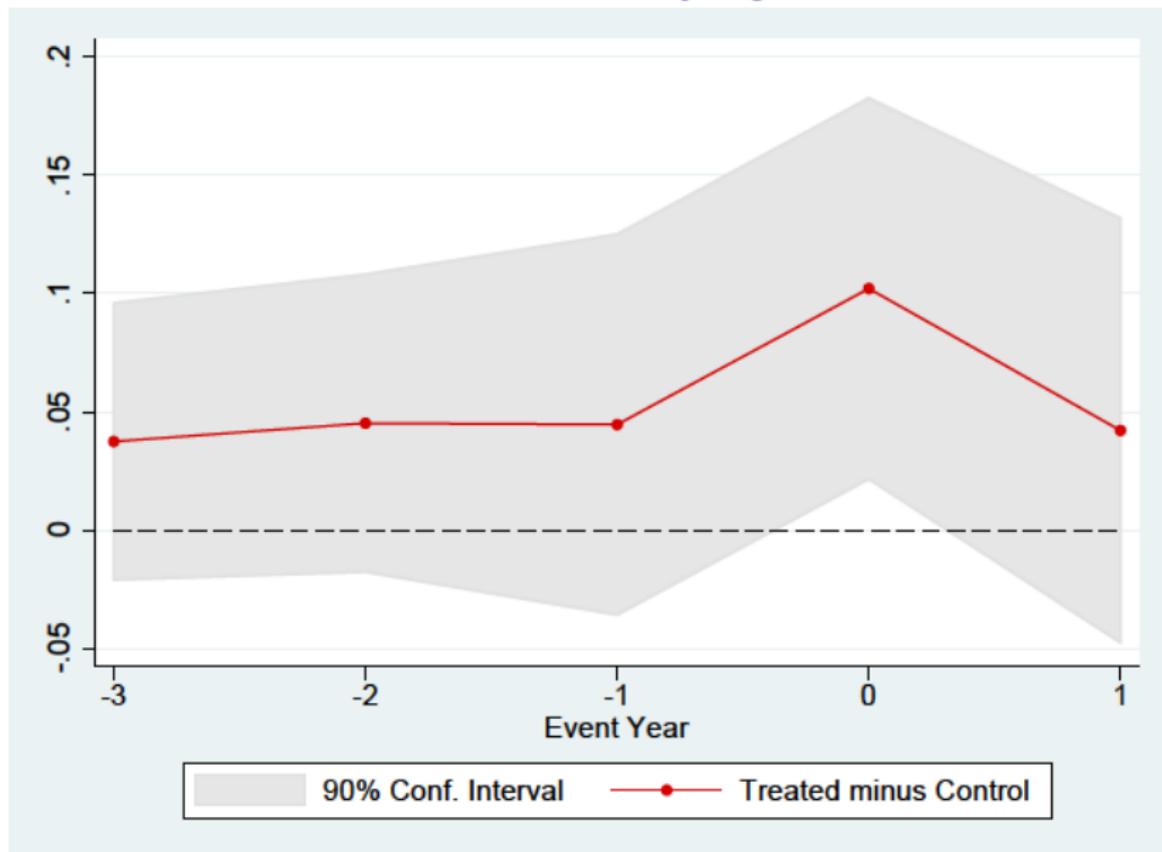
  - Unit of observation - county (aggregate different levels of local government in each year).
  - Recalibrated - fraction of local governments upgraded within each county (treatment dosage).
  - Post Dummy - equals 1 in 2011-2012 (employment as of March) and 2010-2012 (income as of December).

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Government Employment

	(1)	(2)	(3)	(4)	(5)
	Panel 2007-2012		Panel 2009-2011		Growth 2009-2011
Recalibrated × Post Dummy	0.040	0.049	0.058**	0.058**	
	(0.035)	(0.034)	(0.028)	(0.028)	
Recalibrated					0.058*
					(0.035)
Controls	No	Yes	No	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	No
County fixed effects	Yes	Yes	Yes	Yes	No
R-squared	0.011	0.011	0.022	0.022	0.001
Observations	8,757	8,751	4,380	4,377	1,458
Number of counties	1,462	1,461	1,462	1,461	

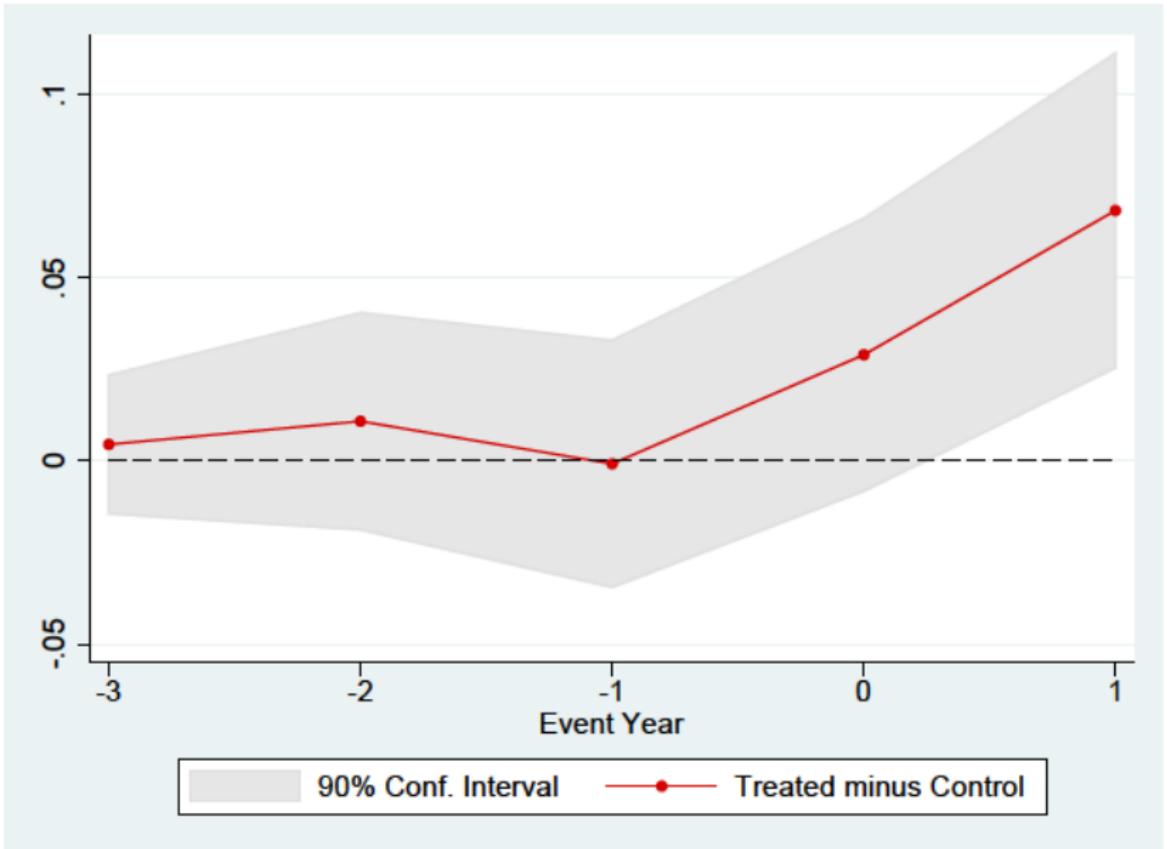- 3 jobs created in local government sector per $1 million dollar of spending.

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Private Employment

	(1)	(2)	(3)	(4)	(5)
	Panel 2007-2012		Panel 2009-2011		Growth 2009-2011
Recalibrated × Post Dummy	0.050***	0.033**	0.034***	0.037***	
	(0.016)	(0.015)	(0.012)	(0.012)	
Recalibrated					0.028*
					(0.014)
Controls	No	Yes	No	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	No
County fixed effects	Yes	Yes	Yes	Yes	No
R-squared	0.260	0.266	0.070	0.078	0.016
Observations	8,777	8,771	4,389	4,386	1,462
Number of counties	1,467	1,466	1,465	1,464	

- 23 jobs created in private sector per $1 million dollar of spending.

- **26 jobs created in total (public and private) per $1 million dollar of spending.**
- **Cost per job of $38,000.**

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Non-Tradable and Tradable Employment

	(1)	(2)	(3)	(4)	(5)
	Panel 2007-2012		Panel 2009-2011		Growth 2009-2011
Panel A: Non-Tradable Employment					
Recalibrated × Post Dummy	0.241***	0.168***	0.066*	0.071*	
	(0.056)	(0.054)	(0.040)	(0.040)	
Recalibrated					0.122***
					(0.047)
Controls	No	Yes	No	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	No
County fixed effects	Yes	Yes	Yes	Yes	No
R-squared	0.663	0.667	0.139	0.139	0.005
Observations	8,696	8,690	4,361	4,358	1,446
Number of counties	1,466	1,465	1,464	1,463	
Panel B: Tradable Employment					
Recalibrated Post Dummy	-0.103	-0.078	-0.121	-0.114	
	(0.154)	(0.153)	(0.224)	(0.225)	
Recalibrated					-0.295
					(0.283)
Controls	No	Yes	No	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	No
County fixed effects	Yes	Yes	Yes	Yes	No
R-squared	0.061	0.061	0.012	0.012	0.01
Observations	6,179	6,173	3,074	3,071	959
Number of counties	1,184	1,183	1,116	1,115	

Education and Health Sector Employment

	(1)	(2)	(3)	(4)
	Educational Services		Health Care and Social Services	
Recalibrated × Post Dummy	0.070*		0.077***	
	(0.040)		(0.018)	
Recalibrated		0.119**		0.095***
		(0.052)		(0.028)
Controls	Yes	Yes	Yes	Yes
Year fixed effects	Yes	No	Yes	No
County fixed effects	Yes	No	Yes	No
R-squared	0.033	0.006	0.041	0.010
Observations	2,392	746	4,050	1,322
Number of counties	871		1,379	

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	(1)	(2)	(3)	(4)	(5)
	Panel 2007-2012		Panel 2009-2011		Growth 2009-2011
Recalibrated × Post Dummy	0.122***	0.117***	0.106***	0.107***	
	(0.019)	(0.019)	(0.016)	(0.016)	
Recalibrated					0.099***
					(0.019)
Controls	No	Yes	No	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	No
County fixed effects	Yes	Yes	Yes	Yes	No
R-squared	0.611	0.612	0.700	0.700	0.016
Observations	8,814	8,808	4,407	4,404	1,469
Number of counties	1,469	1,468	1,469	1,468	

- **Local income multiplier of 4** (aggregate income per dollar of local government spending).
- Consistent with notion that fiscal multiplier is higher during depressed economic conditions.

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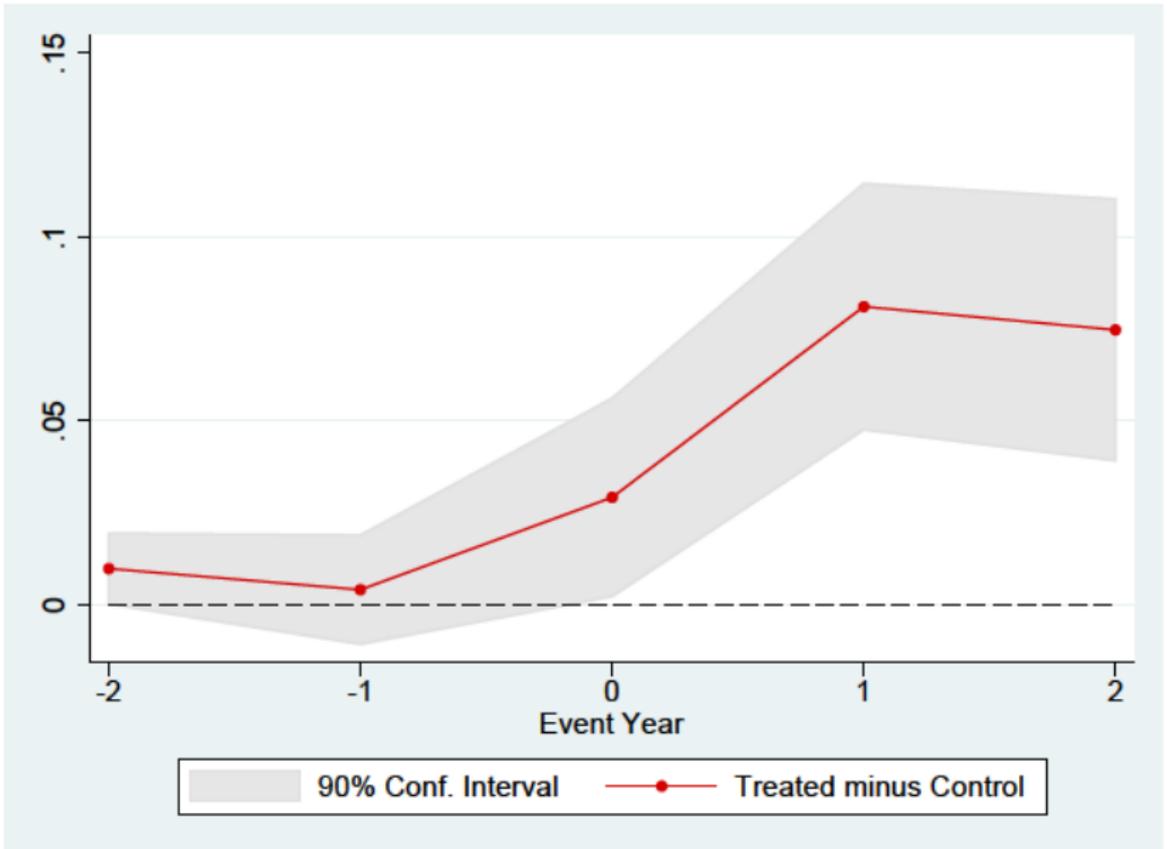
Conclusion

- Explore Moody's municipal bond ratings recalibration to measure the effect of local governments financing on the economy.

- Upgraded municipalities experience increases in dollar volume and reductions in borrowing costs of new issues.

- Increases in local government employment, private sector (non-tradable) employment, and income of upgraded municipalities.

- Supply of financing to local governments have important effects on the local economy.

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- Government employment tests at issuer level.
- Government revenues and expenditures at issuer level.