

Web Appendix for *Are transfer-dependent governments more creditworthy? Reassessing the fiscal federal foundations of subnational default risk*

1 Descriptions of Data

1.1 Bailout Analysis

Bailout Probabilities: .05 to 1; Source: Moody's press releases, rating reports and US state rating methodology

Transfer Dependence Moderate: 0 or 1; 1 for moderate levels of transfer dependence and 0 otherwise; Source: Moody's rating reports

Transfer Dependence High: 0 or 1; 1 for high levels of transfer dependence and 0 otherwise; Source: Moody's rating reports

National GDP per capita (thousands): 6.7 to 44; national GDP per capita (current US\$ thousands); annual averages from 2006 to 2010; Source: World Bank

Default History: 0 or 1; 1 if history of defaults at the sectoral level and 0 otherwise; Source: Moody's rating reports

Bicameralism: 0-3; measure of strength of subnational representation in upper chamber; Source: Sweden 2010 and author's own calculations

1.2 Standalone Rating Analysis

Standalone Credit Rating: 0-17; numeric translation of Moody's alphabetic scale; Source: Moody's rating reports

Discretionary Revenues: 0-100; percentage of discretionary over total revenues. Discretionary revenues refer to revenues from streams under subnationals' control

Debt to Operating Revenues: Net direct and indirect debt as a percentage of operating revenues

Surplus to Operating Revenues: Gross operating balance as a percentage of annual operating revenues. Gross balance refers to total operating revenues minus total operating expenditures as a percentage of operating revenues.

Short-term Debt: Short-term direct debt as a percentage of total direct debt. Short-term debt refers to all debt with a maturity of less than one year.

Interest payments: Annual interest payments on debt as a percentage of annual operating revenues.

Log of local GDP: Log of local GDP per capita adjusted for purchasing power parity.

Fiscal Management: 1, 8.5, 15; 15 if unit fails to meet fiscal targets more often than not, i.e., revenue estimates often prove imprudent, resulting in shortfalls of notable size and spending often exceeds initial forecast by a substantial margin; 8.5 if unit meets fiscal targets in most years, i.e., revenue estimates prove reasonable in most years, resulting in only occasional shortfalls of notable size and spending exceeds initial forecast by a substantial margin only occasionally; 1 if unit typically meets or exceeds fiscal targets, i.e., revenues almost always meet or come close to initial budget estimates and spending almost always approximates or is kept within the initial budget forecast. Source: Moody's rating reports

Financial Transparency: 1, 8.5, 15; 15 if unit consistently provides independently audited financial statements with an auditor's opinion that contains no serious qualifications; 8.5 for units that may provide audited financial statements, but not consistently and when provided, auditor's opinion contains no serious qualifications; 1 for units that do not provide audited financial statements or, if provided, auditor's opinion is seriously qualified. Source: Moody's rating reports

Debt Management: 1, 8.5, 15; 15 if management adheres to a conservative approach regarding investment management policies, avoiding exposure to investments that pose more than nominal risk; and regarding debt management policies, avoiding exposure to high or rapidly changing debt costs, substantial foreign currency or interest rate risk; 8.5 if management adheres to an approach that is neither notably conservative nor lax regarding investment management policies, accepting exposure to investments that pose risk; and regarding debt management policies, accepting exposure to one of (a) high or rapidly changing debt costs, (b) significant foreign currency risk or (c) significant interest rate risk; 1 if management adheres to a lax or aggressive approach regarding investment management policies (or there are no apparent rules governing the approach), accepting exposure to investments that pose significant risk; and regarding debt management policies, accepting exposure to two or more of (a) high or rapidly changing debt costs, (b) significant foreign currency risks or (c) interest rate risk.

Conflict Resolution: 1, 8.5, 15; 15 if clearly defined rules and procedures typically resolve budget and major policy issues through an orderly process, avoiding an impasse or the arbitrary exercise of power; 8.5 if clearly defined rules and procedures most often resolve budget and major policy issues through an orderly process, but these occasionally result in an impasse or the arbitrary exercise of power; 1 if rules and procedures more often than not resolve budget and major policy issues with notable difficulty or result in an impasse or in an arbitrary exercise of power.

Institutional Framework: 1, 8.5, 15; 15 if well-established multi-year record shows that spending responsibilities and revenue structures can be altered in response to changing needs; changes are effected at a deliberate pace, providing sufficient notice to allow most local governments an orderly transition to the new framework; 8.5 if multi-year record shows that spending responsibilities and revenues structures are difficult to alter in response to changing needs; or changes may be effected

at a hurried pace and with little notice, hampering the ability of many local governments to arrange an orderly transition to the new framework; 1 if multi-year record shows that spending responsibilities and revenue structures are nearly impossible to change in response to changing needs; or changes occur frequently or are effected so hurriedly that they introduce significant uncertainties in the annual budget process, leaving most local governments unable to arrange an orderly transition to the new framework. Source: Moody's rating reports

Sovereign Rating: Moody's sovereign rating. Source: moodys.com

Unless otherwise stated, data come from the December 2010 edition of *Moody's Statistical Handbook: Regional and Local Governments Outside the U.S.*

2 Robustness Checks

2.1 Analysis of Standalone Ratings

This section contains four robustness checks of my analysis of standalone credit ratings. The first re-runs the baseline HLM and OLS models, but with an additional control variable, Moody's bailout expectation. The motivation is twofold. First, I want to control for the possibility that bailout expectations affect standalone creditworthiness by, for example, encouraging subnational governments to accumulate larger debts. Second, I want to control for the possibility that standalone ratings capture aspects of bailout beliefs. As I note in the paper, standalone ratings *do not* reflect the possibility of bailouts in the face of imminent default. However, they *do* incorporate the possibility of gap-filling transfers intended to prevent an imminent default scenario. The literature often defines such transfers as bailouts, meaning standalone ratings may, by some definitions, incorporate aspects of Moody's bailout expectations. The results appear in Table A1. The bailout coefficient is positive and statistically significant at the .01 level in the HLM and OLS models. Most importantly, the own-source revenue coefficients, while smaller, do not significantly change. The positive bailout sign is puzzling if one assumes bailouts undermine standalone creditworthiness. But it is also possible that expectations of preemptive and last-minute bailouts (captured by Moody's bailout probabilities and standalone ratings, respectively) are highly correlated, in which case we get the expected sign.

Tables A2 through A4 provide three additional robustness checks: one in which data from the baseline models are demeaned by group to control for unobserved group-level effects, an ordered probit model to account for the potentially ordinal nature of the dependent variable and a tobit model to guard against potential censoring of the uppermost rating category. As we can see from the tables, the choice of model does not meaningfully affect the results.

Finally, Table A5 reports the results of a regression in which the overall credit rating - rather than the standalone rating - is the dependent variable.

Table A1
Determinants of Moody's Standalone Ratings
With Bailout Control

	HLM	OLS
<i>Individual-Level Predictors</i>		
Discretionary Revenue	0.012*** (0.004)	0.017*** (0.006)
Debt	-0.004 (0.003)	0.007* (0.004)
Surplus	0.019*** (0.007)	0.014 (0.010)
Short-term Debt	-0.007** (0.004)	-0.017** (0.008)
Logged GDP per capita	0.643*** (0.196)	0.705*** (0.184)
Interest payments	-0.178*** (0.054)	-0.229* (0.113)
Fiscal Management	0.137*** (0.022)	0.124*** (0.040)
Debt Management	0.043* (0.024)	0.087** (0.037)
Financial Transparency	0.096*** (0.022)	0.114*** (0.026)
Conflict Resolution	0.102*** (0.027)	0.068* (0.034)
<i>Subnational-Level Predictors</i>		
Institutional Stability	-0.004 (0.052)	-0.047 (0.058)
Bailout	0.350** (0.147)	0.316** (0.149)
<i>National-Level Predictor</i>		
Sovereign Rating	0.622*** (0.077)	0.634*** (0.067)
Constant	-8.362*** (2.125)	-10.061*** (2.173)
Res. Variance (Subnational)	0.186 (0.222)	—
Res. Variance (National)	1.215 (0.231)	—
Res. Variance	0.976 (0.049)	—
Observations	256	256
Subnational Groups	56	56
Countries	31	31
R^2	—	0.916

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standard errors clustered by country in OLS model

Table A2
Determinants of Moody's Standalone Ratings
Data De-meaned by Group

	HLM
Discretionary Revenue	0.015** (0.007)
Debt	-0.004 (0.003)
Surplus	0.016* (0.008)
Short-term Debt	-0.005 (0.004)
Logged GDP per capita	0.732*** (0.203)
Interest payments	-0.160*** (0.062)
Fiscal Management	0.138*** (0.021)
Debt Management	0.042* (0.023)
Financial Transparency	0.097*** (0.022)
Conflict Resolution	0.097*** (0.028)
Constant	0.016 (0.057)
Res. Variance (Subnational)	1.02e-13 (3.65e-13)
Res. Variance (National)	2.27e-14 (1.13e-13)
Res. Variance	.882 (.041)
Observations	239
Subnational Groups	36
Countries	22

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

22 singleton groups dropped from fixed effects model. This is why there are fewer observations than in Table 3

Table A3
Determinants of Moody's Standalone Ratings
Ordered Probit Estimates

	M1
Discretionary Revenue	0.016*** (0.004)
Debt	0.005 (0.003)
Surplus	0.014 (0.009)
Short-term Debt	-0.014** (0.006)
Logged GDP per Capita	0.616*** (0.161)
Interest payments	-0.213*** (0.082)
Institutional Stability	-0.029 (0.049)
Fiscal Management	0.121*** (0.046)
Debt Management	0.060** (0.027)
Financial Transparency	0.093*** (0.024)
Conflict Resolution	0.053** (0.024)
Sovereign Rating	0.573*** (0.078)
Observations	256
Countries	31
<i>Pseudo-R</i> ²	0.43
Log-Likelihood	-393.26

Standard errors clustered by country in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < .01$

Table A4
Determinants of Moody's Standalone Ratings
Tobit Estimates

	M1
Discretionary Revenue	0.021*** (0.006)
Debt	0.007 (0.005)
Surplus	0.016 (0.011)
Short-term Debt	-0.016** (0.008)
Logged GDP per Capita	0.893*** (0.184)
Interest payments	-0.262** (0.109)
Institutional Stability	-0.034 (0.075)
Fiscal Management	0.125*** (0.039)
Debt Management	0.084** (0.035)
Financial Transparency	0.114*** (0.028)
Conflict Resolution	0.086*** (0.032)
Sovereign Rating	0.664*** (0.078)
Constant	-12.160*** (2.03)
σ	1.327*** (0.122)
Observations	256
Countries	31
<i>Pseudo-R</i> ²	0.412

Standard errors clustered by country in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < .01$

Table A5
Determinants of Moody's Credit Ratings
HLM Estimates

	Demeaned by group	
<i>Individual-Level Predictors</i>		
Discretionary Revenue	.008* (.004)	.011* (.006)
Debt	.001 (.003)	.0003 (.003)
Surplus	.019*** (.007)	.015** (.007)
Short-term Debt	-.003 (.003)	-.002 (.003)
Logged GDP per capita	.750*** (.175)	.675*** (.183)
Interest Payments	-.110** (.052)	-.102* (.055)
Fiscal Management	.127*** (.020)	.134*** (.019)
Debt Management	.044** (.022)	.041* (.021)
Financial Transparency	.082*** (.020)	.096*** (.020)
Conflict Resolution	.095*** (.025)	.078*** (.025)
<i>Subnational-Level Predictor</i>		
Institutional Stability	.008 (.059)	
<i>National-Level Predictor</i>		
Sovereign Rating	.718*** (.075)	
Constant	-10.698*** (1.95)	-.007 (.051)
Res. Variance (Subnational)	.532 (.174)	6.57e-13 (2.41e-12)
Res. Variance (National)	1.016 (.244)	6.61e-13 (3.65e-12)
Res. Variance	.866 (.044)	.794 (.047)
Observations	256	239
Subnational Groups	56	36
Countries	31	22

Groups with singletons dropped from de-meaned model.

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

2.2 Analysis of Bailout Expectations

This section contains three robustness checks of my analysis of bailout expectations: a multiple imputation model, which imputes missing values of the dependent variable; a robust-regression model (Yohai's robust MM estimator), which addresses vertical outliers and good and bad leverage points; and a jackknife-style analysis, which tests the sensitivity of coefficients to observations of particular countries. The results do not differ significantly from those of the baseline models. The dependence coefficients are negative across all models and substantive and statistical significance decrease somewhat when values of the dependent variable are imputed. Substantive and statistical significance improve in a subset of robust regression models, but the coefficients fail to reach statistical significance at the .05 level in the full model. The dependence coefficients are highly unstable in the jackknife procedure, suggesting that the results are highly dependent on the countries in the sample. The results reinforce my initial conclusions: no evidence of a positive relationship (the literature's prediction) and suggestive evidence of a non-effect (my prediction). I discuss each set of models in more detail below.

Coverage of the dependent variable is limited to units that were rated as of 2006, the first year in which bailout probabilities were issued. Moody's released precise probabilities at this time, but has only released ranges of probabilities since. These ranges are classified as low (0 to .3), moderate (.31 to .5), high (.51 to .7), very high (.71 to .95) and fully supported (.96 to 1). I impute values for 12 groups (roughly 20 percent of the sample) using Rubin's multiple imputation methods.¹

The imputation models include all variables from Model 3 in Table 4 and two auxiliary regressors. The first auxiliary is the World Bank's Government Effectiveness Index (GEI), a country-level metric that Moody's uses to assess the quality of borrowers' national operating environment. I average countries' GEI scores from 2006 to 2010. The second is an ordinal index of Moody's bailout ranges (see previous paragraph). Imputed values are constrained to fall within the continuous ranges assigned to each value of the ordinal index.

I also impute the dependent variable for US states. Moody's rates the states using a separate methodology that does not assign bailout probabilities. However, Moody's clearly indicates, in its rating materials, that state ratings do not incorporate any likelihood of extraordinary support.² I can safely assume, therefore, that states fall within the low range of 0 to .3. I can also infer their performance on other Moody's indicators, including transfer dependence (low) and recent default history (none). I incorporate this information into the imputation model.

The results appear in Table A6. Standard errors clustered by country appear in parentheses. The magnitudes of the transfer dependence coefficients are lower than they are in the baseline models. The negative impact of moderate and high transfer dependence falls from .09 to .07 and 0.13 to .12, respectively, in the full model. Both coefficients fail to reach statistical significance at the .05 level, though high dependence reaches statistical significance at the .10 level in models 1 and 2.

I also conduct a jackknife-style analysis, in which I re-run the full model from Table 2 of the paper 23 times, dropping observations from a different country each time. The negative effect of moderate dependence shrinks by nearly half when Spanish groups are omitted. It increases from roughly .09 (M1) to .14 (M3) and becomes statistically significant, however, when Japanese cities and prefectures are excluded. The high dependence coefficient ranges from -.08 (M3) when Czech cities and regions are dropped to -.16 (M3) when Portuguese cities and regions are omitted. The dependence coefficients are more volatile than those of other variables. The coefficients of variation for the moderate and high dependence estimates are .18 and .14, respectively, significantly higher

¹?

²?

Table A6
Determinants of Moody's Probabilities of Extraordinary Support
Values of Dependent Variable Imputed

	Model 1	Model 2	Model 3
Moderate Transfer Dependence	-0.114 (0.0935)	-0.104 (0.0910)	-0.0667 (0.0827)
High Transfer Dependence	-0.187* (0.108)	-0.184* (0.107)	-0.117 (0.082)
GDP	0.0140*** (0.004)	0.0137*** (0.004)	0.00592* (0.003)
Bicameralism		0.0323 (0.050)	0.0335 (0.038)
Default			-0.354*** (0.064)
Constant	0.173 (0.148)	0.164 (0.150)	0.477** (0.129)
Observations	58	58	58
Countries	33	33	33
R^2	.41	.42	.65

* $p < 0.10$, ** $p < 0.05$, *** $p < .01$

Standard errors clustered by country in parentheses

than .09 for GDP, .11 for Bicameralism and .04 for Default. This uncertainty does not, of course, affirm my hypothesis of no effect, but it is suggestive and the consistently negative sign is strong evidence against a positive relationship, which the literature predicts.

The dataset contains a number of influential observations. I do not have obvious theoretical reasons for dropping these. Nor do I want to shrink an already small sample. Thus, I re-estimate the models with Yohai's MM-estimator.³ It increases robustness in the presence of outliers, but unlike Huber's M-estimator and other robust-estimation techniques, combines a high breakdown point with high levels of asymptotic efficiency and resistance to good and bad leverage points. Yohai identified a trade-off between the efficiency and the robustness of the MM-estimator: the higher the efficiency, the higher the maximum bias due to data contamination. Maronna and colleagues recommend 85% efficiency as a good compromise between efficiency and robustness.⁴ This is the level I use.

Influential cases are evident in all models. In M3, six observations (Argentinean provinces, Brazilian states, Japanese cities, Japanese prefectures, Spanish foral provinces and Greek cities) are weighted 0.

Compared to Table 1, the magnitude of the dependence coefficients increases significantly in models 1 and 2, but decrease in the full model (Model 3). The dependence coefficients are also statistically significant at the .05 level or better in the first two models, but fail to meet this standard when I control for default history. Statistical significance disappears entirely when the model's Gaussian efficiency increases to 95% (recall the trade off between efficiency and the maximum potential bias for the MM-estimator). Finally, note that the standard errors in Table A7 may be inflated: they are only asymptotically valid and the sample size is small and they do not account for group-level clustering of observations.

³?. See ? for a recent political science application.

⁴?

Table A7
Determinants of Moody's Probabilities of Extraordinary Support
Robust Regression (Yohai's MM-Estimator)

	Model 1	Model 2	Model 3
Moderate Transfer Dependence	-0.303*** (0.104)	-0.234** (0.111)	-0.053 (0.043)
High Transfer Dependence	-0.353*** (0.120)	-0.264** (0.127)	-0.089* (0.050)
GDP	0.013*** (0.005)	0.015*** (0.005)	0.003 (0.002)
Bicameralism		0.061 (0.054)	0.229*** (0.021)
Default			-0.265*** (0.039)
Constant	0.353** (0.171)	0.212 (0.183)	0.442*** (0.078)
Observations	46	46	46
Residual Std. Error	0.203 (df=42)	0.208(df=41)	0.117 (df=40)

* $p < 0.10$, ** $p < 0.05$, *** $p < .01$

References

- Johnson, Joel. 2013. "Campaign Spending in Proportional Electoral Systems: Incumbents Versus Challengers Revisited." *Comparative Political Studies* 46(8):968–993.
- Maronna, Ricardo, Martin Doug and Victor Yohai. 2006. *Robust Statistics: Theory and Methods*. John Wiley & Sons.
- Moody's. 2013. "US States Rating Methodology."
- Rubin, Donald. 1987. *Multiple Imputation for Nonresponse Data*. John Wiley & Sons.
- Yohai, Victor. 1987. "High Breakdown-Point and High Efficiency Robust Estimates for Regression." *The Annals of Statistics* 15(2):2.