



Measuring Fiscal Sustainability of Local Governments: A Stress Testing Approach Using Illinois Municipalities

Kenneth A. Kriz, University Distinguished Professor

Richard Funderburg, Associate Professor

Background

- Concept of fiscal sustainability
 - Inherently forward looking
 - Yet seldom measured that way
- Most applied research has involved “indicators”
 - Brown (1993), Hendrick (2004), Maher & Nollenberger (2009), Gorina, Maher, and Joffe (2018)
- One exception is FTMS
 - Groves and Valente (2004)
- Another approach has been unit root/cointegration analysis
 - Hamilton and Flavin (1986) , Quintos (1995), Mahdavi and Westerlund (2011), Ji, Ahn and Chapman (2016)

Our Idea: Stress Testing

- Developed during the 1990s to address increasing instability in financial systems
- World Bank and IMF's FSAP
 - Blaschke, et.al. (2001)
- Used in many domains
 - Banks (Schuermann, 2014)
 - Household debt levels (Bhutta et.al., 2019)
 - Public pension systems (Mennis, Banta and Draine, 2018)

Decision Items (Blaschke, et.al. 2001)

Decision Item	Our Model
Type of Risk Model	Financial – Operational Risk Model
Type of Stress Test	Other – Effects of an Unexpected Shortfall in Revenues or Increase in Expenditures
Type of Shock	Underlying Volatilities
Type of Scenario	Hypothetical – Based on Standard Errors of Forecasts
Core Assets to be Shocked	Operating Balance (equation (1))
Peripheral Assets to be Shocked	Revenues of Various Types, Operating Expenditures
Size of Shocks	One and Two Standard Error Deviations from Forecasted Values
Time Horizon	Current and Four Future Years (2019-2024)
Risk Management Techniques	None - Passive Acceptance of Risk

Sample Cities

City	Population (2017 est.)	Data Availability	Region
Springfield	114,868	2003-2018	Central
Waukegan	87,729	2000-2018	Northeast
Normal	54,284	2005-2018	Central
Carbondale	25,899	2004-2018	South
Park Forest	21,682	2001-2018	Northeast
Prospect Heights	16,180	2002-2018	Northeast
Hawthorn Woods	8,412	1999-2017	Northeast
Hillside	8,043	2001-2018	Northeast
Geneseo	6,533	1999-2018	West Central
Thornton	2,488	2003-2018	Northeast
Oakbrook Terrace	2,161	2005-2018	Northeast

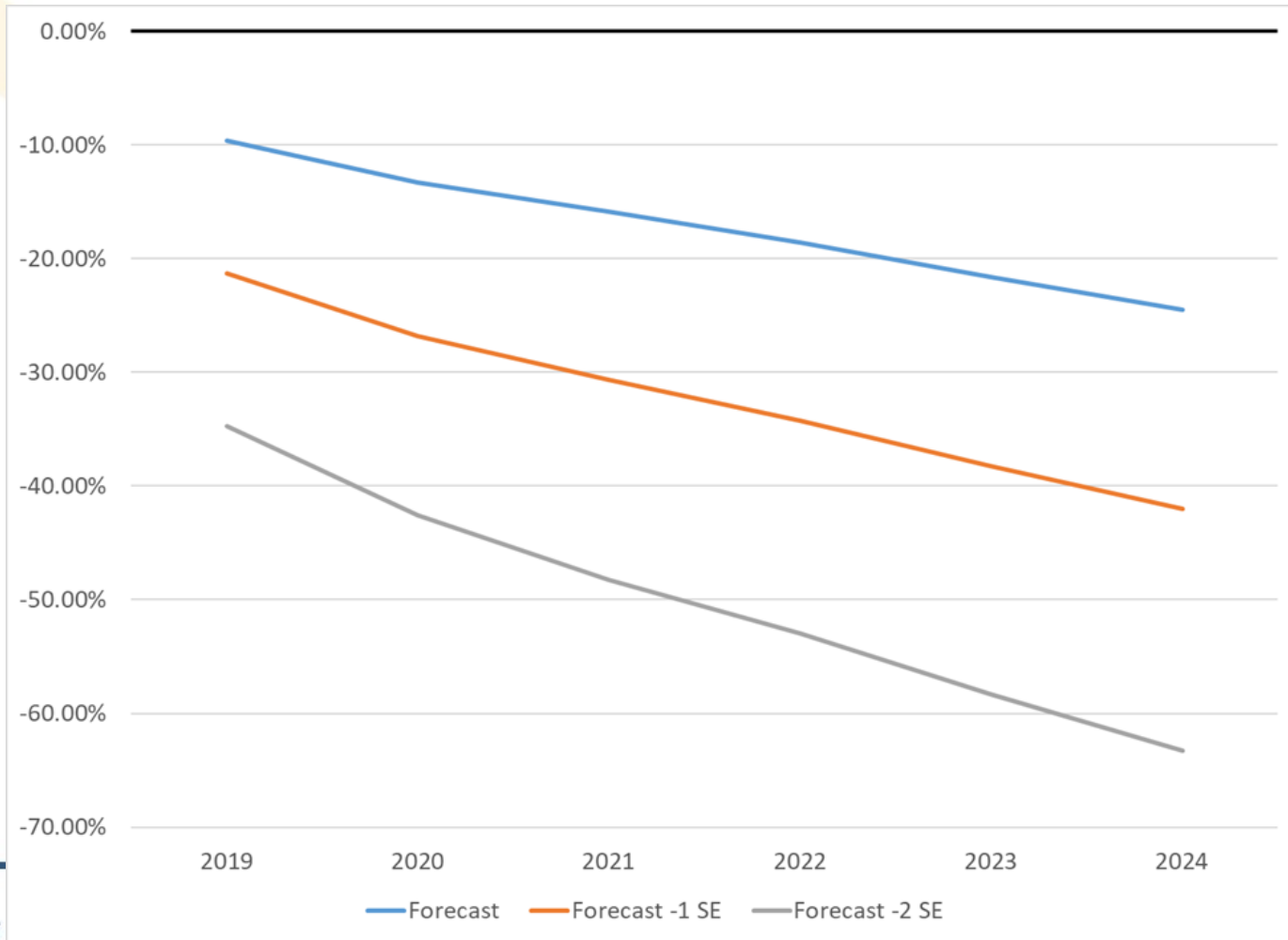
Economic Forecasts & Results

City	Variable and Final Model	MAPE (In-Sample)
Springfield	PCPI: VAR(1)	0.92
	WAGES: VAR(1)	1.18
	EMP: VAR(1)	0.79
Waukegan	TAXABLE: AR(1) w/PCPI	1.86
	PCPI: ARIMA (0,1,0) w/WAGES	2.49
	WAGES: ARIMA (0,1,0) w/EMP	2.16
	EMP: ARIMA (1,0,1)	1.06
Normal	TAXABLE: AR(1) w/PCPI, EMP	3.99
	PCPI: ARIMA (1,1,0)	1.50
	WAGES: ARIMA (0,1,0) w/EMP	0.94
	EMP: MA(2)	0.61
Carbondale	TAXABLE: VAR(2)	0.91
	PCPI: VAR(2)	0.62
	WAGES: VAR(2)	0.68
	EMP: VAR(2)	0.26
Geneseo	TAXABLE: ARIMA (1,0,[4]) w/PCPI, WAGES	2.39
	PCPI: AR(1) w/EMP	3.02
	WAGES: ARIMA ([4],0,0) w/PCPI	1.82
	EMP: AR(1)	1.79
Thornton	TAXABLE: VAR(2)	2.14
	PCPI: VAR(2)	1.28
	WAGES: VAR(2)	0.71
	EMP: VAR(2)	1.43

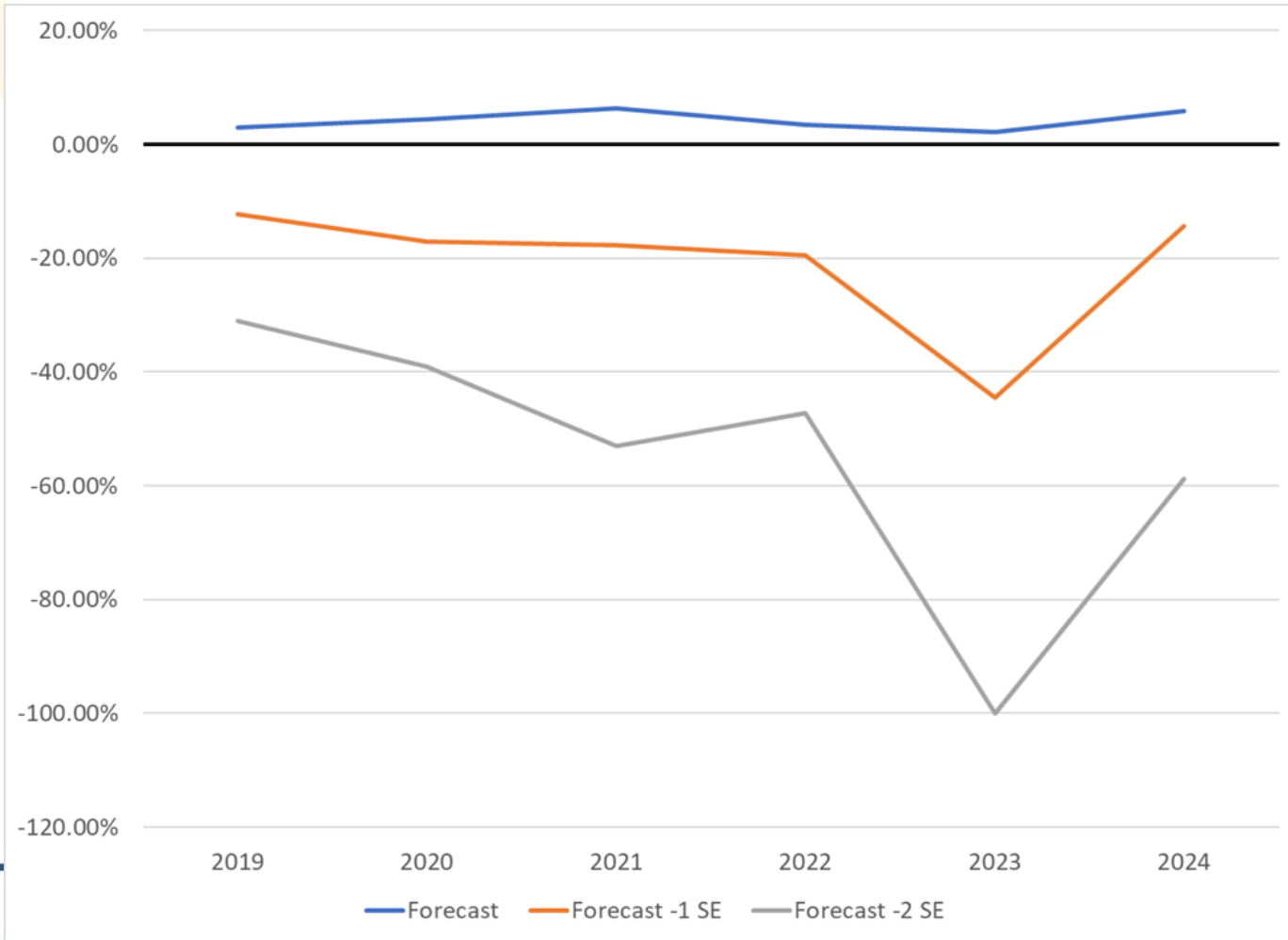
Financial Variables Forecasts & Results

City	Variable and Final Model	MAPE (In-Sample)
Springfield	TOTVALUATION: ARIMA(0,1,0) w/PCPI	1.07
	TAXABLE: ARIMA(0,1,0) w/PCPI	1.93
	IGREV: OLS w/PCPI, WAGES, EMP	10.09
	OTHERREV: ARIMA([2],0,0) w/PCPI, EMP	7.44
	OPERATINGEXP: AR(1) w/PCPI	3.13
	NETTRANSFER: ARIMA(0,1,1) w/Y2016	45.55
Waukegan	TAXES: VAR(2) w/PCPI	3.57
	IGREV: VAR(2) w/PCPI	34.79
	OTHERREV: VAR(2) w/PCPI	10.53
	TOTEXP: VAR(2) w/PCPI	4.04
Normal	TAXES: AR(1) w/PCPI, TAXABLE	3.50
	IGREV: AR(1) w/PCPI, TAXABLE	11.93
	CHARGES: AR(2) w/PCPI	1.14
	OTHERREV: AR(1) w/PCPI, TAXABLE, WAGES	5.34
	OPERATINGEXP: OLS w/PCPI, TAXABLE, WAGES	22.93
Carbondale	TOTVALUATION: ARIMA(2,1,0)	1.27
	SALESSERVICEUTIL: AR(1)	8.14
	IGREV: AR(1) w/TAXABLE, EMP	10.52
	OTHERREV: ARIMA(0,0,[2]) w/TAXABLE, EMP	3.02
	TOTALEXP: AR(1) w/PCPI, EMP	1.40
Geneseo	TAXES: ARIMA(0,1,0) w/TAXABLE, EMP	3.58
	IGREV: AR(1) w/TAXABLE, EMP, WAGES	48.88
	CHARGES: OLS w/ TAXABLE, EMP, WAGES, Y2013	8.62
	OTHERREV: ARIMA([1,4],0,0) w/PCPI	15.52
	OPERATINGEXP: ARIMA(2,0,[3]) w/PCPI, WAGES, Y2013	2.94
Thornton	TAXES: VAR(1) w/PCPI	3.86
	IGREV: VAR(1) w/PCPI	10.57
	OTHERREV: VAR(1) w/PCPI	11.56
	OPERATINGEXP: VAR(1) w/PCPI	5.70

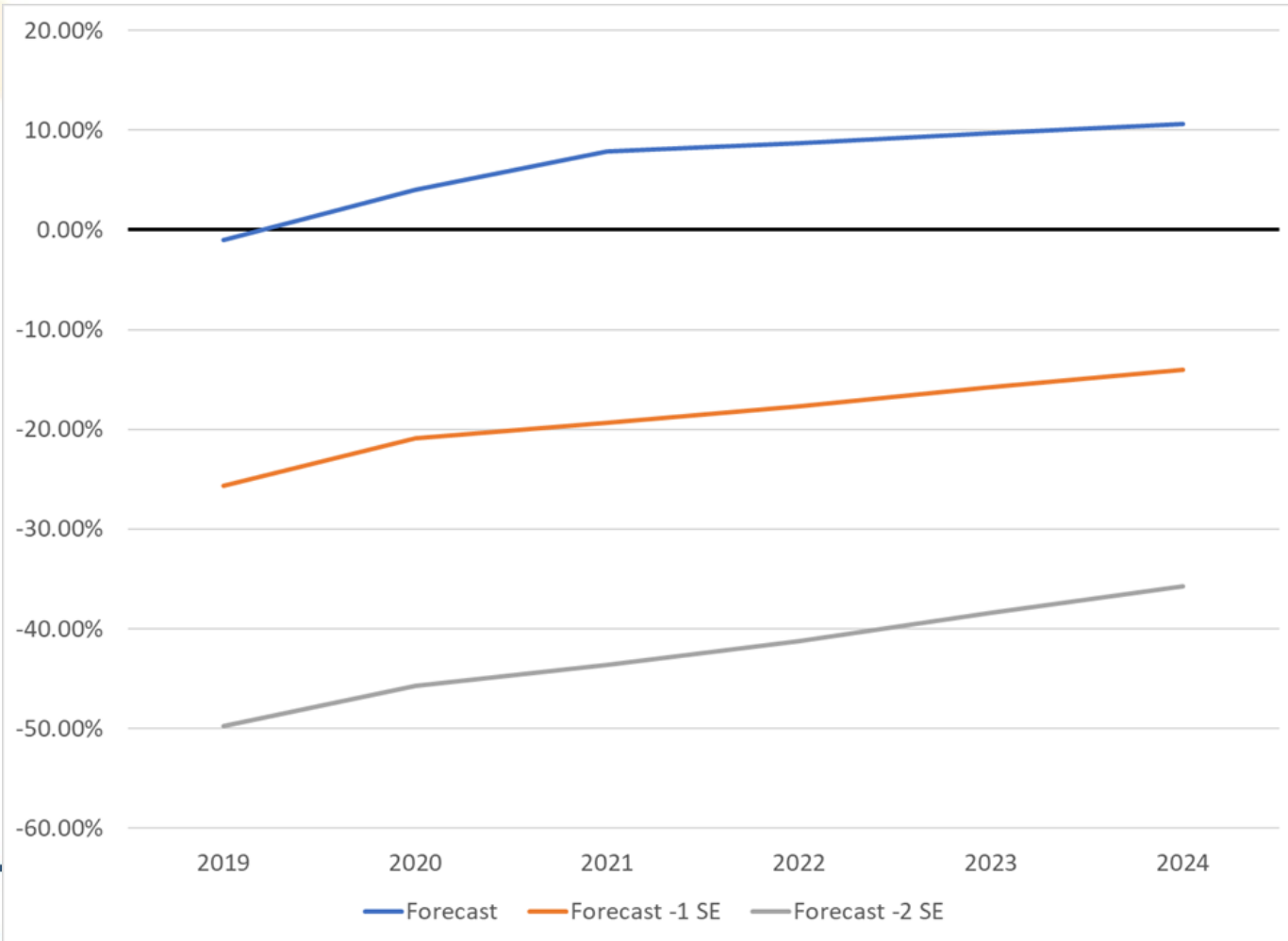
Springfield Operating Balance Forecasts



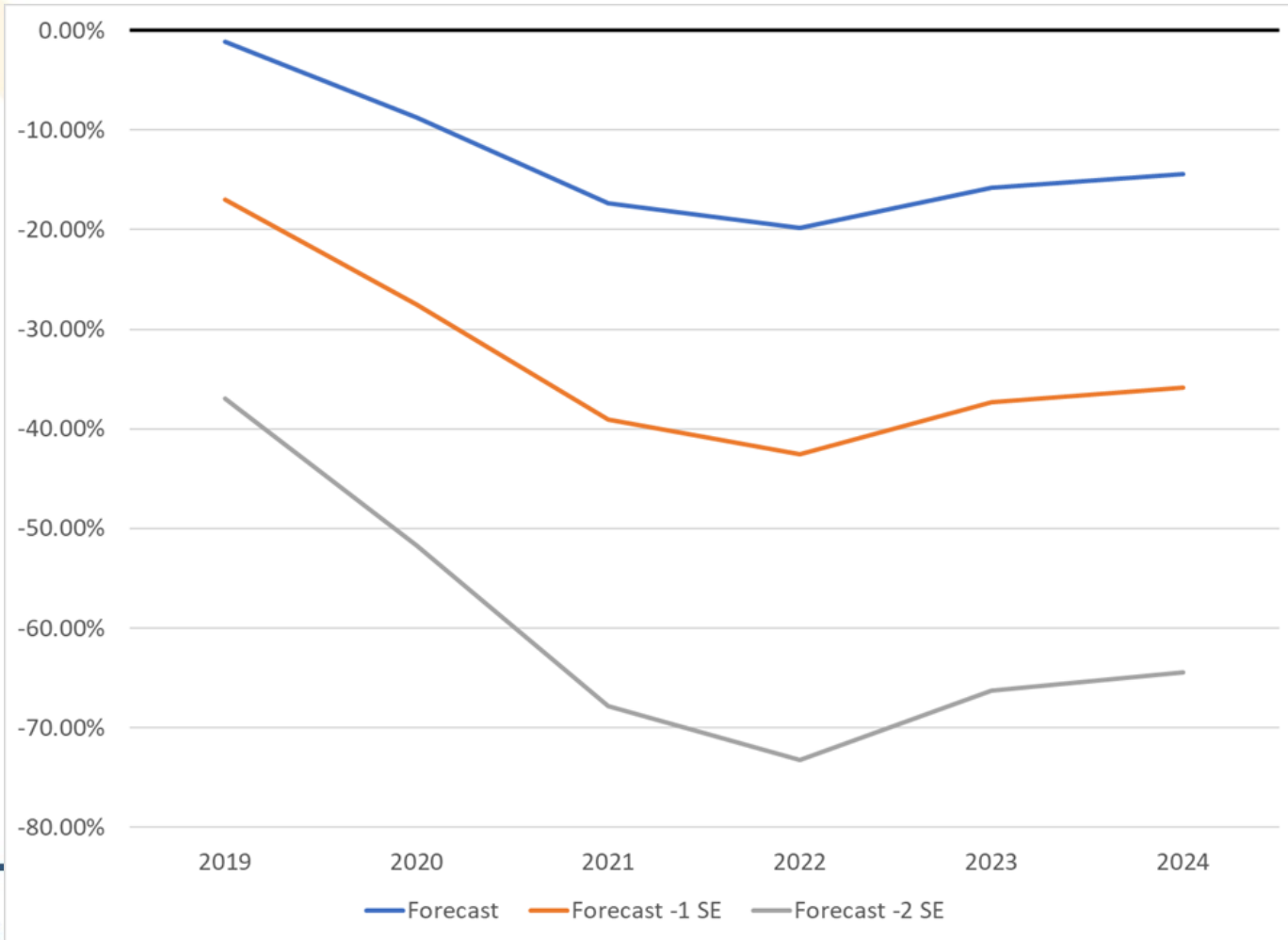
Waukegan Operating Balance Forecasts



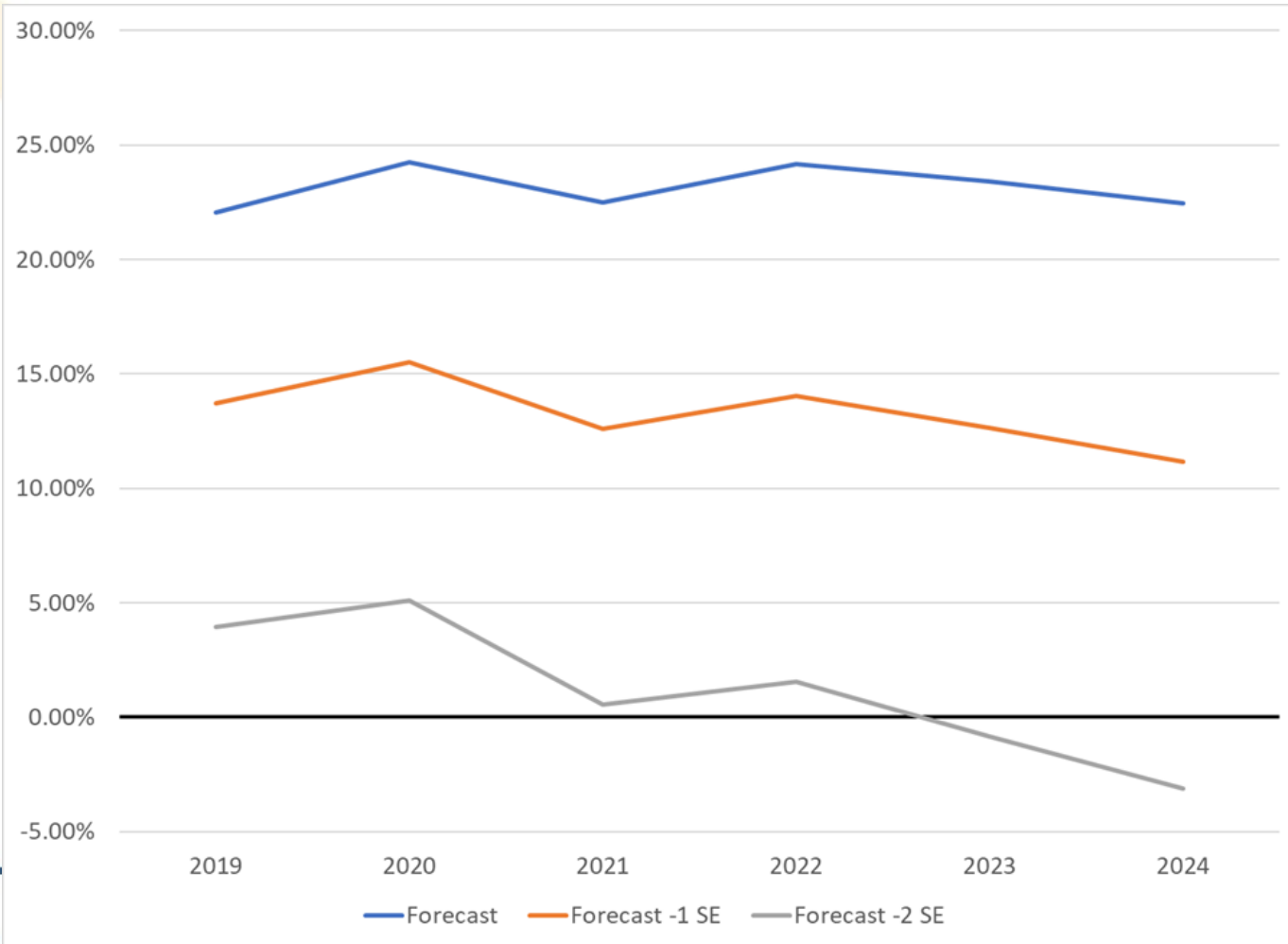
Normal Operating Balance Forecasts



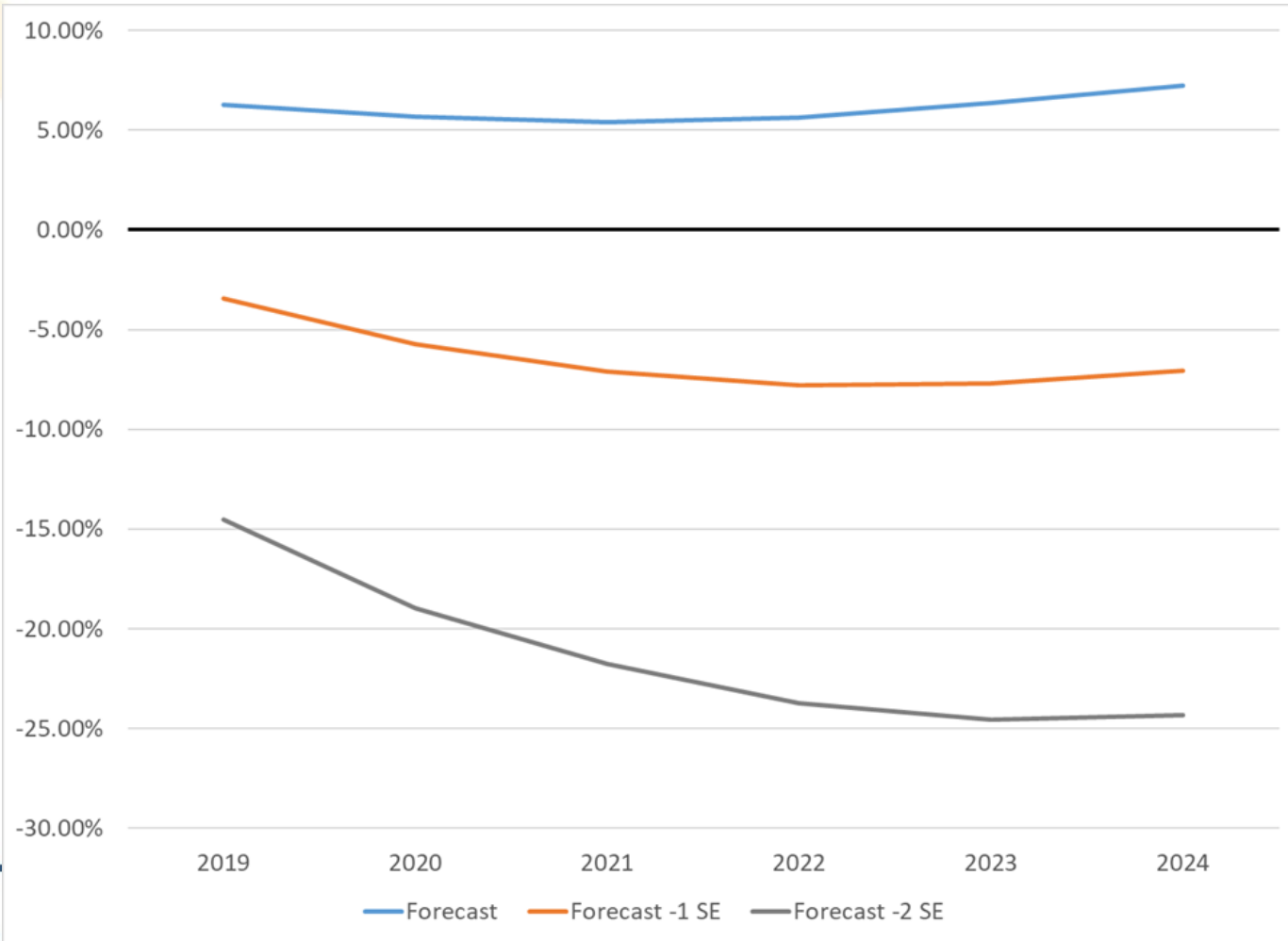
Carbondale Operating Balance Forecasts



Geneseo Operating Balance Forecasts



Thornton Operating Balance Forecasts





Issues

- Data difficulties
- Reporting differences
- Structural breaks



Next Steps

- More cities
- More years
- Reaction estimates