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ESTIMATING LONG-TERM GROWTH RATES

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- He has directed valuations of businesses, interests in businesses, intellectual property, intangible assets, real property and machinery and equipment. Roger has testified in court as an expert witness on matters of solvency, the value of closely held businesses and business interests, valuation and amortization of intangible assets and other valuation issues. His testimony in U.S. District Court was referenced in the U.S. Supreme Court opinion decided in his client's favor in the landmark Newark Morning Ledger case.
- Roger is co-author of the Duff & Phelps annual Valuation Handbook series: Valuation Handbook-Guide to Cost of Capital, Valuation Handbook- Industry Cost of Capital, International Valuation Handbook-Guide to Cost of Capital, and International Valuation Handbook- Industry Cost of Capital (John Wiley & Sons, 2015); co-author with Shannon Pratt of Cost of Capital: Applications and Examples, 5th ed. (John Wiley & Sons, 2014); co-author with Shannon Pratt of The Lawyer's Guide to Cost of Capital (American Bar Association, 2014).
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Common approach- assume long-term GDP Growth

- Some analysts default to long-term growth equal to long-term real GDP growth plus expected inflation (assuming net cash flows are in nominal dollars)
- Consistent with observation that corporate earnings have remained a consistent percentage of GDP but vary over the business cycle
 - When E/GDP is low, earnings will grow faster than GDP;
 - when E/GDP is high, earnings growth will be less than GDP growth
 - >> implies mean reversion

Common approach- assume long-term GDP Growth (cont'd)

- GDP growth includes both growth in existing businesses and growth in newly formed companies
- Implication: an existing business will grow by an amount less than overall GDP growth
- Applying Arnott & Bernstein's "dilution methodology", Cornell estimates that real long-term growth in aggregate corporate earnings will be 3%, with 2% attributable to new companies
 - long-term average real earnings for existing businesses = 1%
- Source: Bradford Cornell, "Economic Growth and Equity Investing," *Financial Analysts Journal* Vol 66 (2010)

Revisiting the Perpetual Growth [g] Assumption

- In the customary DCF valuation, it is assumed that a mature company will survive and will grow at a constant rate in perpetuity
- This assumption is likely invalid for two reasons:
 - The impact of corporate mortality
 - The impact of decelerating company growth due to economic changes and/or obsolescence
- The constant perpetual growth assumption can result in overstated values

Impact of Growth Rates on Value

- Valuation estimates are highly influenced by the growth rate expectation. Small Changes in growth rate assumptions cause big changes in value estimates

Present Value Infinite series						
Cost Of Capital	10%	15%	20%	25%	30%	
Rate of growth						
1%	11.22	7.21	5.32	4.21	3.48	
2%	12.75	7.85	5.67	4.43	3.64	
3%	14.71	8.58	6.06	4.68	3.81	
4%	17.33	9.45	6.50	4.95	4.00	
5%	21.00	10.50	7.00	5.25	4.20	

Long Run Growth Estimation

- How long is the long run?
- We can compare finite life series with the commonly used infinite life series and see the time horizon over which bulk of the value is captured. Using the same set of parameters and a life of 20 years

Present Value finite series 20 years life						
Cost Of Capital	10%	15%	20%	25%	30%	
Rate of growth						
1%	9.10	6.61	5.10	4.11	3.43	
2%	9.74	6.99	5.34	4.27	3.54	
3%	10.45	7.41	5.61	4.45	3.67	
4%	11.24	7.87	5.89	4.64	3.80	
5%	12.11	8.38	6.21	4.85	3.94	

Long Run at 20 Years

Present Value Capture 20 years						
Cost Of Capital		10%	15%	20%	25%	30%
Rate of growth						
	1%	81%	92%	96%	98%	98%
	2%	76%	89%	94%	96%	97%
	3%	71%	86%	93%	95%	96%
	4%	65%	83%	91%	94%	95%
	5%	58%	80%	89%	92%	94%

Growth Rates for what?

- Valuation parameters are cash flows at different levels of estimation.
- The correct growth rate should match the parameter being used in valuation
 - Revenues
 - EBITDA
 - EBIT
 - NI (may be subject to “financial engineering”)
 - Free Cash Flow to Firm
 - Free Cash Flow to Equity

Growth Rate for What Industry/Company?

- Common practice is to use a long run growth rate as a one size fits all.
- Is that true?
- Are there differences across industries and parameters?
- This is one of the gaps that we are attempting to fill in today

Data Set Description

- Period 1950 to 2018
 - 68 years of firm data
- Total number of firm years with available growth rates 387,664
- Total number of firm years with no acquisition 310,647
- Data set includes 148 firms that were in existence in 1950 and continued in operation until 2018
- The results are based on this sample of no acquisition years as our focus is on organic growth.
- We find that there are significant differences across industry groups.

Measures of Growth

- Nominal Growth vs. Real (inflation adjusted)
 - Organic Growth -- removing Acquisition and Divestiture driven changes in Growth
- Key measure: Inflation adjusted Organic Growth
- Difference between Nominal and Real growth rates indicates the ability of the firms in the industry to push through pricing increases.

Real and Nominal GDP Growth- Reference Point

- 1950-2018
- Inflation accounted for half of the nominal growth in U.S. GDP
 - Average Annual Nominal Growth 6.39%
 - Average Annual Real Growth 2.93%

Revenue Growth as a Measure of Growth

- Top line revenue --Clean measure unadulterated by Financial and Tax Engineering
- Results: Growth Stages as organic growth slows
 - Bursting through the gate
 - Stabilizing Phase
 - Long Run steady period
- Growth rates presented
 - Annualized - nominal and real minus growth driven by acquisition = organic growth - nominal and real

EBIT Growth as a Measure of Growth

- Use of EBIT growth rate in DCF also requires analyst to estimate capital expenditures and net working capital required to support growth in revenues
- Difference between EBITA growth and EBIT growth can benchmark depreciation growth as revenues grow
- Capital expenditures should generally exceed growth in depreciation
- See for example, “The Long-term Relationships between Capital Expenditures and Depreciation and Long-term Net Working Capital to Sales across Industries” by Brian H. Lee, ASA, Daniel L. McConaughy, PhD, ASA, Mary Ann K. Travers, ASA, and Steven R. Whitehead, *Business Valuation Review* (Summer/Fall 2012)
- EBIT growth is expected to be slower than EBITDA growth

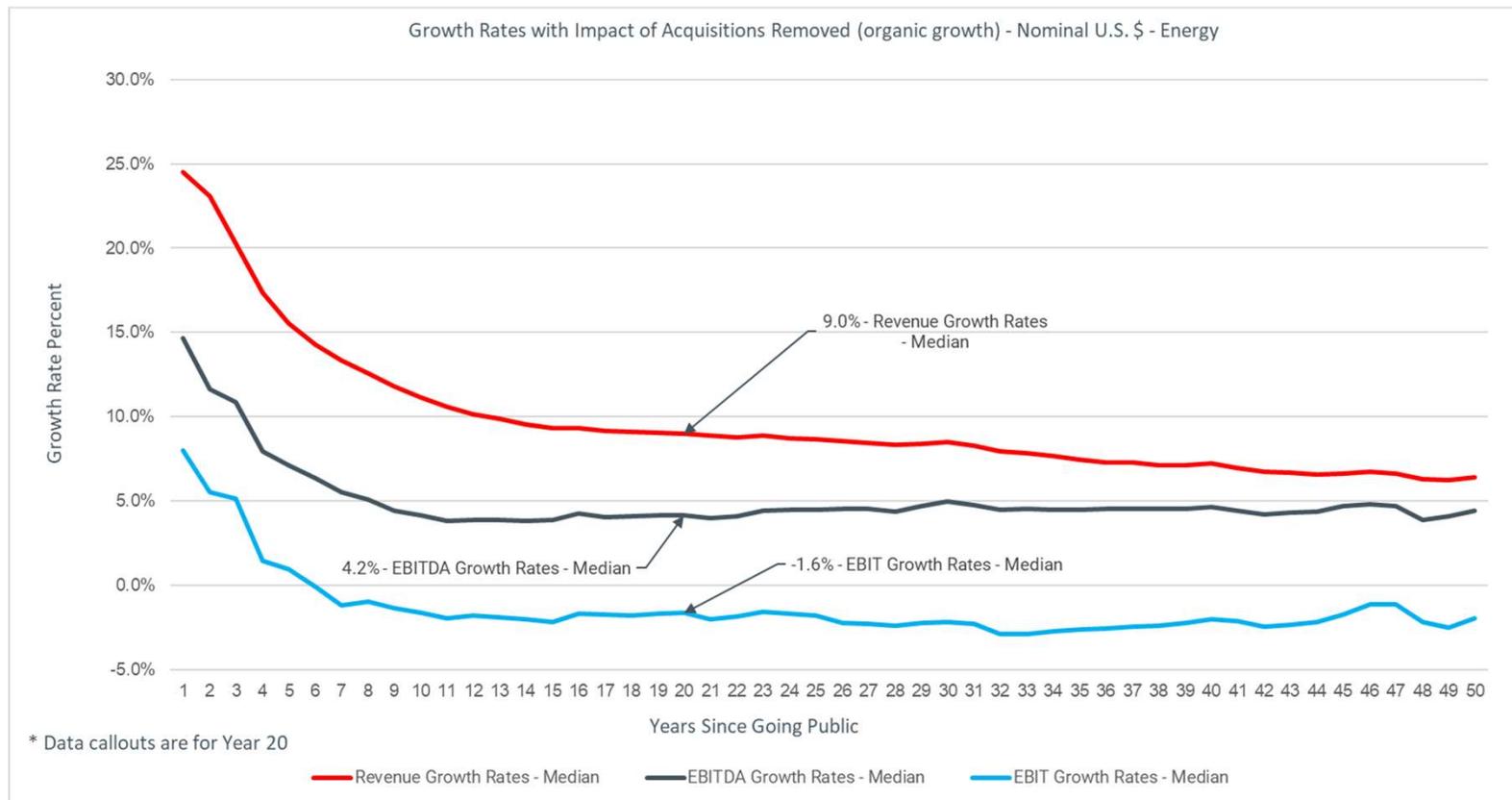
EBITDA Growth as a Measure of Growth

- Measure often used as proxy for operating cash flow – but it is before investments needed in capital expenditures and net working capital
- Use of EBITDA growth rate in DCF requires analyst to estimate capital expenditures required to support growth in revenues
 - Research has shown that in the long-term capital expenditures typically exceed depreciation
- Difference between EBITDA growth and Revenue growth impacted by operating leverage

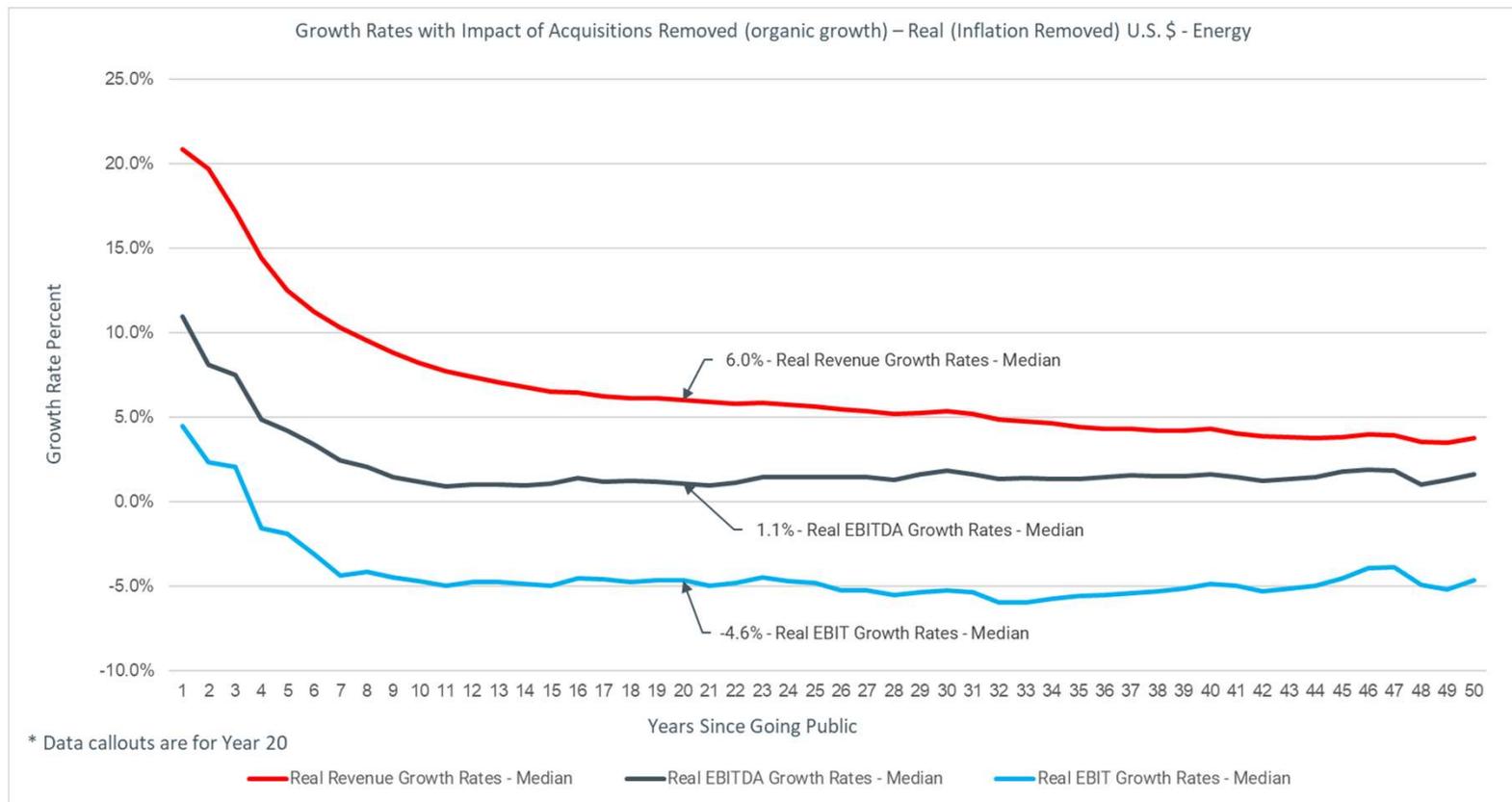
Long Run Growth Rate Estimates

- We present “lifetime” long run growth estimates based on annualized organic growth (impact of acquisitions removed)
 - In nominal dollars
 - In real dollars (with GDP deflator used to convert nominal to real)
- For comparison, we display the annualized growth rates in year 20
- Long Term growth rate estimates partitioned by industry groups are presented.

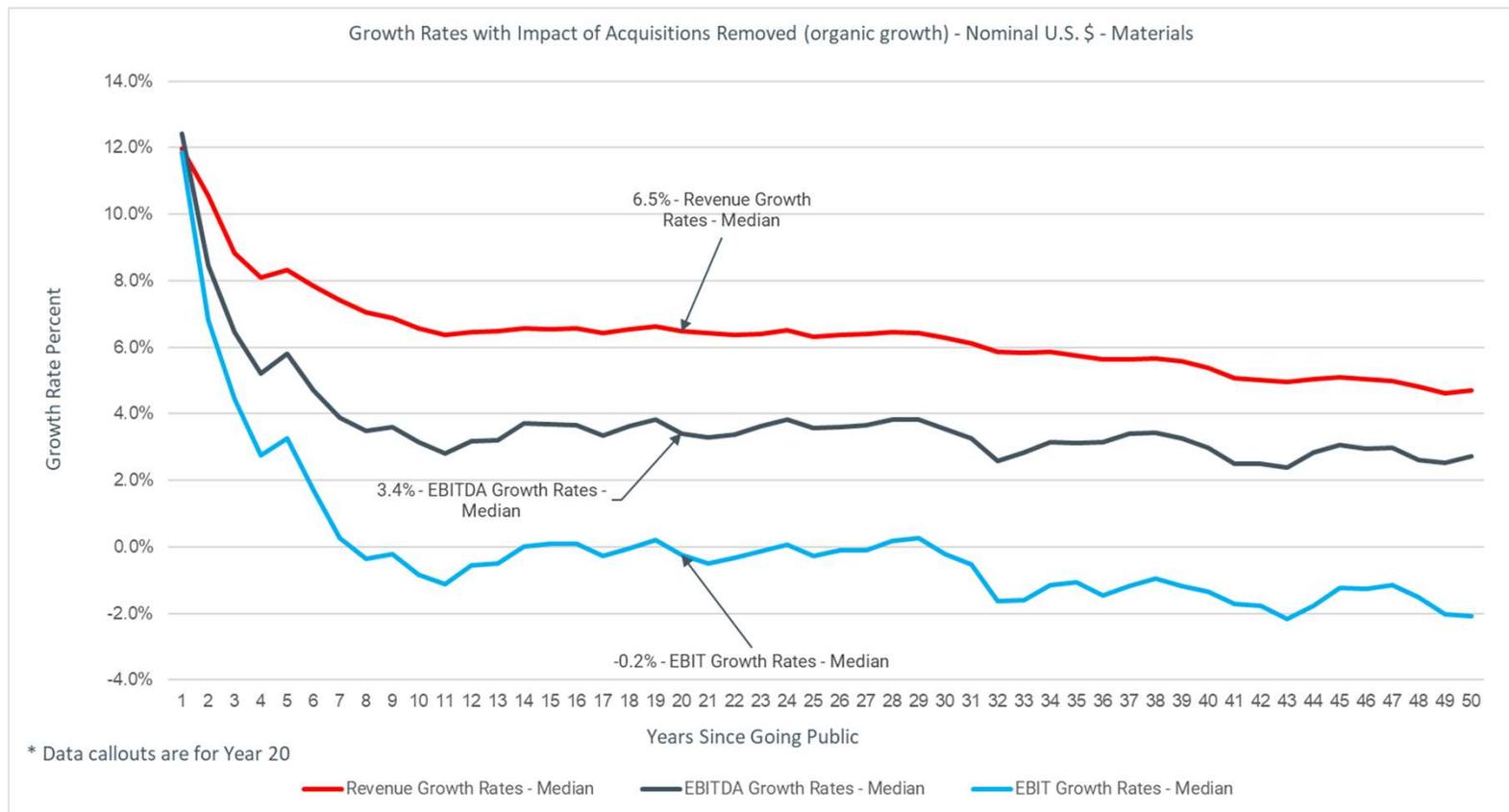
GIC 10 Energy- Nominal



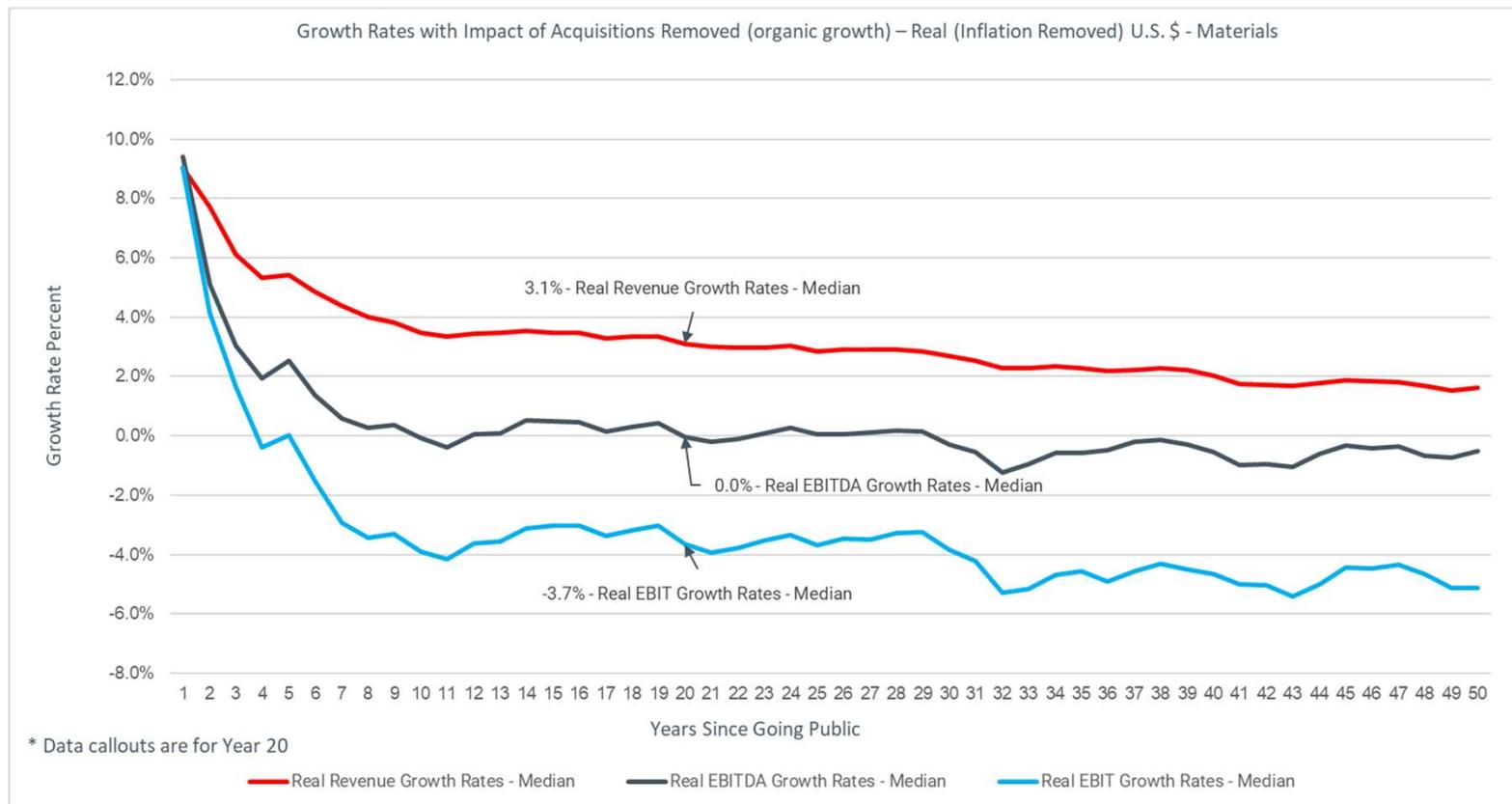
GIC 10 Energy- Real



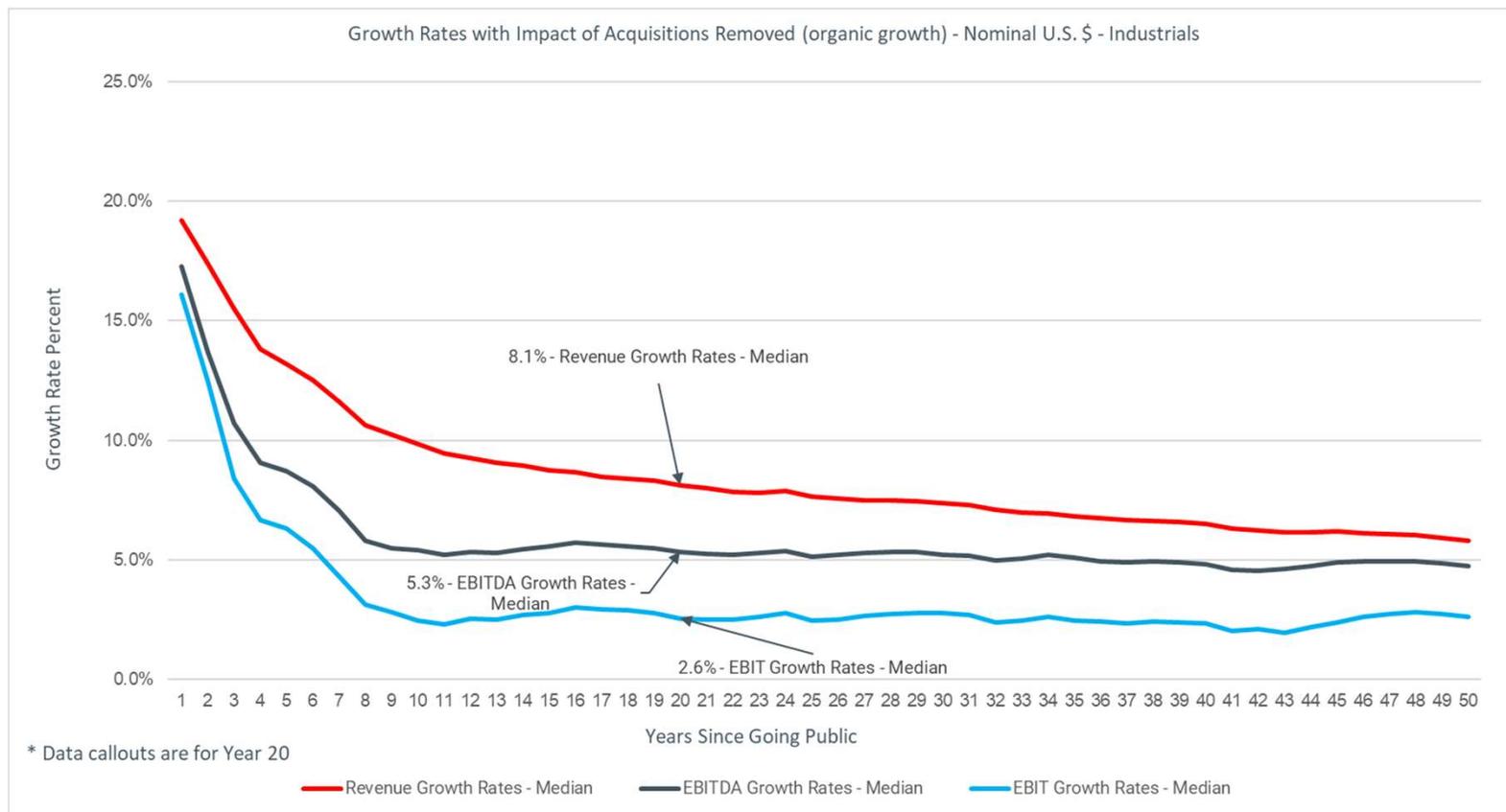
GIC 15 Materials - Nominal



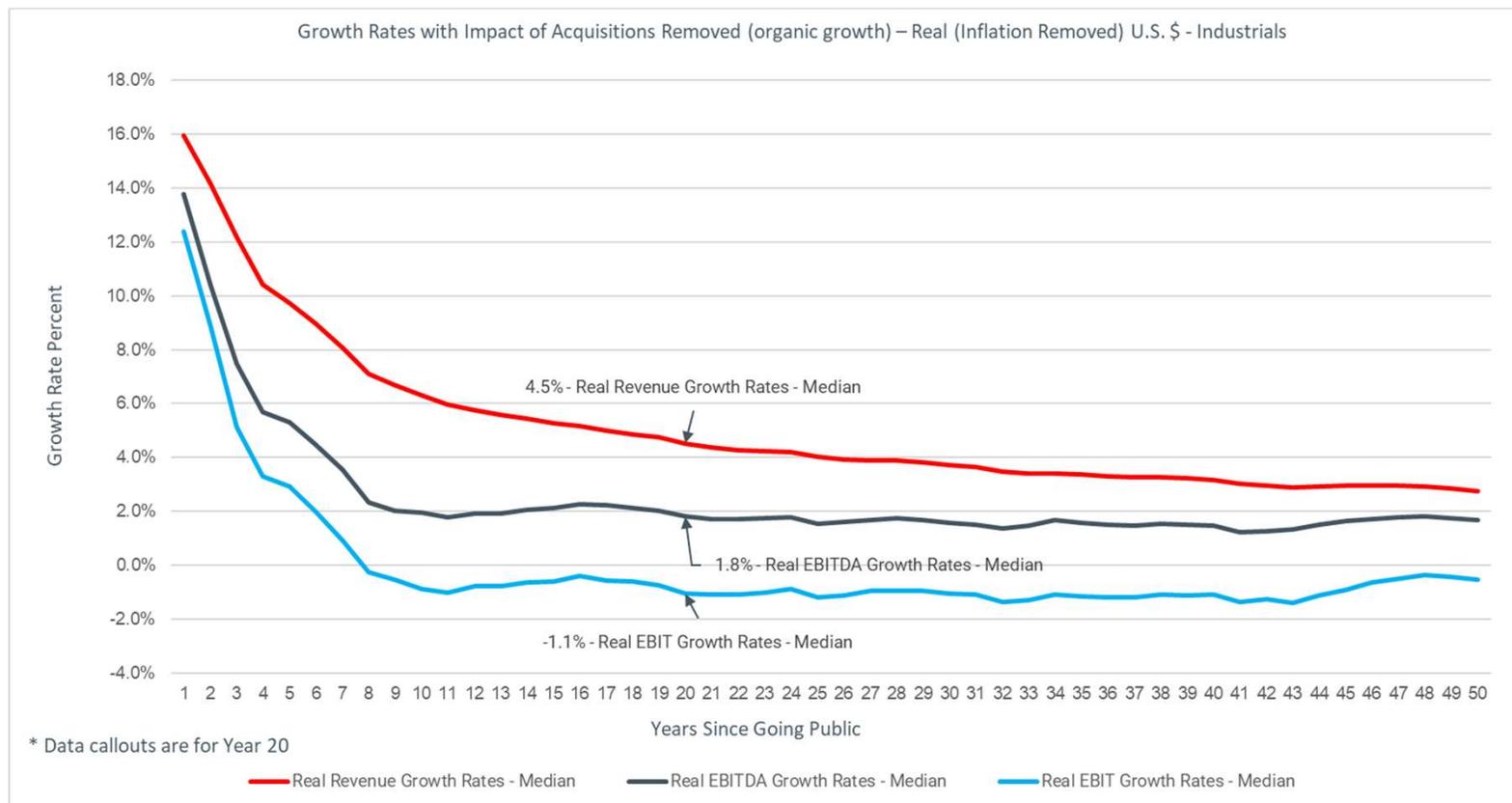
GIC 15 Materials - Real



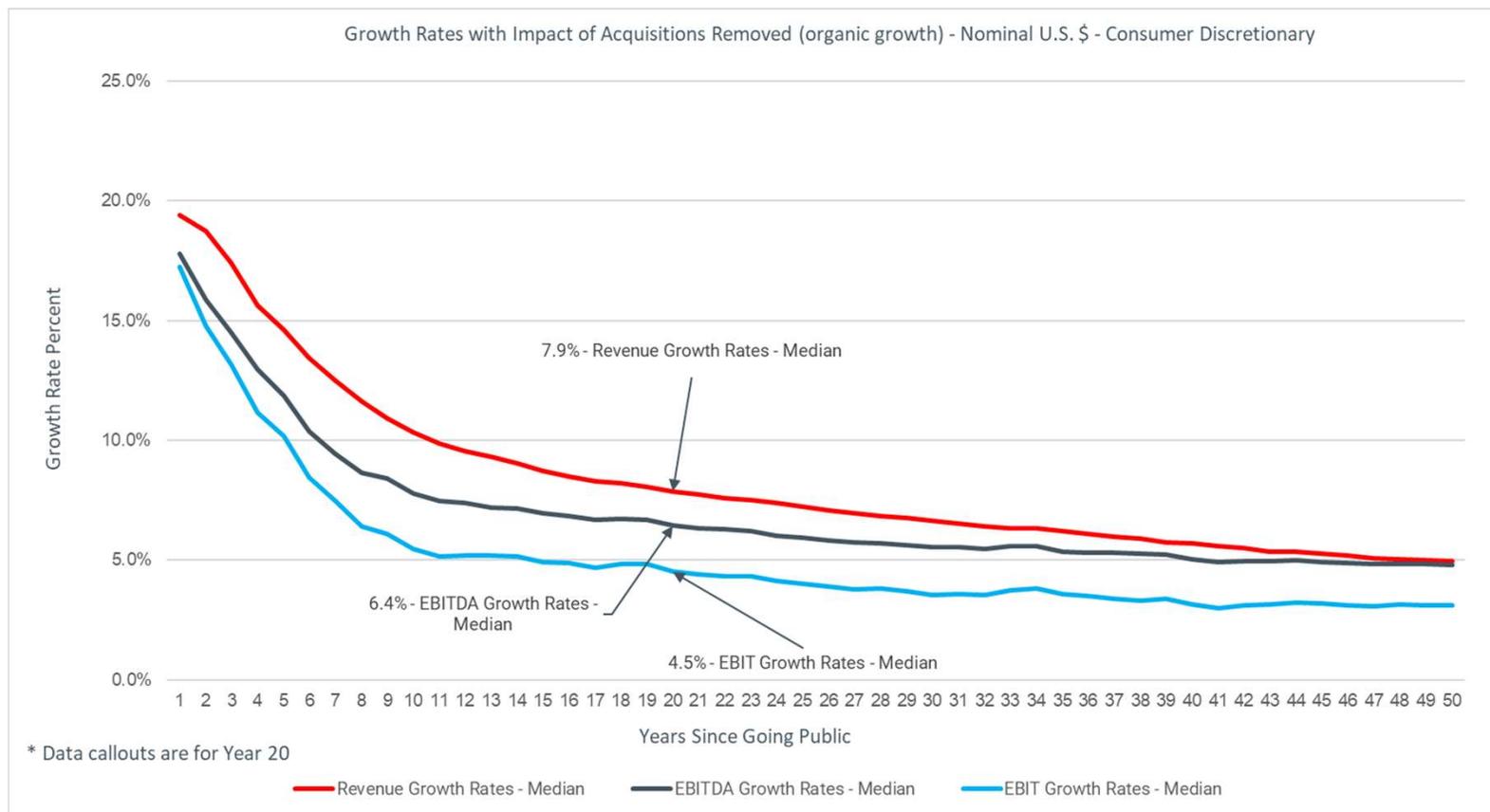
GIC 20 Industrials- Nominal



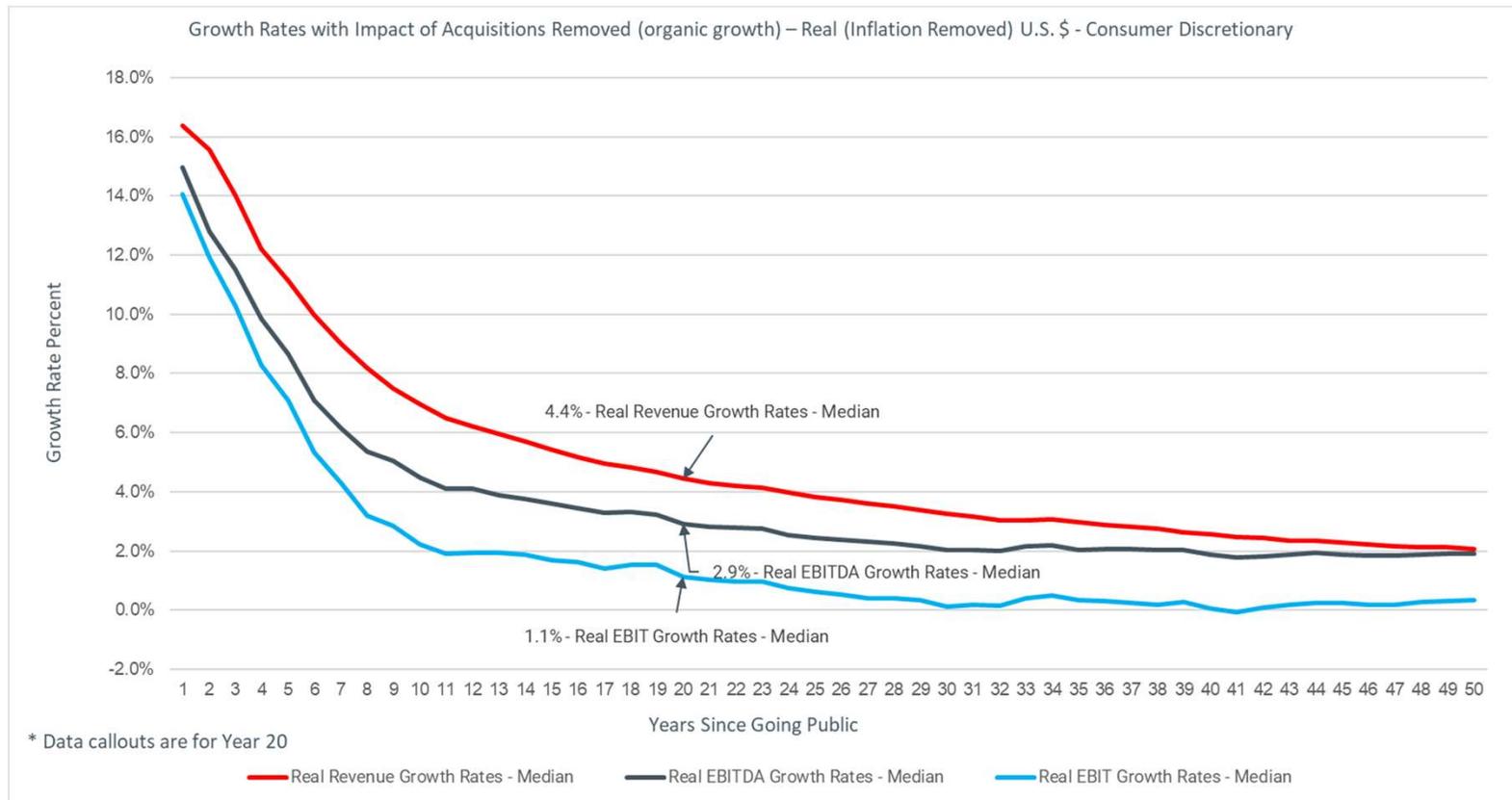
GIC 20 Industrials - Real



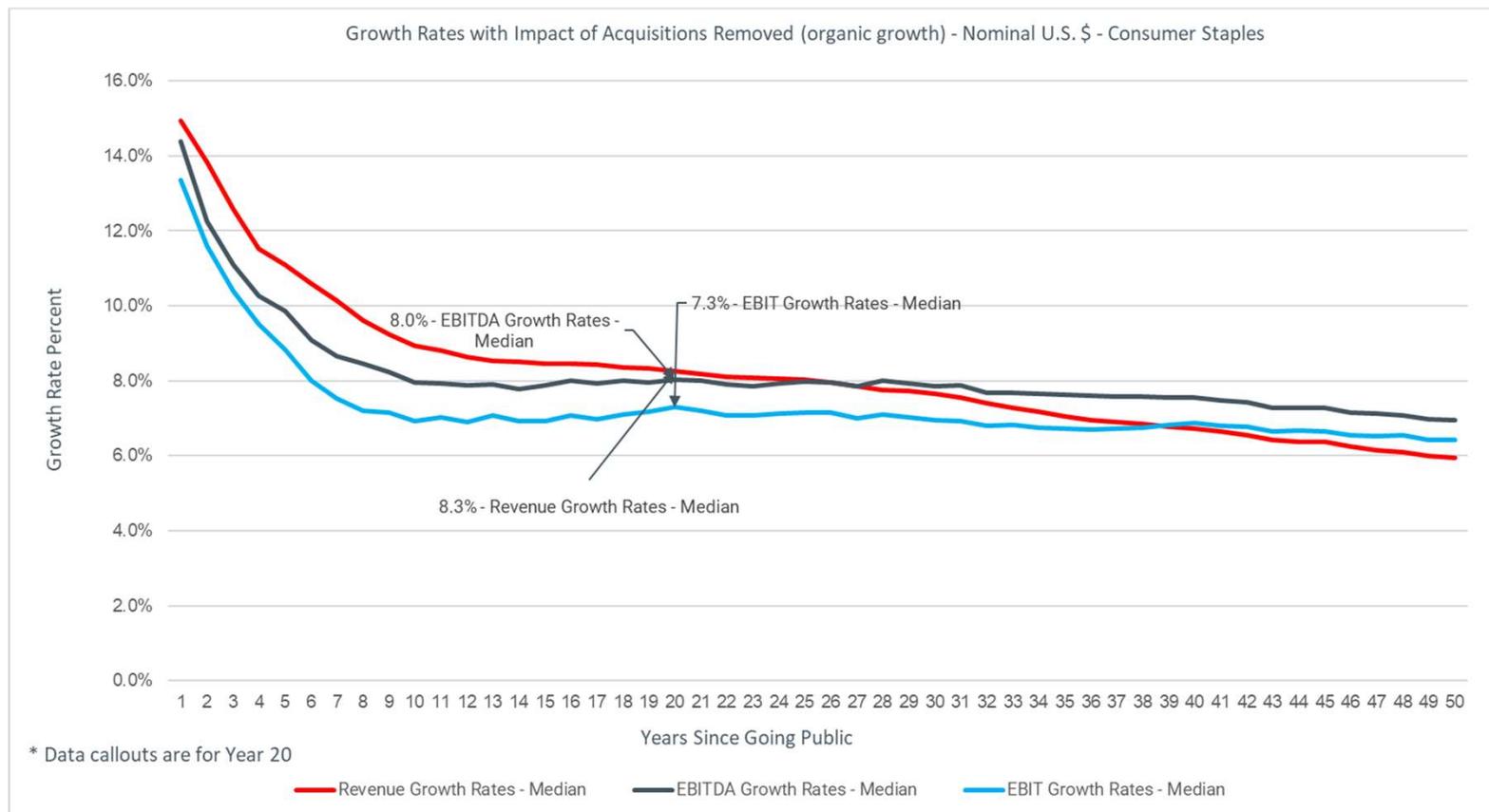
GIC 25 Consumer Discretionary - Nominal



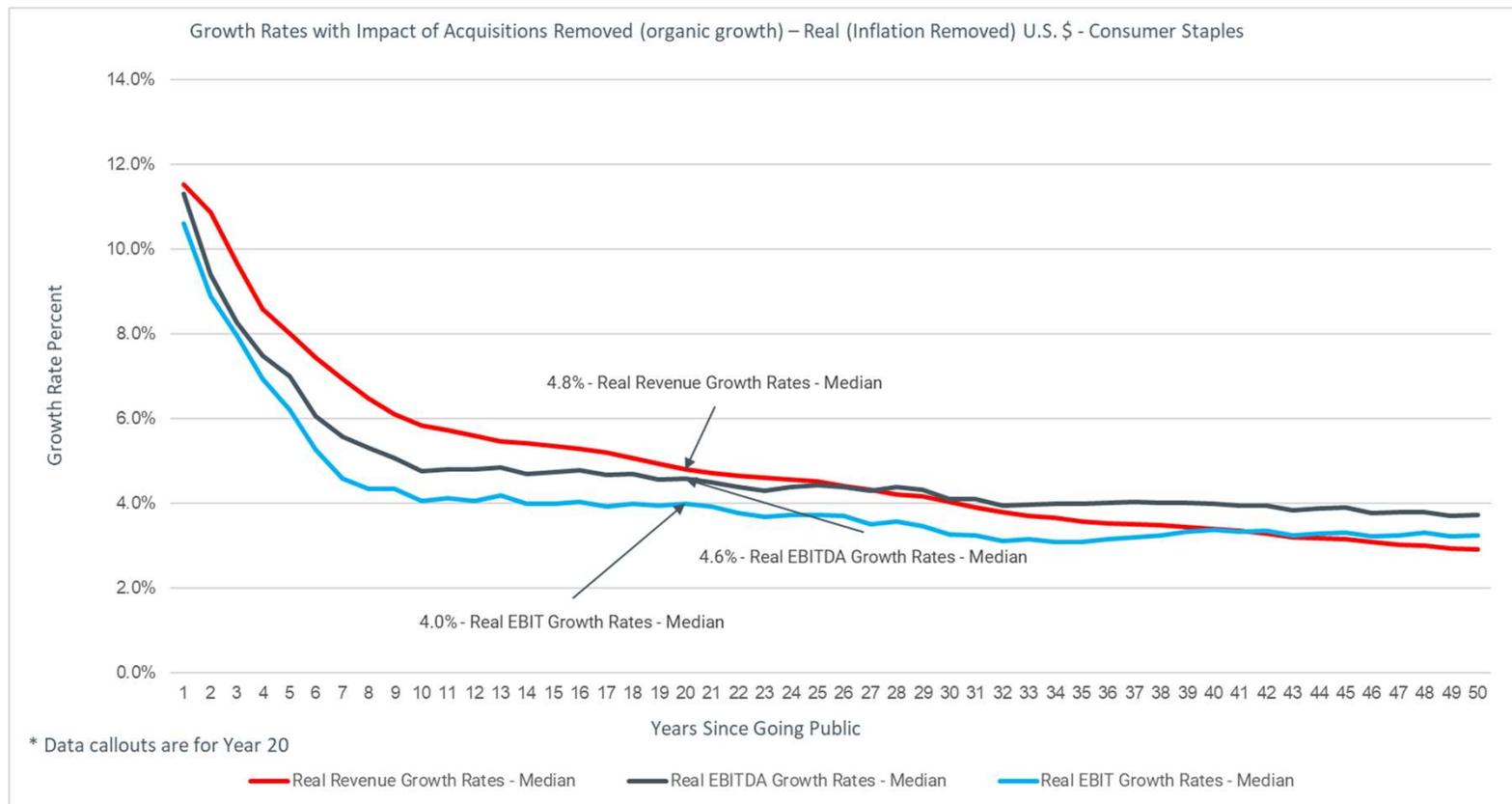
GIC 25 Consumer Discretionary- Real



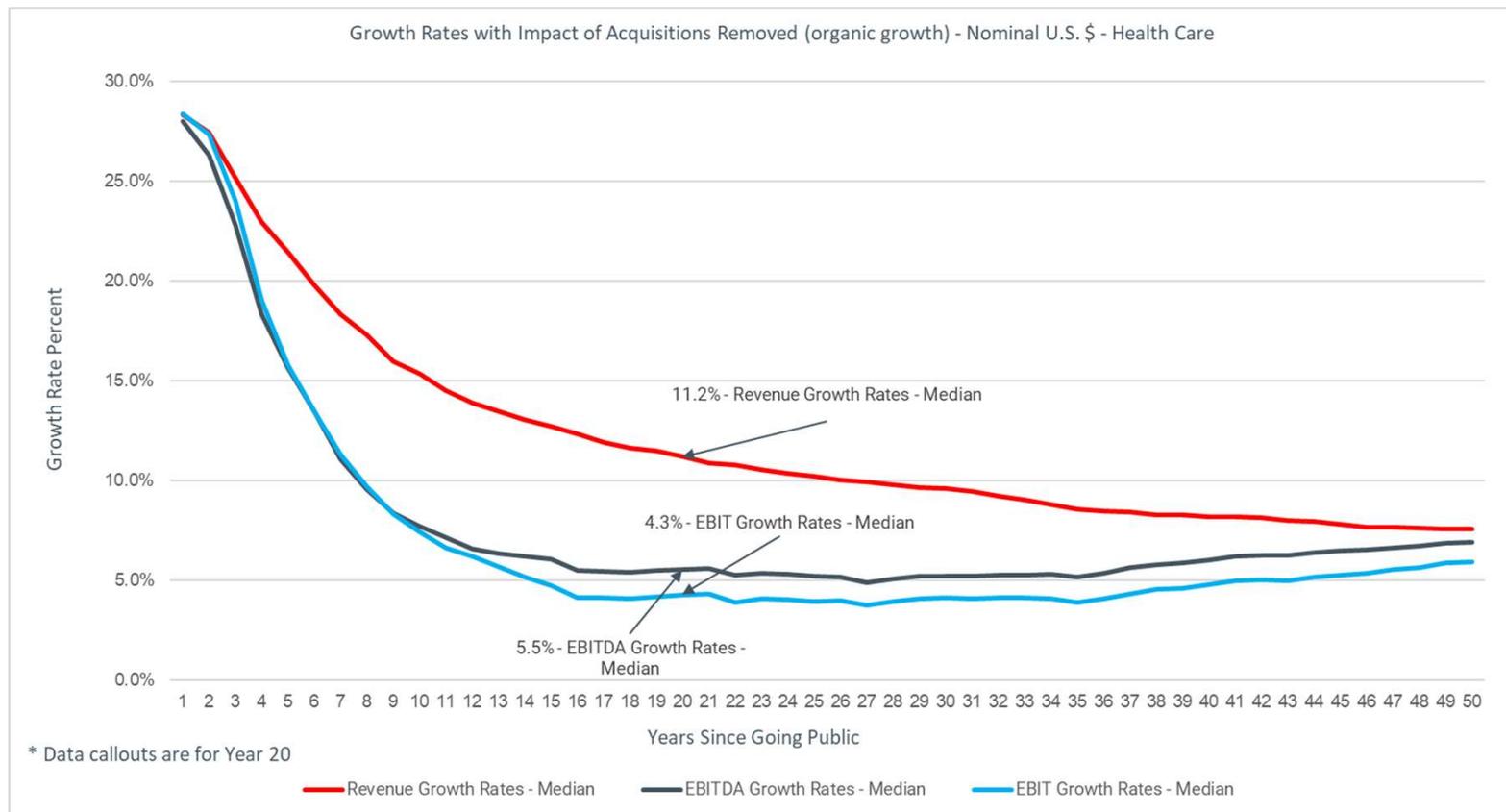
GIC 30 Consumer Staples - Nominal



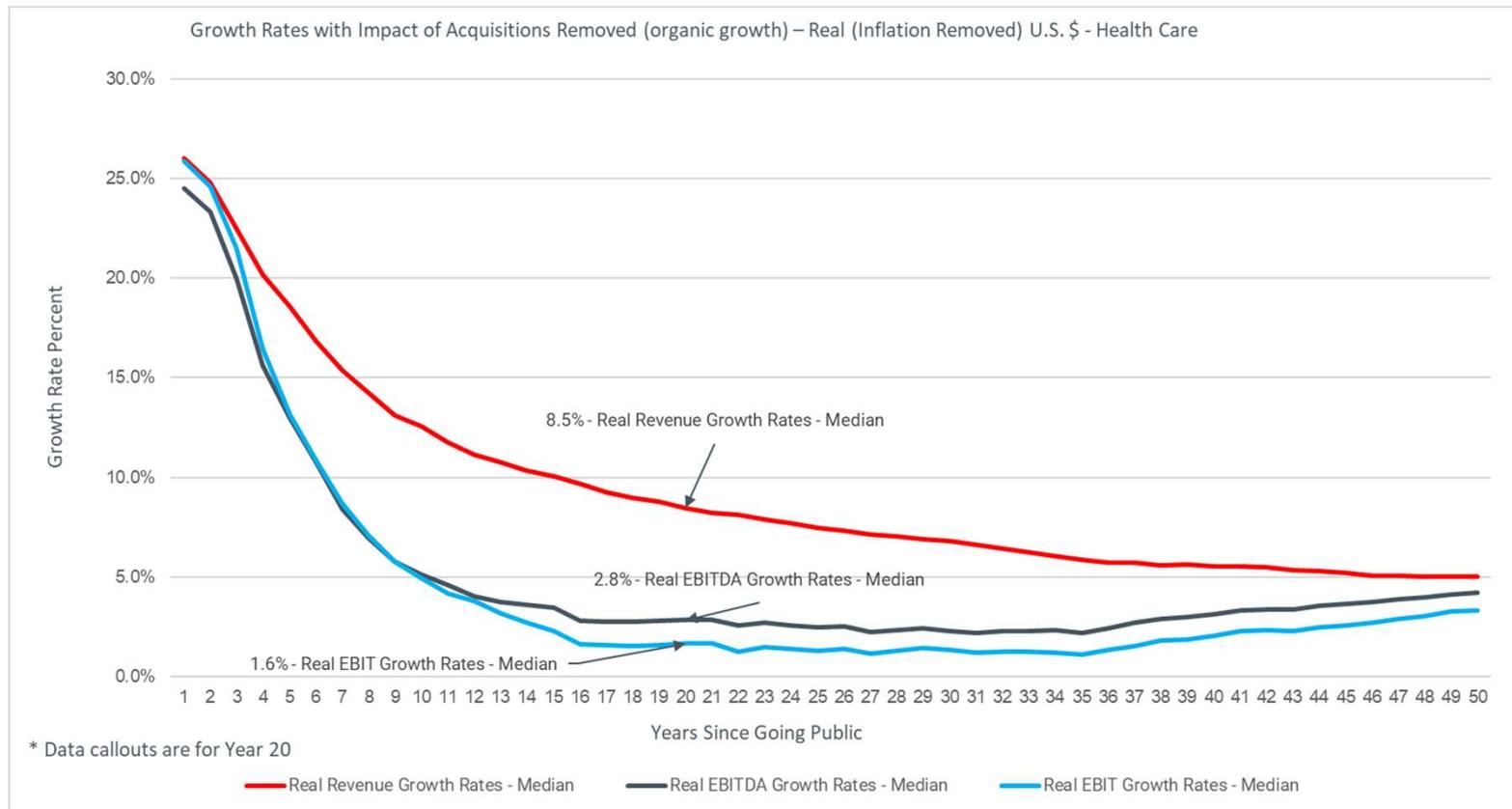
GIC 30 Consumer Staples - Real



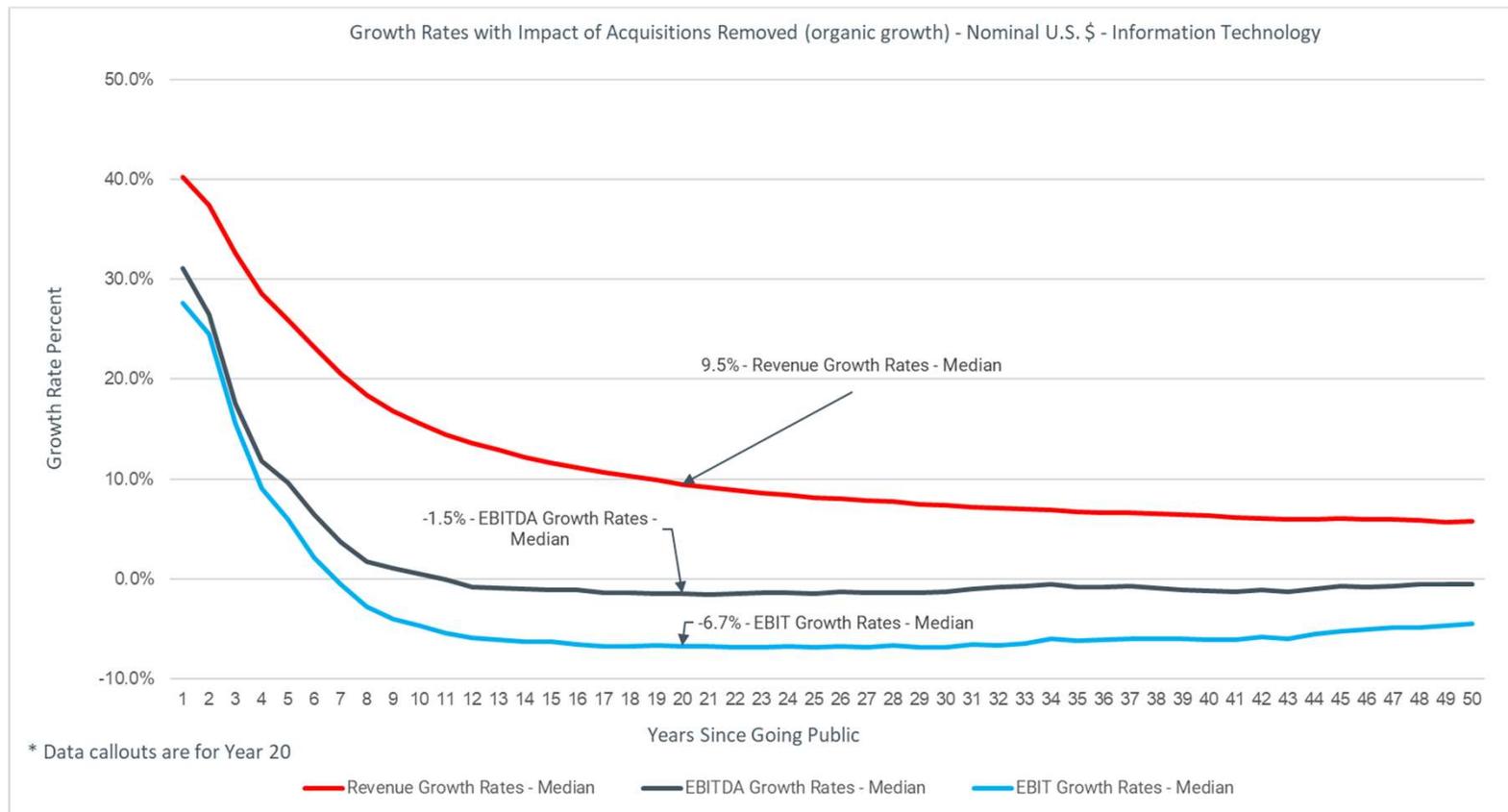
GIC 35 Health Care- Nominal



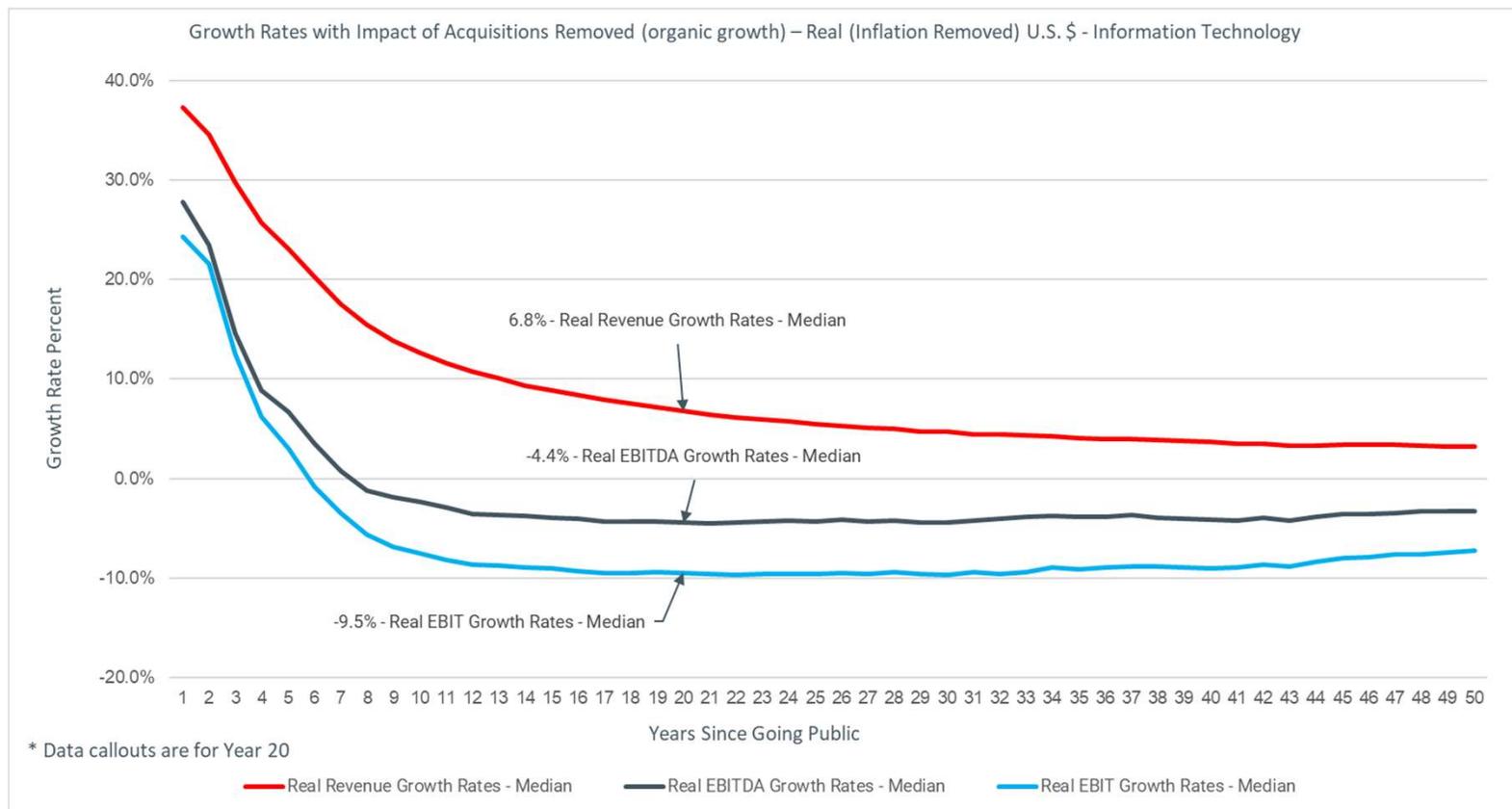
GIC 35 Health Care- Real



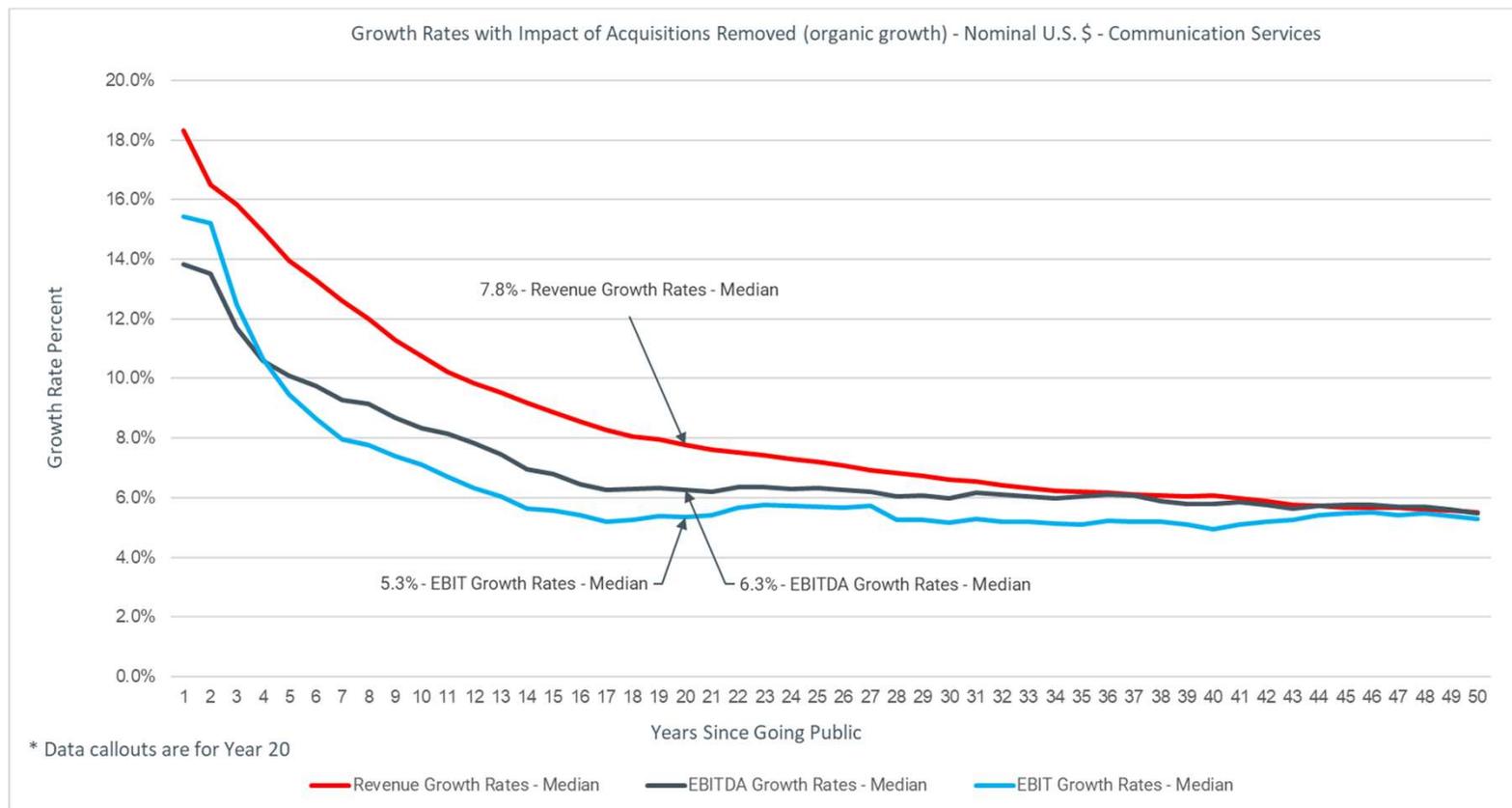
GIC 45 Information Technology- Nominal



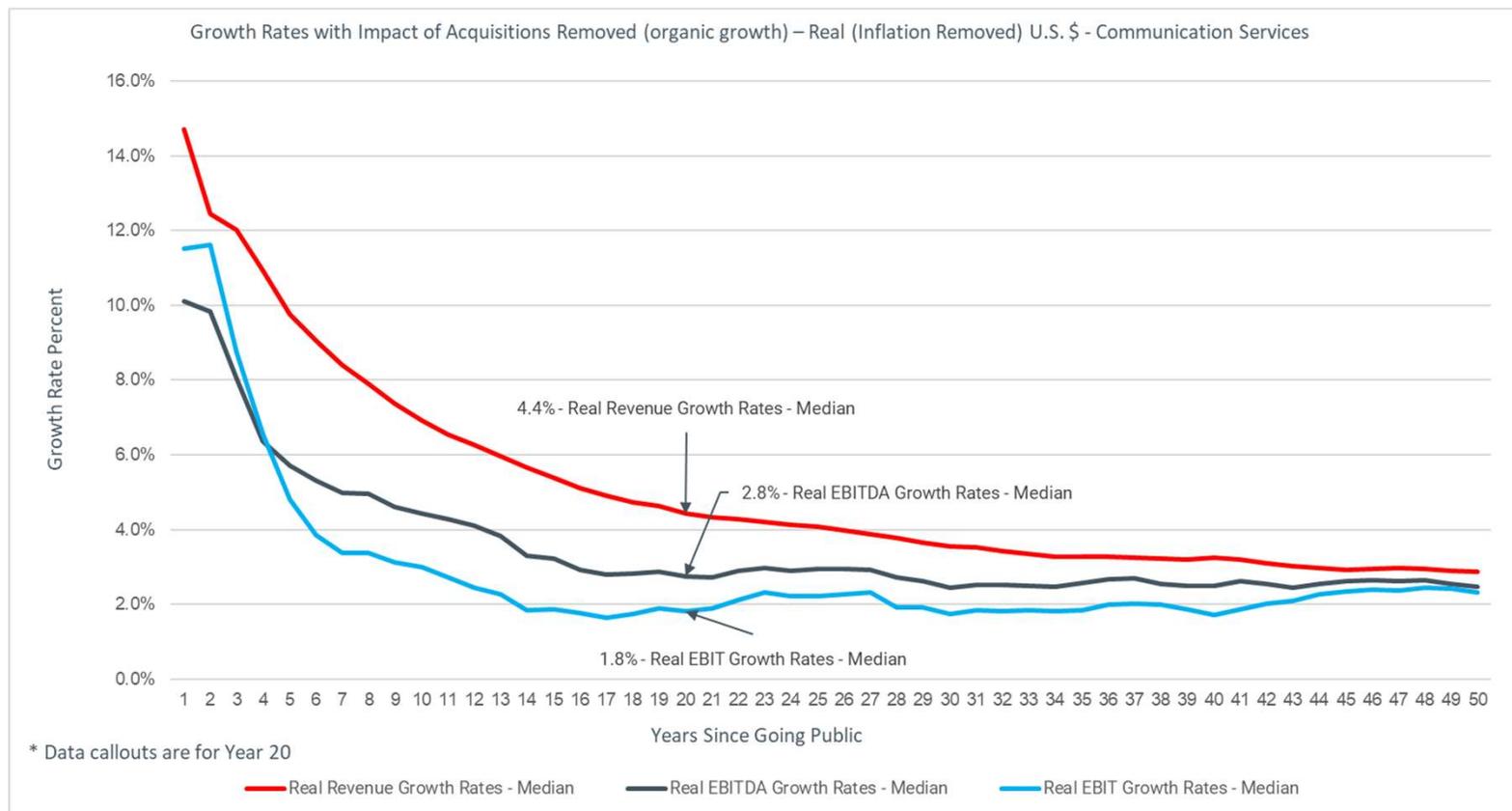
GIC 45 Information Technology- Real



GIC 50 Communication Services- Nominal



GIC 50 Communication Services- Real



Does One Growth Rate Fit All Industries and Time?

- Answer appears to be “NO”.
- Important to verify that the valuation metric and corresponding growth rate reflect reality.
- In the following section, we present overall industry
 - average annual growth rates, and
 - annualized long-term growth rates (calculated as the geometric average of preceding twenty annual growth rates), grouped by the Standard & Poor's (S&P) global industry classification groups.
- These results differ from prior results which were organic growth rates. These results include existing and new companies coming into the industry over time/

Nominal Growth Rates 1975-2019 Revenue Growth-- 1 year

Nominal Growth rates 1975-2019 Revenue Growth --1 year						
GIC Sectors	Industry	Mean	Std Dev	Minimum	Maximum	Median
10	Energy	5.53%	15.75%	-29.41%	45.76%	5.70%
15	Materials	3.92%	8.92%	-25.95%	18.97%	4.17%
20	Industrials	6.38%	5.63%	-9.85%	15.02%	6.45%
25	Consumer Discretionary Goods	7.41%	5.79%	-8.17%	17.28%	8.28%
30	Consumer Staple Goods	6.52%	5.17%	-3.64%	17.97%	7.17%
35	Healthcare	5.18%	7.09%	-10.74%	23.10%	5.39%
40	Financials	7.34%	11.11%	-22.82%	34.13%	5.48%
45	IT	6.57%	7.27%	-9.26%	20.27%	5.53%
50	Telecom	5.58%	5.95%	-3.30%	20.94%	4.80%
55	Utilities	6.74%	11.79%	-30.88%	52.50%	6.39%
60	Real Estate	5.00%	11.37%	-38.76%	36.07%	7.05%

Nominal Long-Term Growth Rates 20-year Revenue growth Annualized

Nominal Annualized Growth Rates 1975-2019						
GIC Sectors		Mean	Std Dev	Minimum	Maximum	Median
10	Energy	4.50%	2.36%	0.18%	7.59%	4.96%
15	Materials	3.51%	1.11%	1.63%	5.64%	3.22%
20	Industrials	6.19%	0.62%	5.09%	7.24%	6.20%
25	Consumer Discretionary Goods	7.47%	1.32%	4.95%	8.98%	7.98%
30	Consumer Staple Goods	6.18%	0.64%	5.04%	7.31%	6.24%
35	Healthcare	5.74%	2.57%	1.58%	8.42%	6.82%
40	Financials	7.23%	1.23%	5.15%	9.70%	6.97%
45	IT	6.59%	2.00%	3.05%	9.09%	7.32%
50	Telecom	4.99%	0.68%	3.46%	5.79%	5.15%
55	Utilities	6.71%	1.23%	3.36%	8.43%	6.95%
60	Real Estate	3.11%	2.23%	0.50%	6.93%	2.40%

Nominal Growth Rates 1975-2019

EBITDA Growth 1 year

Nominal EBITDA Growth 1975-2019-- 1 year						
GIC Sectors		Mean	Std Dev	Minimum	Maximum	Median
10	Energy	6.70%	22.15%	-54.09%	58.90%	4.44%
15	Materials	5.93%	18.93%	-37.74%	43.60%	4.17%
20	Industrials	7.65%	9.44%	-21.39%	22.90%	9.78%
25	Consumer Discretionary Goods	8.70%	11.44%	-19.78%	35.22%	9.69%
30	Consumer Staple Goods	7.68%	5.91%	-3.33%	20.51%	6.43%
35	Healthcare	5.05%	8.64%	-15.13%	18.07%	5.91%
40	Financials	9.11%	16.85%	-58.58%	55.34%	9.43%
45	IT	7.77%	15.50%	-44.43%	44.81%	7.91%
50	Telecom	5.07%	6.85%	-7.56%	22.64%	4.40%
55	Utilities	6.19%	5.29%	-5.84%	14.37%	6.65%
60	Real Estate	3.77%	15.15%	-23.54%	27.67%	7.18%

Nominal Long-Term Growth Rates

20-year EBITDA growth Annualized

Nominal EBITDA 20 -year Growth 1975-2019 Annualized						
GIC Sectors		Mean	Std Dev	Minimum	Maximum	Median
10	Energy	4.99%	2.67%	0.07%	8.50%	5.46%
15	Materials	4.56%	1.71%	0.20%	7.56%	4.60%
20	Industrials	7.26%	0.87%	5.87%	8.82%	7.37%
25	Consumer Discretionary Goods	8.17%	1.32%	5.71%	9.54%	8.76%
30	Consumer Staple Goods	7.43%	0.55%	6.75%	8.60%	7.18%
35	Healthcare	6.17%	2.61%	1.68%	9.12%	6.94%
40	Financials	8.64%	1.84%	5.55%	12.73%	8.28%
45	IT	6.67%	3.90%	0.55%	12.17%	7.55%
50	Telecom	4.35%	0.93%	2.55%	5.50%	4.36%
55	Utilities	5.95%	0.75%	4.55%	7.15%	5.86%
60	Real Estate	0.81%	2.00%	-3.14%	4.75%	0.73%

Nominal Annual and Long-Term Growth Rates

- The long-term annualized rates are tighter in distribution and statistically more significant.
- This pattern holds across industries as shown in the next slide.
- Measured across periods of economic expansion and contraction, recessions and recoveries, long term annualized growth rates provide better guidance for future performance as compared to past annual rates.

Comparing short term(annual) and Long term (annualized) growth rates - nominal

- For example, Annual Revenue Growth Nominal

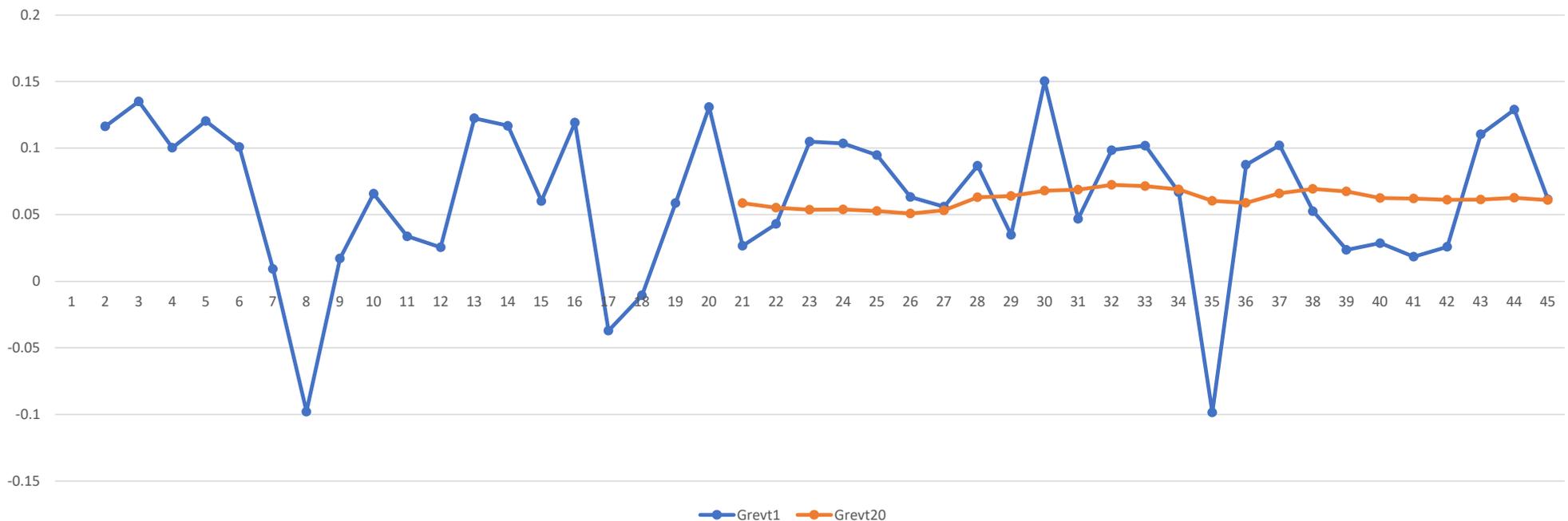
GIC Sectors	Industry	Mean	Std Dev	Minimum	Maximum	Median
20	Industrials	6.38%	5.63%	-9.85%	15.02%	6.45%
45	IT	6.57%	7.27%	-9.26%	20.27%	5.53%

- And Annualized 20 Year Revenue Growth Nominal

GIC Sectors	Industry	Mean	Std Dev	Minimum	Maximum	Median
20	Industrials	6.19%	0.62%	5.09%	7.24%	6.20%
45	IT	6.59%	2.00%	3.05%	9.09%	7.32%

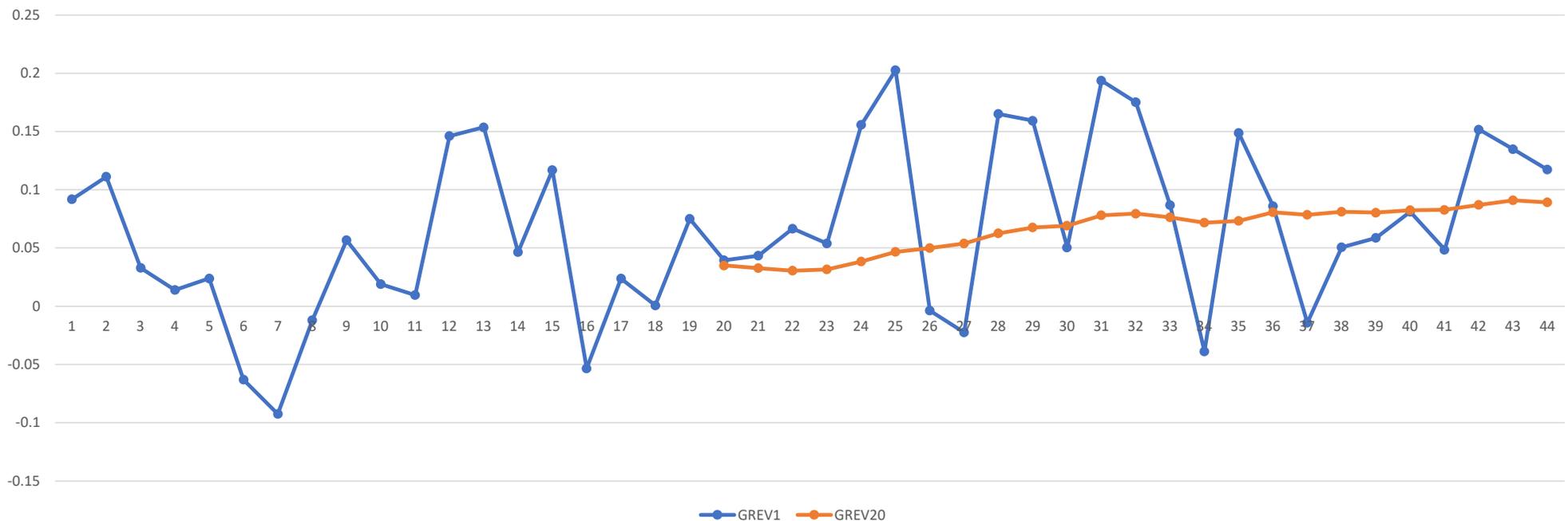
Industrials (GIC 20) Nominal Revenue Growth 1975-2019

Nominal Revenue Growth Rates Annual and annualized Long Term



IT(GIC 45) Nominal Revenue Growth 1975-2019

Nominal Revenue Growth Rates Annual and annualized Long Term



Real Growth Rates 1975-2019 Revenue Growth-- 1 year

Real Growth rates 1975-2019 Revenue Growth-- 1 year						
GIC Sectors		Mean	Std Dev	Minimum	Maximum	Median
10	Energy	2.40%	15.40%	-29.94%	42.58%	1.51%
15	Materials	0.82%	8.55%	-26.51%	15.83%	1.42%
20	Industrials	3.23%	5.63%	-15.04%	12.01%	3.36%
25	Consumer Discretionary Goods	4.27%	6.44%	-13.51%	13.28%	5.26%
30	Consumer Staple Goods	3.36%	4.92%	-6.59%	14.88%	3.77%
35	Healthcare	2.12%	7.75%	-17.22%	20.94%	3.08%
40	Financials	4.12%	10.49%	-24.30%	32.63%	3.15%
45	IT	3.47%	7.87%	-14.54%	17.64%	3.61%
50	Telecom	2.43%	5.49%	-5.04%	17.78%	0.36%
55	Utilities	3.53%	11.05%	-31.96%	49.17%	3.02%
60	Real Estate	1.89%	11.18%	-40.18%	34.56%	4.15%

Real Long-Term Growth Rates

20-year Revenue growth Annualized

Real Annualized Growth Rates 1975-2019

GIC Sectors		Mean	Std Dev	Minimum	Maximum	N	Median
10	Energy	1.88%	2.94%	-3.16%	5.55%	25	2.98%
15	Materials	0.91%	1.14%	-0.64%	3.13%	25	0.79%
20	Industrials	3.52%	1.26%	1.16%	4.84%	25	4.18%
25	Consumer Discretionary Goods	4.77%	2.04%	0.75%	6.72%	25	5.61%
30	Consumer Staple Goods	3.51%	1.25%	1.25%	4.83%	25	4.08%
35	Healthcare	3.10%	3.25%	-2.79%	6.27%	25	4.68%
40	Financials	4.53%	1.65%	1.22%	7.08%	25	4.64%
45	IT	3.92%	2.71%	-1.00%	7.03%	25	5.13%
50	Telecom	2.35%	1.30%	-0.31%	3.79%	25	3.05%
55	Utilities	4.02%	1.25%	1.38%	5.64%	25	3.84%
60	Real Estate	0.53%	2.76%	-3.59%	4.97%	25	-0.09%

Real Growth Rates 1975-2019

EBITDA Growth 1 year

Real EBITDA Growth 1975-2019-- 1 year						
GIC Sectors		Mean	Std Dev	Minimum	Maximum	Median
10	Energy	3.57%	21.79%	-54.53%	55.42%	0.99%
15	Materials	2.82%	18.57%	-41.36%	39.84%	1.81%
20	Industrials	4.49%	9.47%	-25.96%	21.48%	7.21%
25	Consumer Discretionary Goods	5.55%	11.68%	-26.43%	33.67%	6.34%
30	Consumer Staple Goods	4.49%	5.76%	-5.56%	15.95%	4.20%
35	Healthcare	2.01%	9.19%	-20.07%	15.74%	3.19%
40	Financials	5.91%	16.73%	-59.38%	53.56%	4.08%
45	IT	4.67%	15.78%	-45.62%	42.18%	5.29%
50	Telecom	1.94%	6.51%	-9.24%	18.79%	1.38%
55	Utilities	3.02%	4.84%	-8.11%	11.54%	3.27%
60	Real Estate	0.75%	14.98%	-26.94%	23.91%	5.20%

Real Long-Term Growth Rates

20-year EBITDA growth Annualized

Real EBITDA 20 -year Growth 1975-2019 Annualized						
GIC Sectors		Mean	Std Dev	Minimum	Maximum	Median
10	Energy	2.36%	3.18%	-3.27%	6.22%	3.01%
15	Materials	1.93%	1.70%	-1.66%	5.01%	1.93%
20	Industrials	4.57%	1.49%	1.86%	6.24%	5.01%
25	Consumer Discretionary Goods	5.46%	1.97%	1.34%	7.41%	6.54%
30	Consumer Staple Goods	4.72%	0.99%	2.75%	6.07%	5.11%
35	Healthcare	3.51%	3.24%	-2.12%	6.94%	4.76%
40	Financials	5.91%	2.12%	2.22%	10.04%	5.59%
45	IT	4.01%	4.51%	-2.97%	10.05%	5.08%
50	Telecom	1.73%	1.50%	-1.19%	3.48%	2.32%
55	Utilities	3.28%	0.51%	2.48%	4.44%	3.25%
60	Real Estate	-1.72%	2.34%	-5.23%	2.75%	-1.76%

Real Annual and Long-Term Growth Rates

- The relationship between short term and long-term annualized rates holds even after removing the inflation impact.
- Long term annualized growth rates are tighter in distribution and statistically more significant.
- Measured across periods of economic expansion and contraction, recessions and recoveries, long term annualized growth rates provide better guidance for future performance as compared to past annual rates.

Comparing short term(annual) and Long-term (annualized) growth rates

- For example, Annual (1-year)Revenue Growth Real

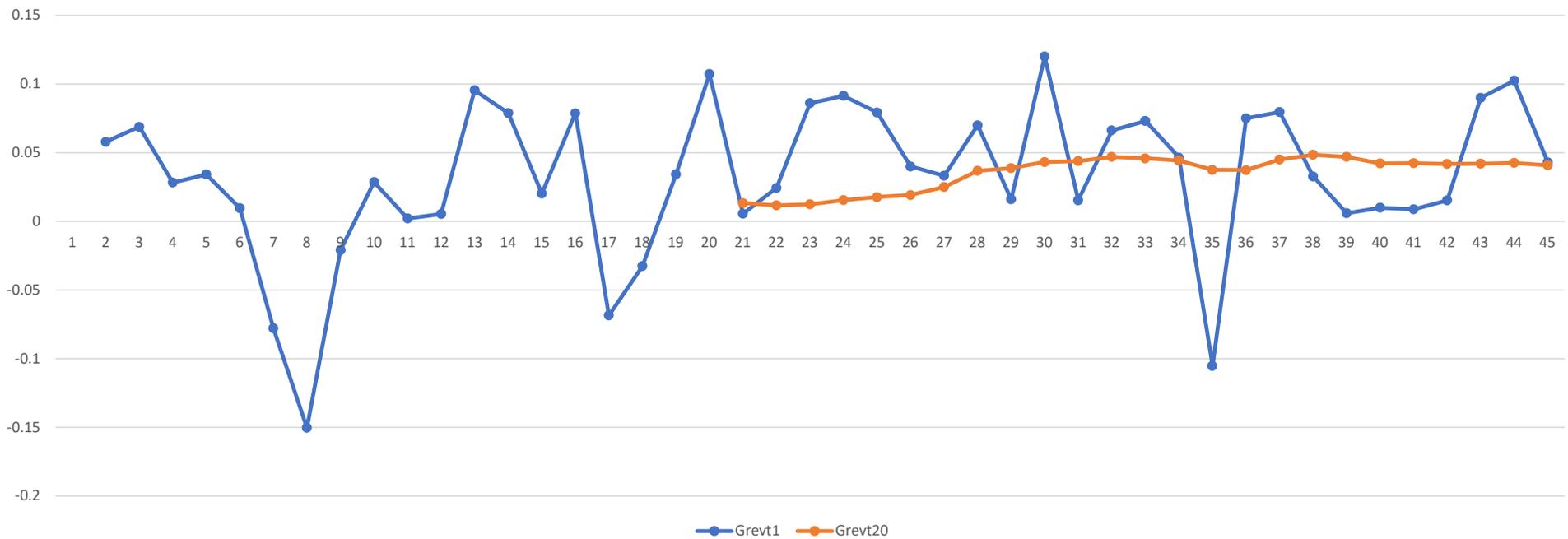
GIC Sectors	Industry	Mean	Std Dev	Minimum	Maximum	Median
20	Industrials	3.23%	5.63%	-15.04%	12.01%	3.36%
45	IT	3.47%	7.87%	-14.54%	17.64%	3.61%

- Vs. Annualized 20 Year Revenue Growth Real

GIC Sectors	Industry	Mean	Std Dev	Minimum	Maximum	Median
20	Industrials	3.52%	1.26%	1.16%	4.84%	4.18%
45	IT	3.92%	2.71%	-1.00%	7.03%	5.13%

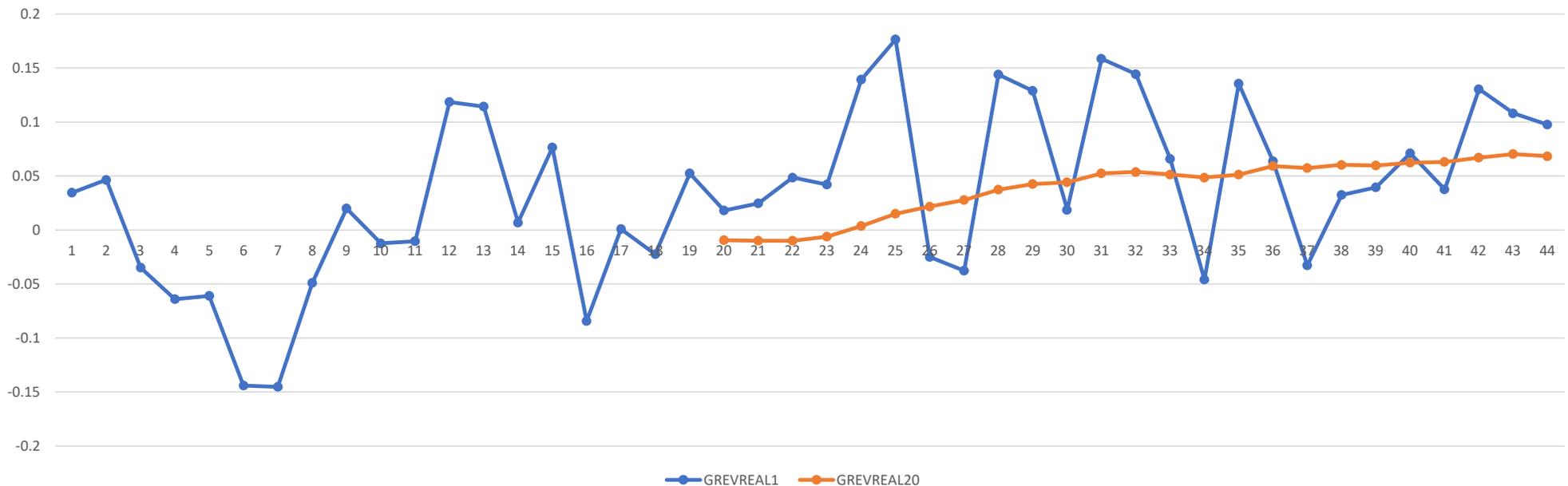
Industrials (GIC 20) Real Revenue Growth 1975-2019

Real Revenue Growth Rates Annual and annualized Long Term



IT(GIC 45) Real Revenue Growth 1975-2019

Real Revenue Growth Rates Annual and annualized Long Term



Examining Economic Recessions and Period to Recovery during 1975-2019

Recessions:

- Q2 1974-Q1 1975
- Q1 1980- Q3 1980
- Q3 1981 – Q1 1982
- Q4 1990 – Q1 1991
- Q3 2008 - Q2 2009
- Q1 2020 -

Recovery From Recession

- Decline and Recovery are uneven
- Different sectors show differences in severity and recovery time
- Recovery consists of reclaiming lost growth measured as restoration of the long-term growth rate
- Data on next two powerpoints examine impact on long-term growth from the 2008-2009 recession
- We compare
 - the long-term annualized growth rate starting with the year before recession onset
 - with subsequent years and the year when the long-term growth rate meets or first exceeds the pre-recession rate (identified as the recovery year).

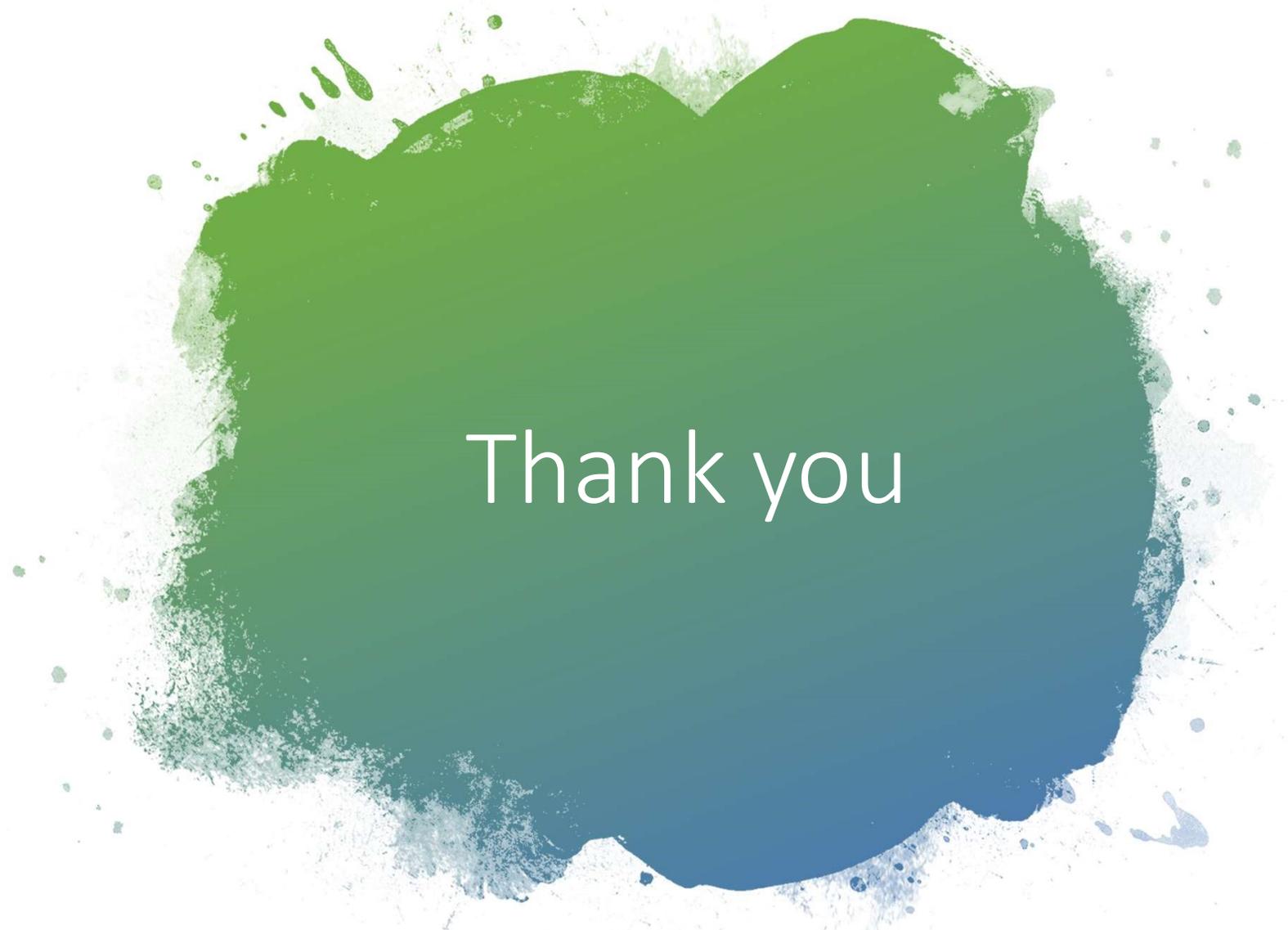
Recovery from Severe Recession in Real Growth Terms

		Annualized Real Revenue growth Rate for 20-year period Ending in			
GSECTOR	Sector	2008	Recovery Year	Growth Rate	2019
10	Energy	5.10%	2013	5.15%	5.30%
15	Materials	2.55%	No Recovery		0.59%
20	Industrials	4.43%	2011	4.49%	4.07%
25	Consumer Discretionary Goods	5.30%	2011	5.52%	6.40%
30	Consumer Staple Goods	4.83%	No Recovery		4.50%
35	Healthcare	5.41%	No decline		5.49%
40	Financials	5.41%	No decline		3.94%
45	IT	5.13%	2011	5.92%	6.83%
50	Telecom	3.21%	No Decline		3.49%
55	Utilities	5.59%	2011	5.64%	1.38%
60	Real Estate	-0.09%	2012	0.59%	4.61%

Recovery from Severe Recession Nominal Growth Terms

Annualized Nominal Revenue Growth Rate for 20-year period Ending in

GSECTOR	Sector	2008	Recovery Year	Growth Rate	2019
10	Energy	7.59%	2018	7.58%	7.35%
15	Materials	4.98%	No recovery		2.55%
20	Industrials	6.90%	2012	6.93%	6.10%
25	Consumer Discretionary Goods	7.79%	2012	7.98%	8.47%
30	Consumer Staple Goods	7.31%	No recovery		6.53%
35	Healthcare	7.90%	2015	7.93%	7.55%
40	Financials	7.91%	No Decline		5.96%
45	IT	7.62%	2011	8.06%	8.91%
50	Telecom	5.66%	No Decline		5.50%
55	Utilities	8.09%	No recovery		3.36%
60	Real Estate	2.28%	2012	2.60%	6.65%



Thank you