Out[229]: Click here to toggle on/off the raw code.

Out[2]:

	PERMNO	date	SHRCD	SICCD	TICKER	COMNAM	PERMCO	CUSIP	BIDLO	ASKHI	PRC	VOL	RET	
0	10001	1996-01-31	11	4920	EWST	ENERGY WEST INC	7953	36720410	8.75000	9.50000	-9.12500	168.0	-0.026667	8.75
1	10001	1996-02-29	11	4920	EWST	ENERGY WEST INC	7953	36720410	8.75000	9.50000	9.25000	524.0	0.013699	9.25
2	10001	1996-03-29	11	4920	EWST	ENERGY WEST INC	7953	36720410	9.25000	9.75000	9.48438	283.0	0.036149	9.00
3	10001	1996-04-30	11	4920	EWST	ENERGY WEST INC	7953	36720410	8.62500	9.37500	-8.81250	327.0	-0.070840	8.62
4	10001	1996-05-31	11	4920	EWST	ENERGY WEST INC	7953	36720410	8.62500	9.00000	8.62500	103.0	-0.021277	8.62
5	10001	1996-06-28	11	4920	EWST	ENERGY WEST INC	7953	36720410	8.00000	9.00000	8.00000	338.0	-0.060290	8.00
6	10001	1996-07-31	11	4920	EWST	ENERGY WEST INC	7953	36720410	8.00000	8.37500	-8.18750	207.0	0.023438	8.00
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1636556	93436	2023-06-30	11	9999	TSLA	TESLA INC	53453	88160R10	207.52000	274.45001	261.76999	34409322.0	0.283627	261.67
1636557	93436	2023-07-31	11	9999	TSLA	TESLA INC	53453	88160R10	255.71001	293.34000	267.42999	23934292.0	0.021622	267.48
1636558	93436	2023-08-31	11	9999	TSLA	TESLA INC	53453	88160R10	215.49001	261.07001	258.07999	25029170.0	-0.034962	258.07
1636559	93436	2023-09-29	11	9999	TSLA	TESLA INC	53453	88160R10	240.50000	276.04001	250.22000	24395440.0	-0.030456	250.23
1636560	93436	2023-10-31	11	9999	TSLA	TESLA INC	53453	88160R10	197.36000	263.62000	200.84000	25905681.0	-0.197346	200.77
1636561	93436	2023-11-30	11	9999	TSLA	TESLA INC	53453	88160R10	205.66000	246.72000	240.08000	26395792.0	0.195379	239.95
1636562	93436	2023-12-29	11	9999	TSLA	TESLA INC	53453	88160R10	235.58000	261.44000	248.48000	22852106.0	0.034988	248.48

1636563 rows × 18 columns

```
/Users/namankedia/anaconda3/envs/tensorflow/lib/python3.7/site-packages/ipykernel_launcher.py:3: SettingWith
CopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html#indexing-vie
w-versus-copy (http://pandas.pydata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
  This is separate from the ipykernel package so we can avoid doing imports until


/Users/namankedia/anaconda3/envs/tensorflow/lib/python3.7/site-packages/ipykernel_launcher.py:1: SettingWith
CopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html#indexing-vie
w-versus-copy (http://pandas.pydata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
  """Entry point for launching an IPython kernel.
/Users/namankedia/anaconda3/envs/tensorflow/lib/python3.7/site-packages/ipykernel_launcher.py:2: SettingWith
CopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html#indexing-vie
w-versus-copy (http://pandas.pydata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
```

```
/Users/namankedia/anaconda3/envs/tensorflow/lib/python3.7/site-packages/numpy/core/fromnumeric.py:2389: Futu
reWarning: Method .ptp is deprecated and will be removed in a future version. Use numpy.ptp instead.
  return ptp(axis=axis, out=out, **kwargs)
```

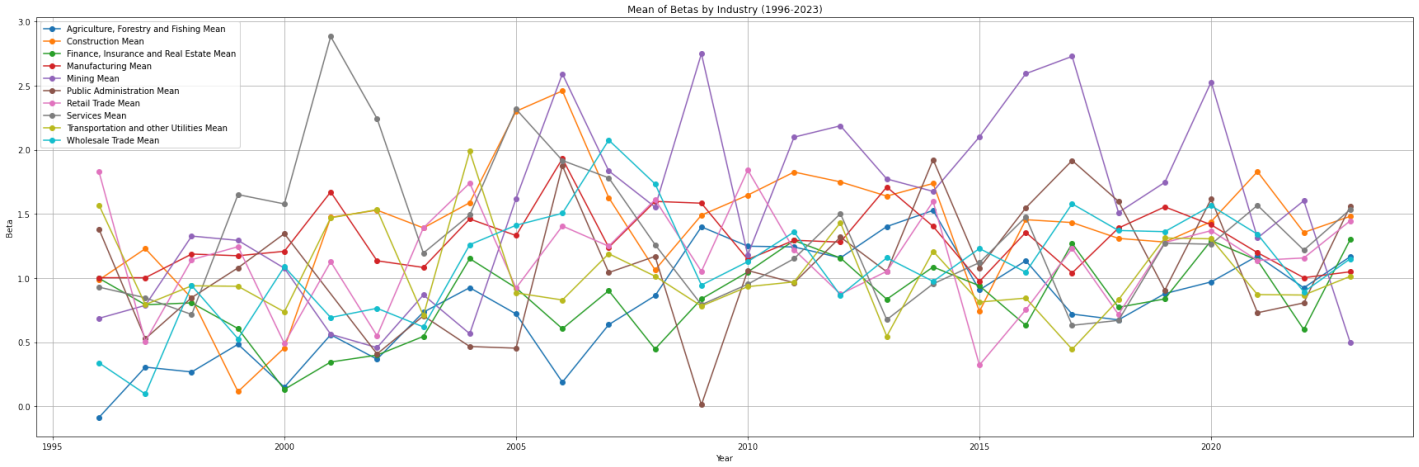
Descriptive Stats Industry Wise

Industry	N	mean	std_dev	min	max	1%	5%	25%	50%	75%	95%	99%	skewness
Agriculture, Forestry and Fishing	695.0	0.802413	1.093988	-6.340539	4.853420	-2.011606	-0.659551	0.318181	0.775567	1.264994	2.676616	3.857353	-0.781928
Construction	785.0	1.412095	1.060189	-6.298582	6.348079	-1.530381	-0.000469	0.880853	1.363898	1.878036	3.232404	4.361862	-0.153295
Finance, Insurance and Real Estate	838.0	0.832577	0.896110	-2.155330	8.033170	-0.849052	-0.328523	0.234262	0.763670	1.254237	2.227388	3.512253	1.650066
Manufacturing	893.0	1.299777	1.163942	-7.945742	8.518016	-0.970511	-0.133570	0.665311	1.190094	1.756273	3.130765	5.691050	0.956319
Mining	766.0	1.561231	1.964255	-11.293700	26.881343	-1.546954	-0.293285	0.666978	1.340221	2.143644	3.926675	8.140320	4.811489
Public Administration	463.0	1.218934	1.315289	-1.972339	7.905778	-1.814591	-0.970550	0.459302	1.207895	1.893913	3.550926	4.912395	0.515997
Retail Trade	797.0	1.151797	1.175780	-7.126285	8.871042	-1.319418	-0.247346	0.518202	1.024757	1.591343	3.054757	5.064336	0.573120
Services	783.0	1.334899	1.368723	-6.029365	6.439849	-2.866116	-0.388840	0.649641	1.197195	1.965237	3.525395	5.064857	-0.311076
Transportation and other Utilities	797.0	1.026799	1.209378	-7.285664	8.672091	-1.042687	-0.273803	0.354405	0.851133	1.424599	3.031627	5.382219	1.531028
Wholesale Trade	765.0	1.105719	1.037656	-4.686725	6.181971	-1.822781	-0.436467	0.557813	1.065569	1.598635	2.818895	3.965559	0.152452

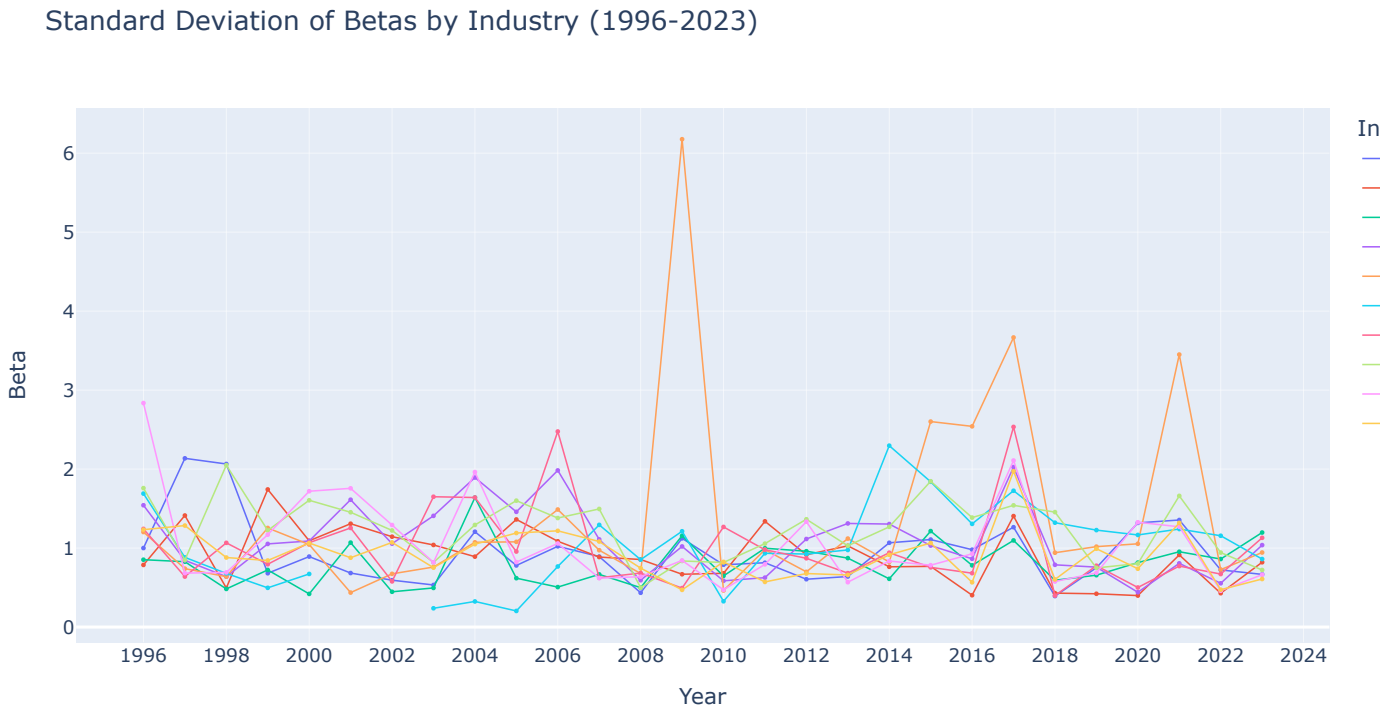
Descriptive Stats Industry-Year Wise

2000	28.0	0.131355	0.419961	-0.724991	0.828741	-0.718056	-0.615190	-0.171583	0.225300	0.446114	0.712745	0.806058	-0
2001	31.0	0.345044	1.068931	-0.537340	5.686436	-0.493993	-0.366409	-0.117914	0.037366	0.572557	0.896402	4.296455	4
2002	38.0	0.398823	0.446636	-0.433474	1.948128	-0.318481	-0.057420	0.139015	0.288029	0.605078	1.237357	1.836801	
2003	28.0	0.544766	0.495282	-0.283282	1.713499	-0.222560	-0.018096	0.141177	0.432907	0.812938	1.324827	1.617102	0
2004	33.0	1.151363	1.639584	-0.107917	8.033170	-0.100584	-0.080780	0.266236	0.680003	1.301482	3.999651	7.093952	3
2005	30.0	0.922872	0.618812	-0.571903	2.184834	-0.519968	-0.194853	0.704044	0.984382	1.172588	1.950778	2.181958	-0
2006	30.0	0.604681	0.506100	-0.258687	1.796031	-0.218182	-0.092491	0.196782	0.616465	0.876622	1.404866	1.685460	0
2007	33.0	0.901508	0.666839	-0.867822	2.012172	-0.801809	-0.266851	0.644845	0.909200	1.212656	1.885214	1.971545	-0
2008	30.0	0.446834	0.498974	-0.345576	1.383551	-0.321601	-0.244791	0.039982	0.411294	0.847929	1.250275	1.346077	0
2009	32.0	0.836838	1.155527	-0.326504	5.618421	-0.290013	-0.153379	0.162214	0.713387	1.019992	2.656341	4.706823	3
2010	30.0	1.046992	0.647526	0.072939	2.401435	0.079717	0.141770	0.537197	1.030480	1.259327	2.290564	2.386156	0
2011	29.0	1.293164	0.998082	-0.435834	3.765529	-0.424086	-0.197463	0.836954	1.206576	1.564407	3.509653	3.703590	0

Mean Betas Graph across industries



Std Deviation of Betas Across industries



Key observations and trends::

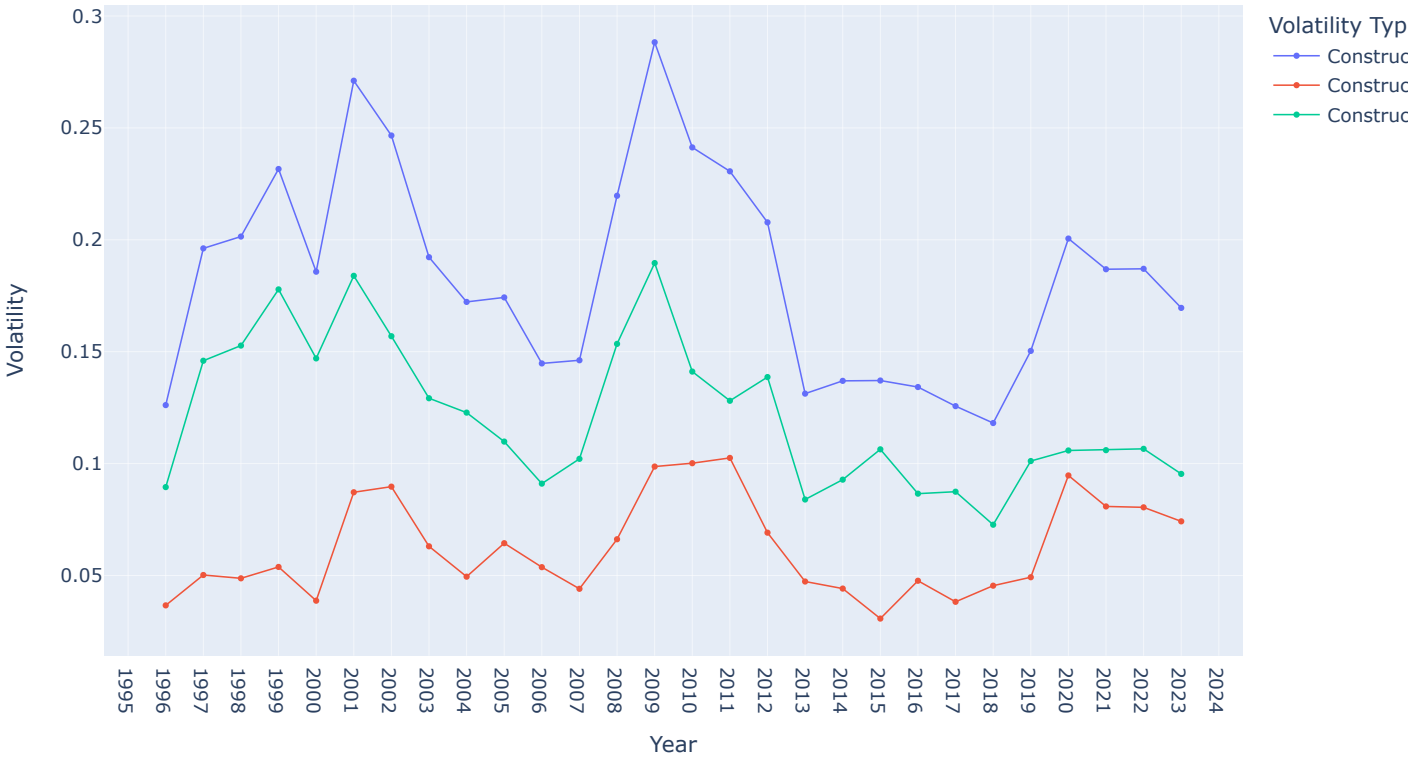
- **Volatility: Most industries show significant volatility in their beta values over time, with frequent ups and downs rather than steady trends**
- **Range: Beta values generally range between 0.5 and 2.5 for most industries across the period, especially after 2004**
- **Significant drop in Beta seen in Finance and Banking industry in 2008 likely owing to the financial crisis.**
- **High Beta is observed in Construction and Mining sectors. THis likely means that these industries tend to perform better than the market overall as they are a more stable business.**
- **Mining shows huge spike in 2008 and 2020 both in Beta and Volatility of Beta. This means irregular impact in the markets for the mining industry during the financial crisis and COVID.**
- **In the most recent years during 2017 and 2021, there's increased volatility across many sectors, possibly reflecting the economic uncertainties related to the COVID-19 pandemic. Reason for 2017 is still inconclusive.**

. . .

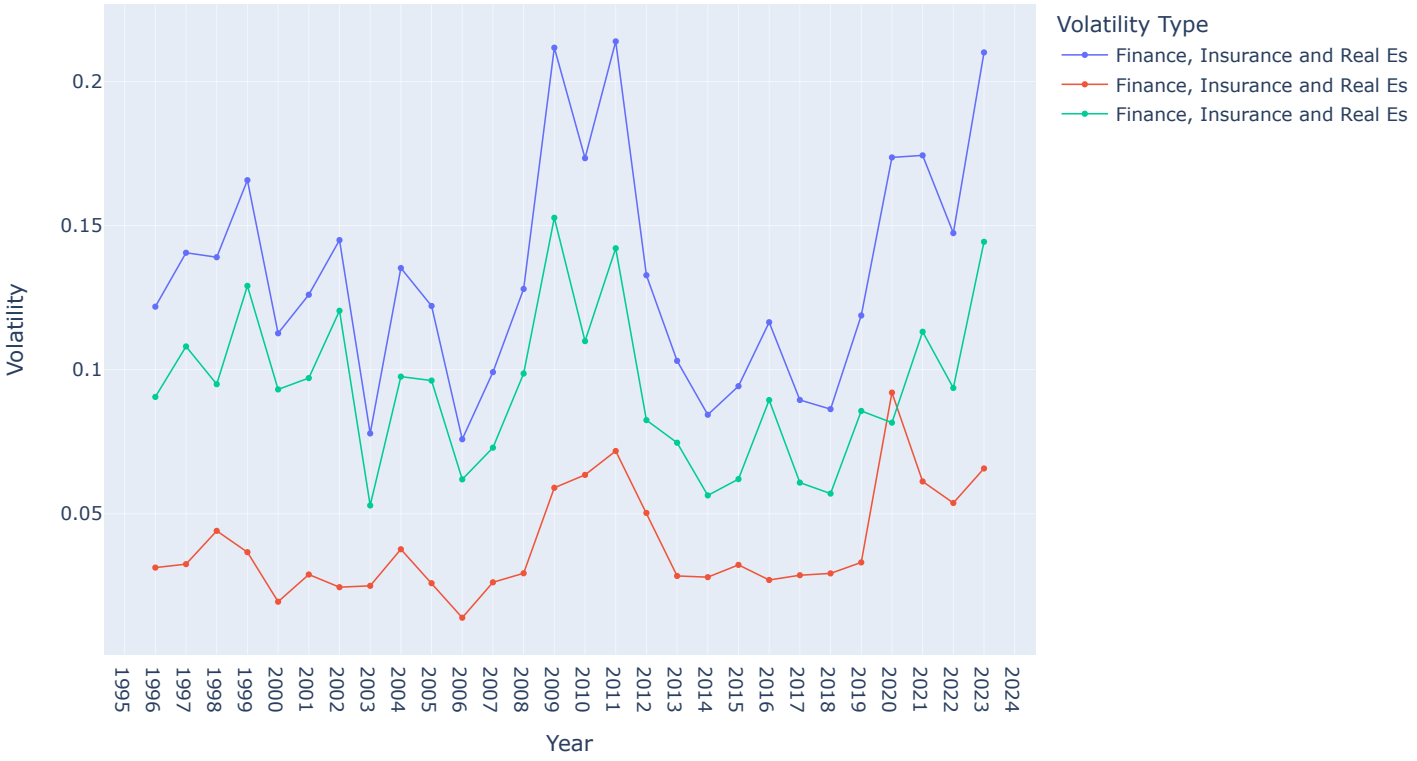
Volatility Plots Industry wise Graph for TVOL,IVOL,SVOL

Volatility Metrics for Agriculture, Forestry and Fishing (1996-2023)

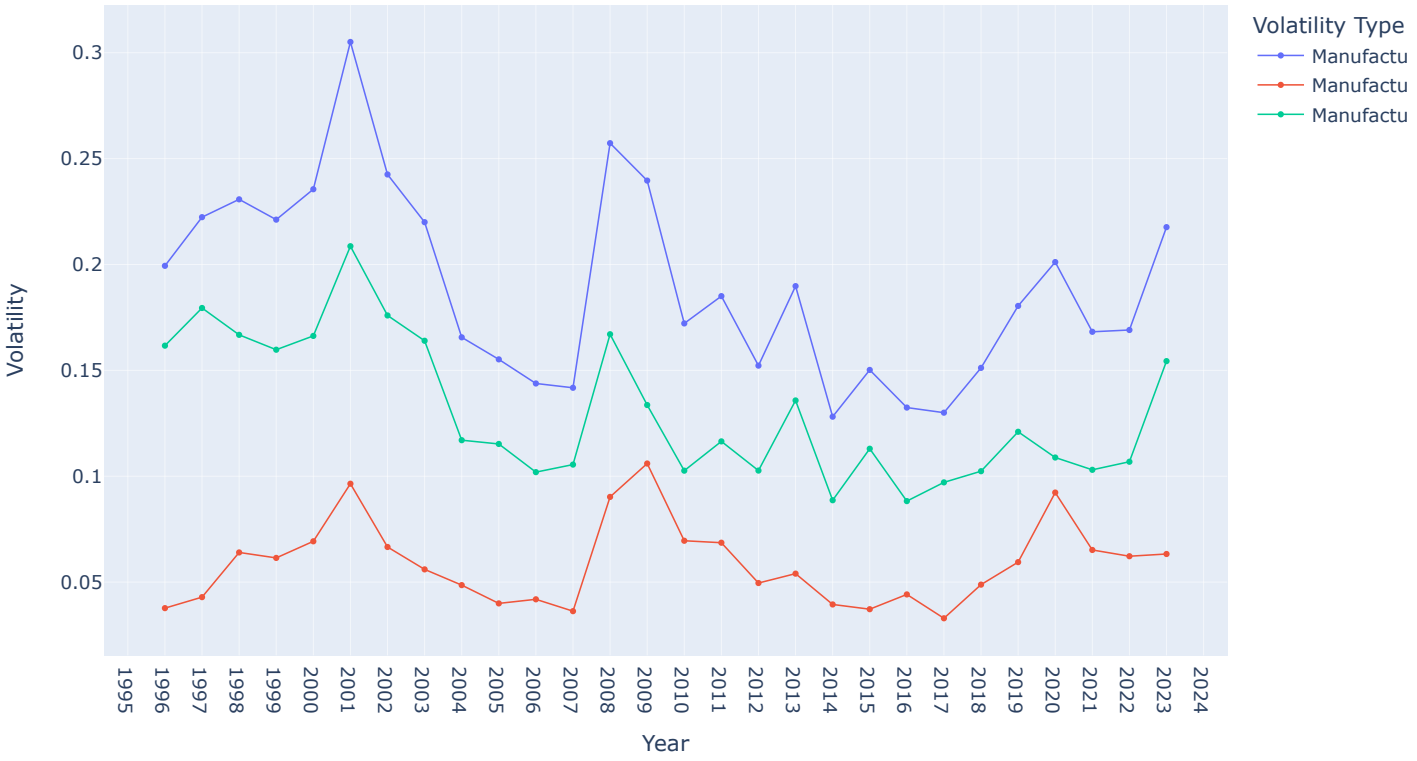
Volatility Metrics for Construction (1996-2023)



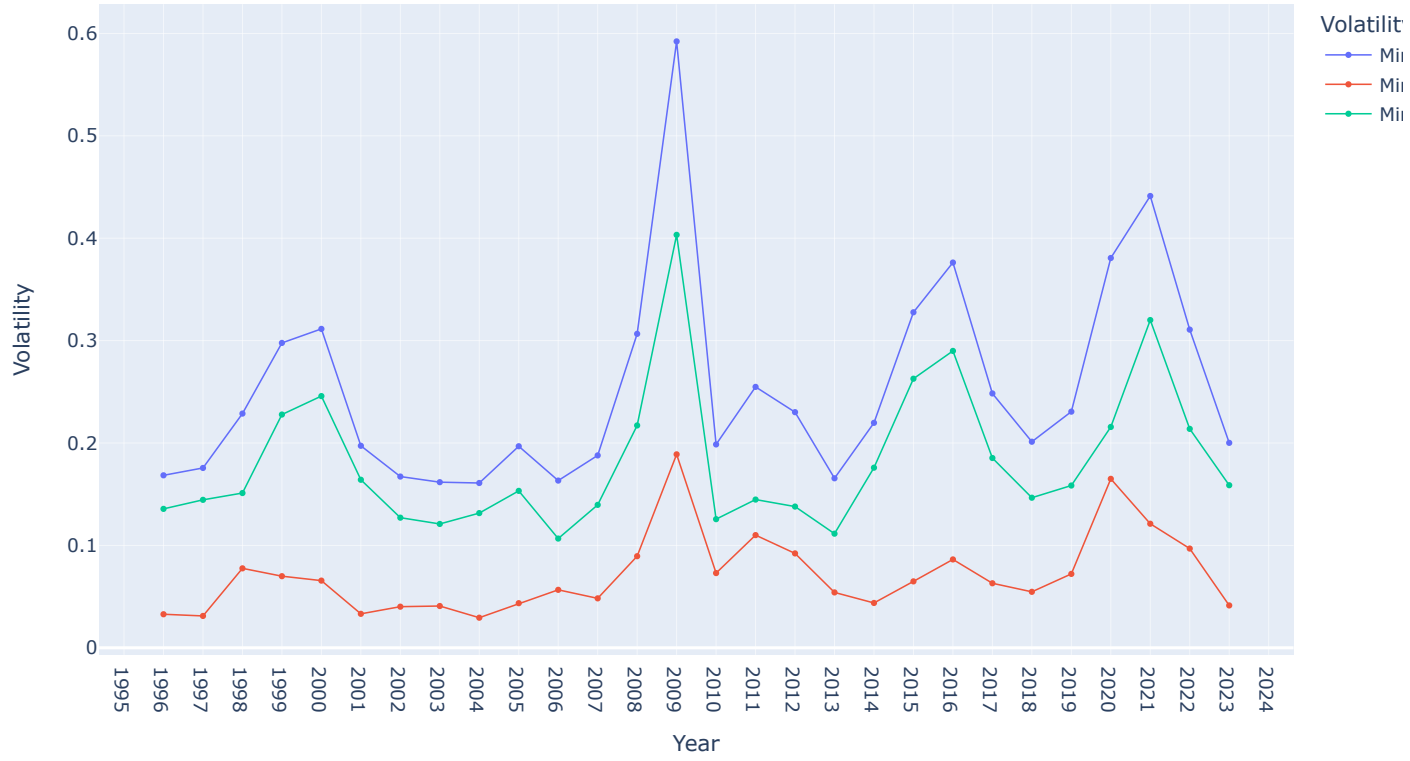
Volatility Metrics for Finance, Insurance and Real Estate (1996-2023)



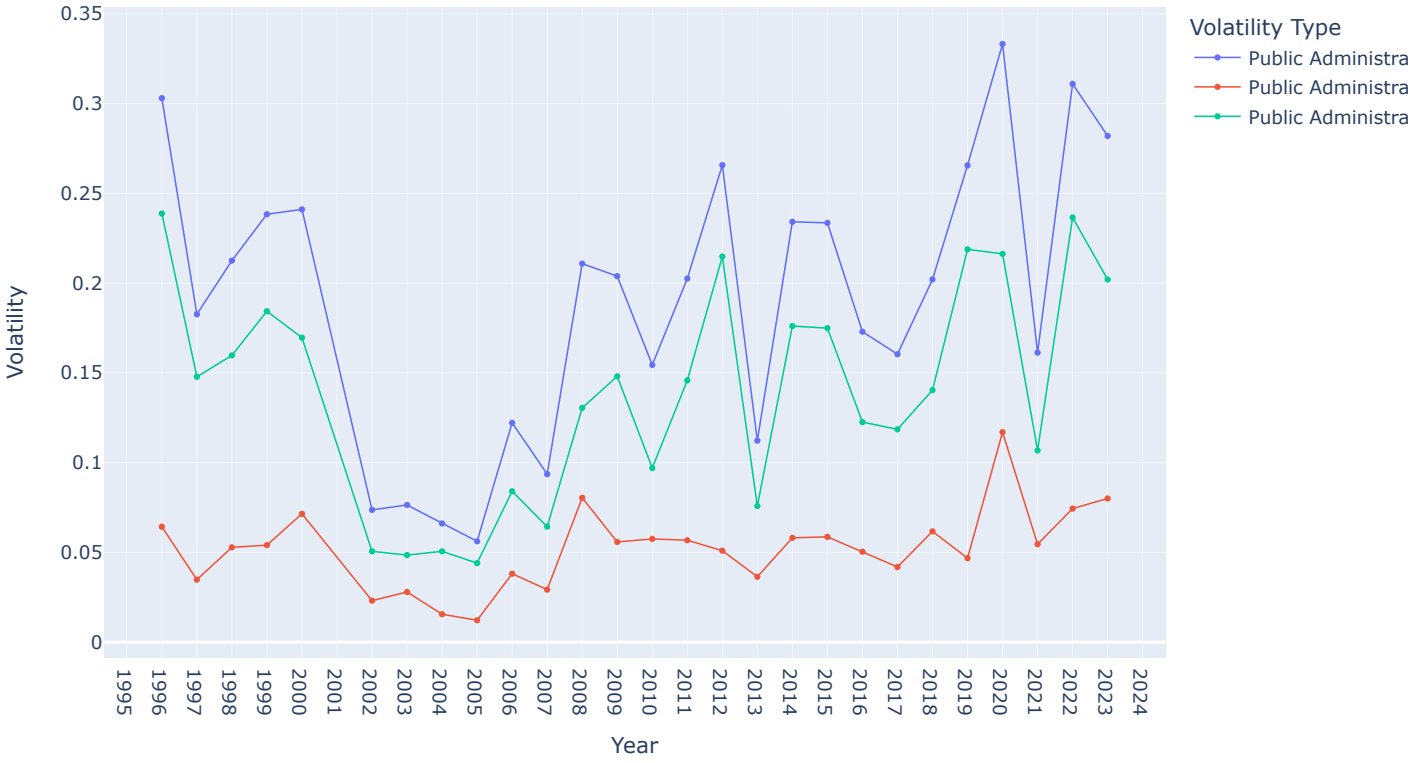
Volatility Metrics for Manufacturing (1996-2023)



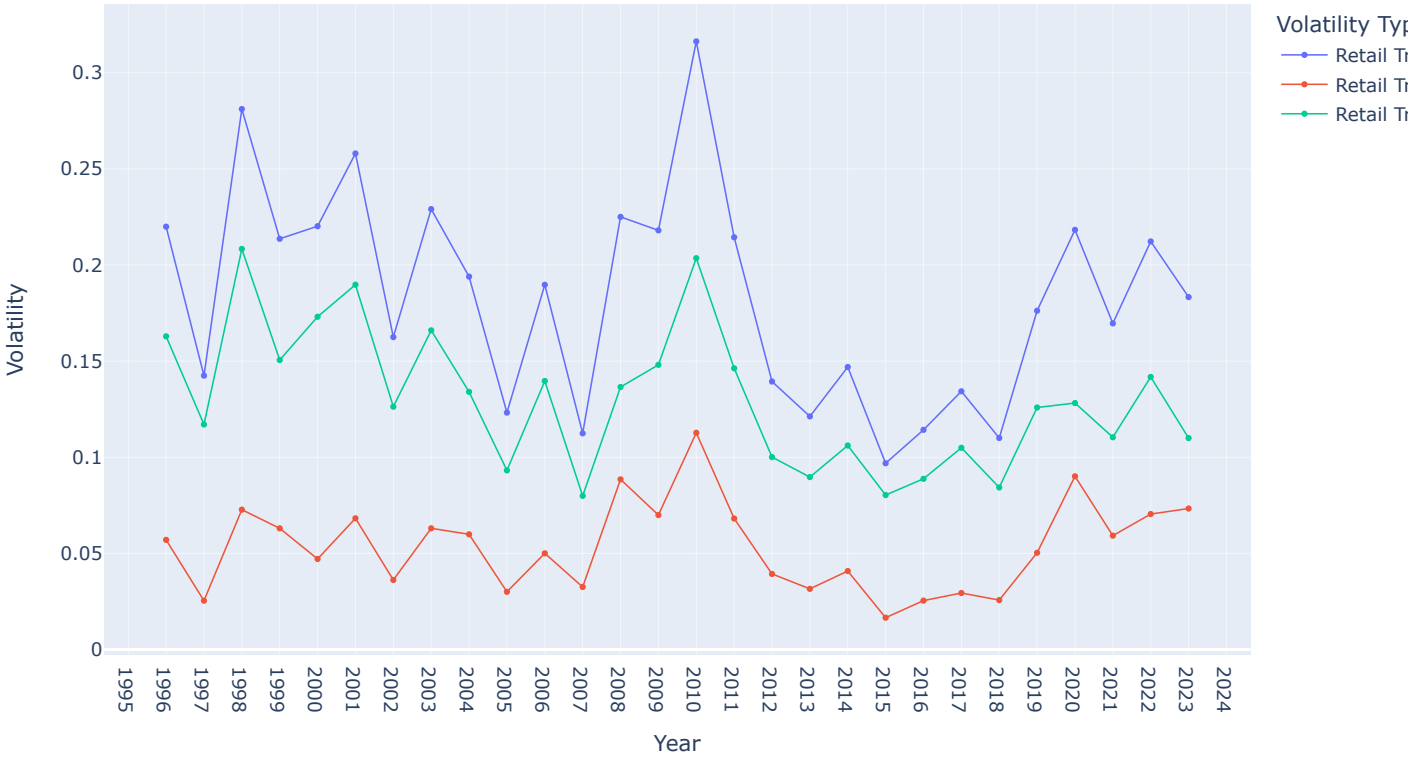
Volatility Metrics for Mining (1996-2023)



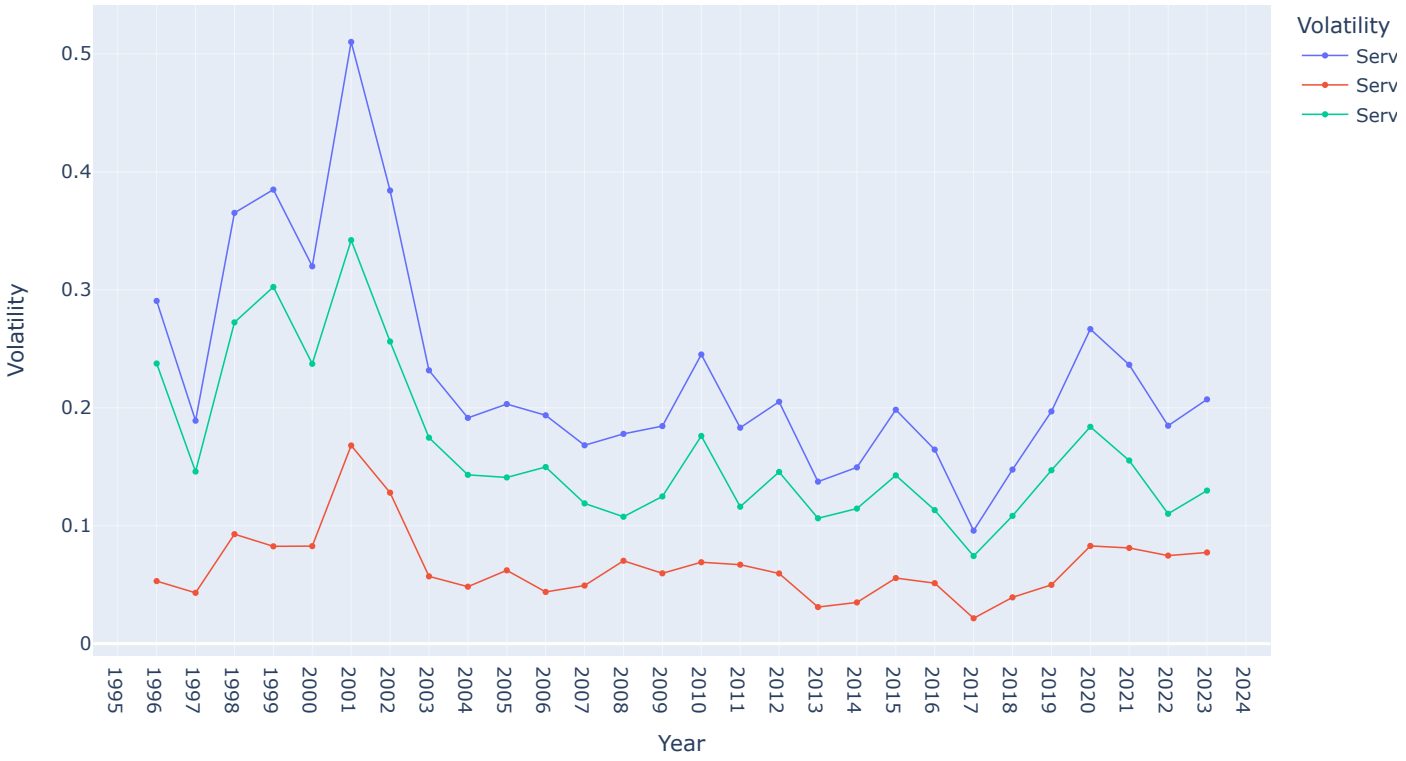
Volatility Metrics for Public Administration (1996-2023)



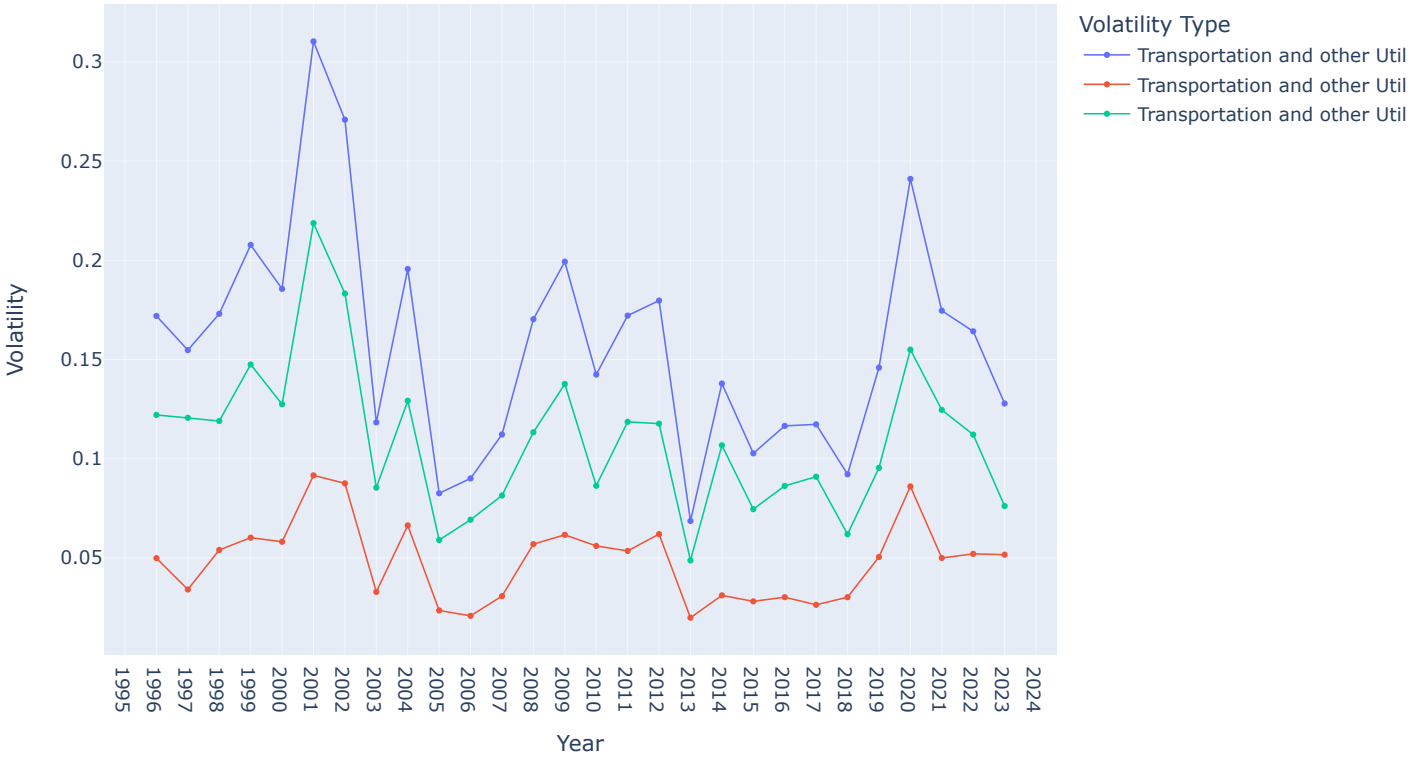
Volatility Metrics for Retail Trade (1996-2023)



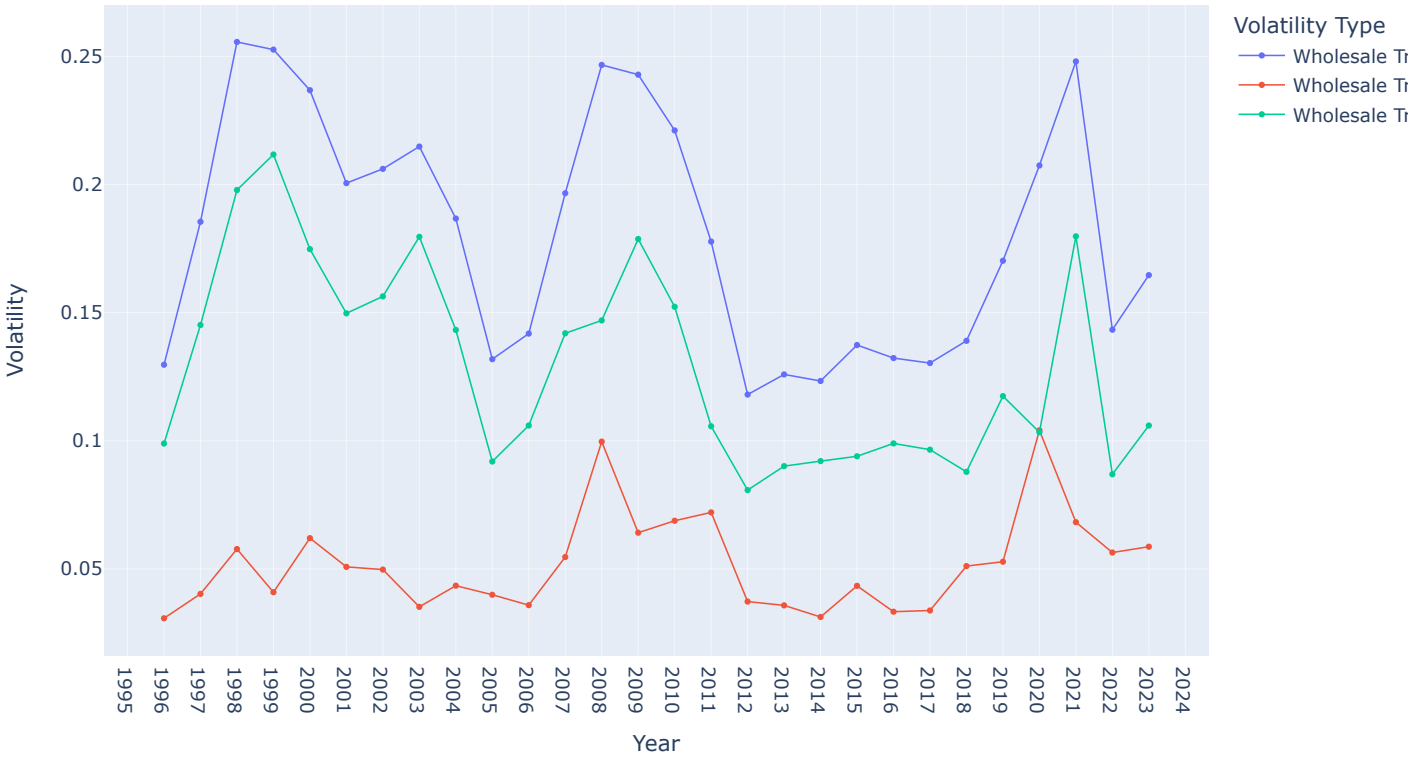
Volatility Metrics for Services (1996-2023)



Volatility Metrics for Transportation and other Utilities (1996-2023)



Volatility Metrics for Wholesale Trade (1996-2023)



Observation

- IVOL major contributor to the TVOL. Most volatility comes from residual volatility of linear regression. This makes sense and sustematic market volatility is less as overall market is more stable than individual stocks.
- TVOL, IVOL and SVOL are dependent and correlated. They all follow the same distribution of trends ie it is not seen that the volatility trends differ from one another (ie. not a single graph with unnatural trends like SVOL increases but TVOL decreases etc.).
- Services industry seen to have relativele stable volatility since 2005
- Highest Volatility seen in mining
- Sharp spikes in TVOL, IVOL and SVOL seen during 2008-2010 period owing to the financial crisis
- Sharp spikes in TVOL, IVOL and SVOL seen during 2020-2021 period owing to the COVID pandemic

...

Portfolio Quintile Information (Sorted by Beta)

```
Average Beta by Quintile:
 quintile
(-11.295, 0.368]   -0.237313
(0.368, 0.852]      0.624102
(0.852, 1.273]      1.058596
(1.273, 1.874]      1.546919
(1.874, 26.881]     2.884764
Name: Beta, dtype: float64


Equal weighted Portfolio distributions:
Average Excess Return by Quintile:
 quintile
(-11.295, 0.368]    0.009948
(0.368, 0.852]      0.008792
(0.852, 1.273]      0.008013
(1.273, 1.874]      0.008187
(1.874, 26.881]     0.016337
Name: returns_excess, dtype: float64
Difference in Excess Return (High Beta 5 - Low Beta 1): 0.008323281051954772


Value weighted Portfolio distributions:
Average Excess Return by Quintile:
 quintile
(-11.295, 0.368]    1.748238e-06
(0.368, 0.852]      5.808381e-06
(0.852, 1.273]      4.609294e-06
(1.273, 1.874]      1.613797e-06
(1.874, 26.881]     9.812637e-07
Name: return_weighted, dtype: float64
Difference in Excess Return Value Weighted (High Beta 5 - Low Beta 1): -3.628030099298125e-06
```

Portfolio Quintile Information (Sorted by IVOL)

```
Average Beta by Quintile:
 quintile
(0.00253, 0.0646]    0.808539
(0.0646, 0.0897]     0.959193
(0.0897, 0.121]      1.117062
(0.121, 0.181]       1.259181
(0.181, 3.678]       1.733162
Name: Beta, dtype: float64


Equal weighted Portfolio distributions:
Average Excess Return by Quintile:
 quintile
(0.00253, 0.0646]    0.010815
(0.0646, 0.0897]     0.009387
(0.0897, 0.121]      0.008708
(0.121, 0.181]       0.003814
(0.181, 3.678]       0.018552
Name: returns_excess, dtype: float64


Value weighted Portfolio distributions:
Average Excess Return by Quintile:
 quintile
(0.00253, 0.0646]    8.949549e-06
(0.0646, 0.0897]     3.104525e-06
(0.0897, 0.121]      1.435112e-06
(0.121, 0.181]       5.957277e-07
(0.181, 3.678]       6.715132e-07
Name: return_weighted, dtype: float64
```