Team 14
Final Presentation

Meet The Team

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Overview

Background - what is the problem we're trying to solve?

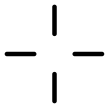
Approach + Findings - how do we approach the problem? what is our conclusion?

Challenges - how could the analysis be improved? what are some of the data limitations?

Sources - where did the data come from?

Understand what makes a ‘recession-proof’ portfolio

The purpose of our analysis is to **identify stock attributes and performance trends** which are **indicative of resilience during economic downturns**



Step 1: Identify the S&P **component stocks which outperformed the aggregate S&P 500** index during several recession periods in the United States

- *our model will solve for Jensen’s Alpha for each stock; we’ll use GSPC as our market index; and we will select the stocks with the highest alphas as ‘outperformers’*

Step 2: Identify the stock **attributes and performance trends which are most predictive of outperformance** during these recession periods

- *fit a logistic regression with key attributes (LTM Returns; LTM Std. Deviation; Sector; Unemployment Rate; Interest Rate) as explanatory variables, and ‘binary outperformance’ (from Step 1) as the response*

Understand what makes a ‘recession-proof’ portfolio

We evaluated three recession periods

January 2001 - October 2001

December 2007 - June 2009

January 2020 - September 2020

Step 1 – Jensen's Alpha + Outperformers

Step 1: Identify the S&P **component stocks which outperformed the aggregate S&P 500** index during several recession periods in the United States

$$\text{Return}_{\text{Stock}} - \text{Return}_{\text{Risk Free}} = \alpha_{\text{Stock}} + B_1 * [\text{Return}_{\text{GSPC}} - \text{Return}_{\text{Risk Free}}]$$

Calculate the alpha's for each stock *in the S&P 500 using GSPC as the market rate, and monthly data for the period*

Rank all securities based on their alpha value. **Stocks with positive alphas, ranking in the top 30% for their period will be marked as 'outperformers'**

Repeat for each **recession period**

Step 1 – 2001 Outperformers

Jensen's Alpha - 2001 Recession Period

Monthly Values (Jan '01 - Oct '01), Market Index: GSPC

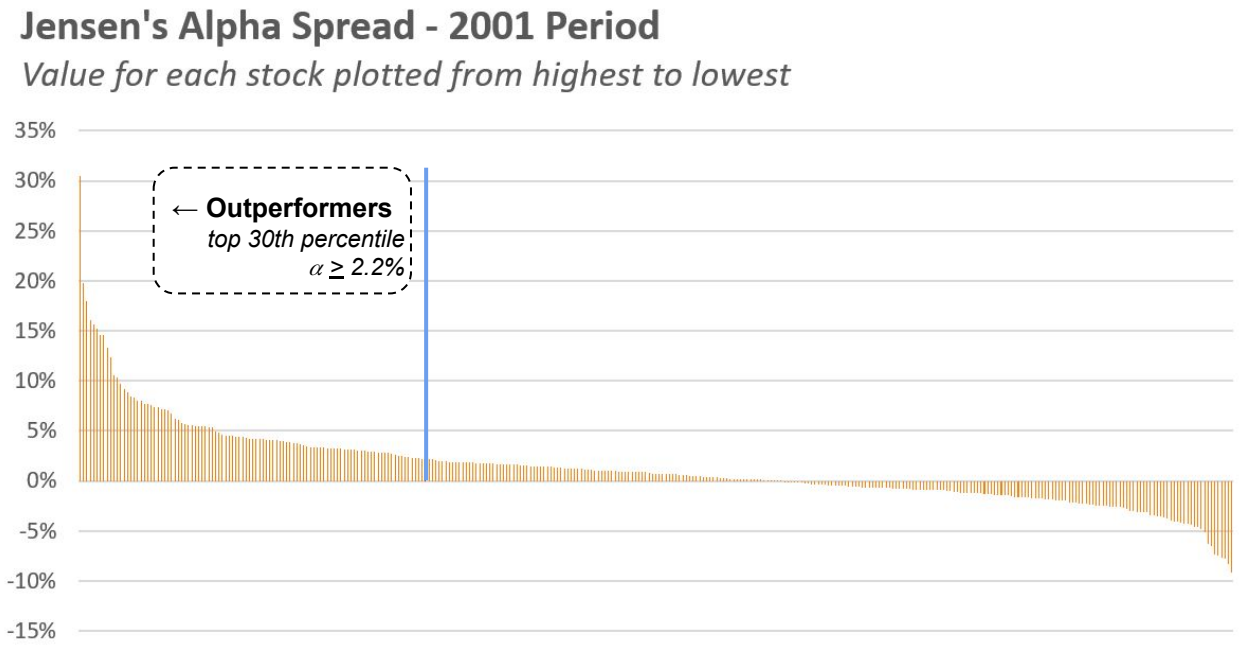
Rank	Ticker	Company	Jensen's Alpha *(Monthly)*	Is Outperformer? *(Binary)*
1	BKNG	Booking Holdings	30.5%	1
2	FIS	Fidelity National Information Services	19.8%	1
3	BBY	Best Buy	18.0%	1
4	WDC	Western Digital	16.1%	1
5	EBAY	eBay	15.6%	1
6	NVDA	Nvidia	15.2%	1
7	CA	CA Technologies	14.6%	1
8	XRX	Xerox	14.6%	1
9	CTXS	Citrix Systems	13.3%	1
10	NLOK	NortonLifeLock	12.4%	1
		... see Github for full list of companies		
331	WAT	Waters Corporation	-4.8%	0
332	EOG	EOG Resources	-5.1%	0
333	TAP	Molson Coors Beverage Company	-6.3%	0
334	NBR	Nabors Industries	-6.6%	0
335	GLW	Corning	-7.3%	0
336	AES	AES Corp	-7.5%	0
337	NOV	Nov	-7.7%	0
338	NTAP	NetApp	-7.8%	0
339	GR	Goodrich Corporation	-8.3%	0
340	TLAB	Tellabs	-9.2%	0

See sources tab - 3, 4

*Jensen's Alpha **must exceed 2.2% to be considered an outperformer** in 2001 recession period*

Informed by top 30th percentile performance by Jensen's Alpha in period

Step 1 – 2001 Visual



See sources tab - 3, 4

Step 1 – 2007 to 2009 Outperformers

Jensen's Alpha - 2007 to 2009 Recession Period

Monthly Values (Dec '07 - Jun '09), Market Index: GSPC

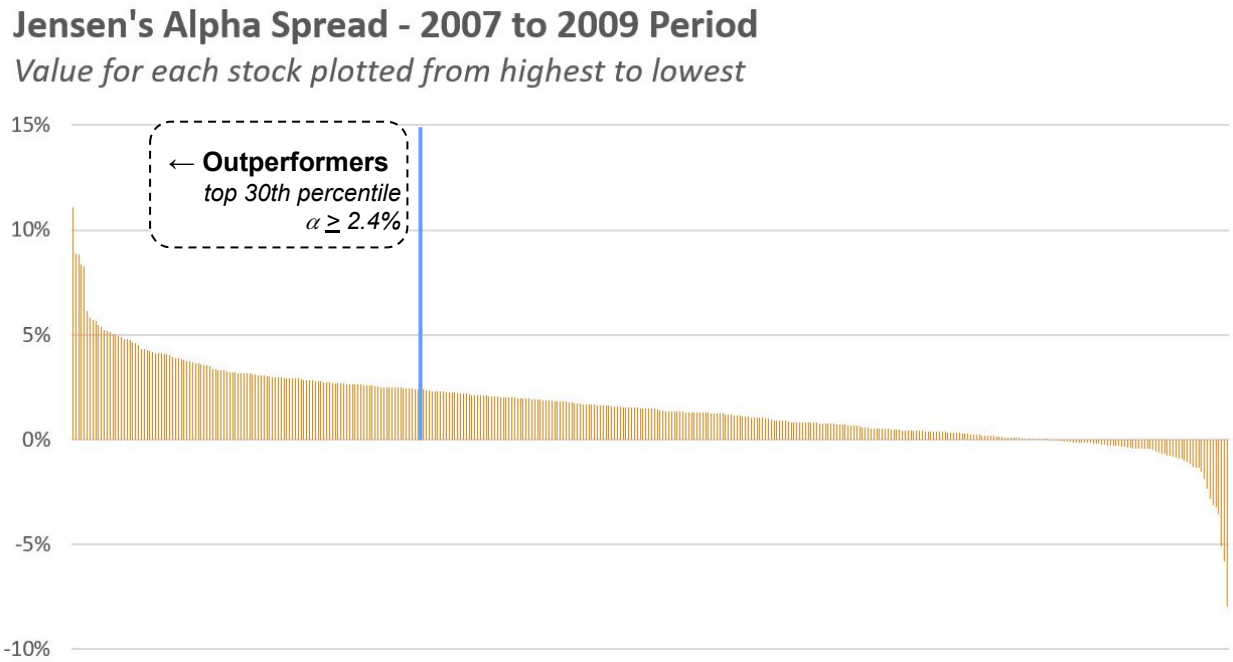
Rank	Ticker	Company	Jensen's Alpha *(Monthly)*	Is Outperformer? *(Binary)*
1	F	Ford	11.1%	1
2	MAC	Macerich	8.9%	1
3	MGM	MGM Resorts International	8.9%	1
4	SIG	Signet Jewelers	8.3%	1
5	PFG	Principal Financial Group	8.3%	1
6	PRU	Prudential Financial	6.2%	1
7	LNC	Lincoln National	5.8%	1
8	RCL	Royal Caribbean Cruises	5.7%	1
9	FFIV	F5 Networks	5.7%	1
10	HIG	The Hartford	5.5%	1
		... see Github for full list of companies		
396	NDAQ	Nasdaq	-1.6%	0
397	VRSN	Verisign	-1.9%	0
398	ANDV	Andeavor	-2.3%	0
399	GRMN	Garmin	-2.8%	0
400	DAL	Delta Air Lines	-3.1%	0
401	VLO	Valero Energy	-3.2%	0
402	ZION	Zions Bancorp	-3.5%	0
403	RF	Regions Financial Corporation	-5.1%	0
404	KEY	KeyCorp	-5.8%	0
405	UAL	United Continental Holdings	-8.0%	0

See sources tab - 3, 4

*Jensen's Alpha **must exceed 2.4% to be considered an outperformer** in 2007 to 2009 recession period*

Informed by top 30th percentile performance by Jensen's Alpha in period

Step 1 – 2007 to 2009 Visual



See sources tab - 3, 4

Step 1 – 2020 Outperformers

Jensen's Alpha - 2020 Recession Period

Monthly Values (Jan '20 - Sep '20), Market Index: GSPC

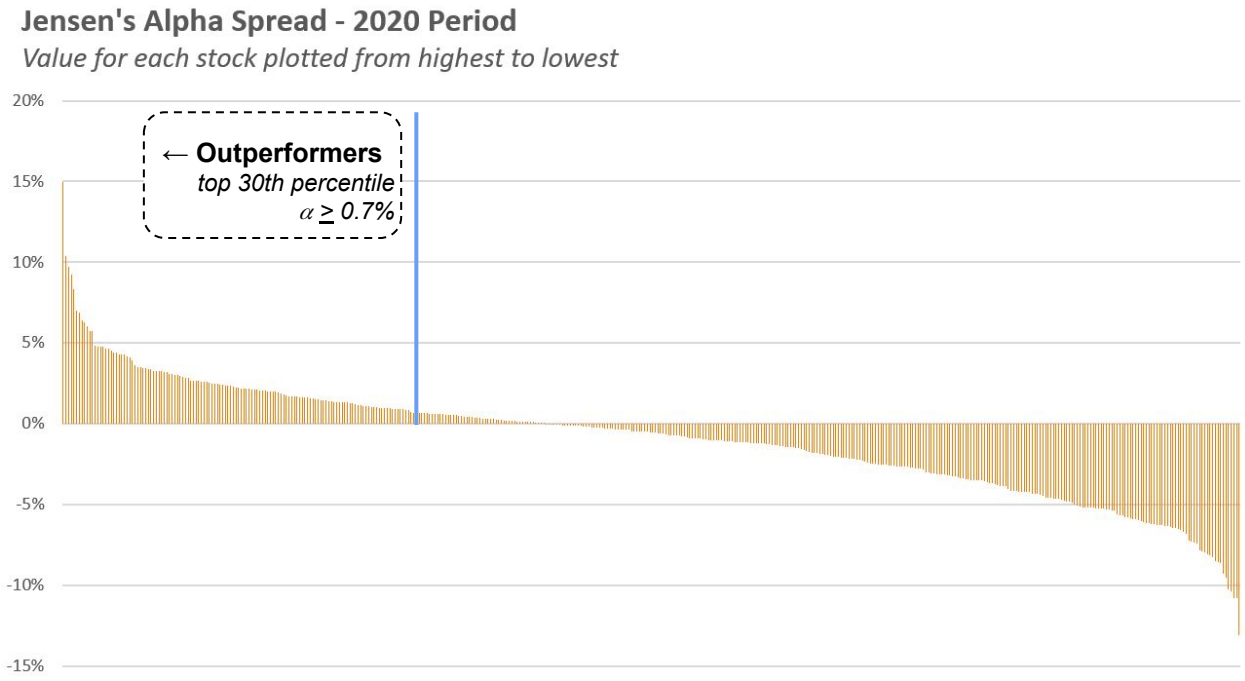
Rank	Ticker	Company	Jensen's Alpha *(Monthly)*	Is Outperformer? *(Binary)*
1	COL	Rockwell Collins	15.0%	1
2	RRC	Range Resources	10.4%	1
3	ARNC	Arconic Inc	9.7%	1
4	NVDA	Nvidia	9.2%	1
5	APA	APA Corporation	8.3%	1
6	EQT	EQT	7.0%	1
7	SIG	Signet Jewelers	6.9%	1
8	PYPL	PayPal	6.4%	1
9	AMD	Advanced Micro Devices	6.3%	1
10	FDX	FedEx	6.0%	1
		... see Github for full list of companies		
434	SLB	Schlumberger	-8.5%	0
435	WFC	Wells Fargo	-8.6%	0
436	UAL	United Continental Holdings	-8.7%	0
437	HP	Helmerich & Payne	-9.3%	0
438	NOV	Nov	-9.5%	0
439	CCL	Carnival Corporation	-10.3%	0
440	OXY	Occidental Petroleum	-10.4%	0
441	FTI	TechnipFMC	-10.8%	0
442	JWN	Nordstrom	-10.8%	0
443	COTY	Coty	-13.1%	0

See sources tab - 3, 4

*Jensen's Alpha **must exceed 0.7% to be considered an outperformer** in 2020 recession period*

Informed by top 30th percentile performance by Jensen's Alpha in period

Step 1 – 2020 Visual



See sources tab - 3, 4

Step 2 – Identify the factors which are most predictive of outperformance

Step 2: Identify the stock **attributes and performance trends which are most predictive of outperformance** during the period

Fit the following logistic regression:

'Outperform?' $_{Stock}$ **=**

$$B_0 + B_1*[\text{LTM Returns}] + B_2*[\text{LTM Volatility}] + B_3*[\text{Is Finance?}] + B_4*[\text{Is Industrials?}] + B_4*[\text{Is Real Estate?}] + B_4*[\text{Unemployment Rate}] + B_4*[\text{Interest Rate}]$$

- *Company LTM Avg. Monthly Returns*
- *Company LTM Monthly Std. Deviation*
- *Company Sector Is 'Finance'? (1 or 0)*
- *Company Sector Is 'Industrials'? (1 or 0)*
- *Company Sector Is 'Real Estate'? (1 or 0)*
- *Avg. Macro Unemp. Rate in period*
- *Avg. Macro Interest Rate in period*

Coefficient sizes and significance inform **which factors are indicative of resilience** in an economic downturn

Step 2 – Variable Selection

Variable Selection

```
Call:
glm(formula = performance ~ LMT_std + mean + interest_mean +
    unemp_mean + fin + inds + real_est + tech + tele, family = binomial(link = "logit"),
    data = combine_converted)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-4.8381  -0.3601  -0.0893   0.0580   2.6502

Coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept)  14.30926    2.77160   5.163 2.43e-07 ***
LMT_std       0.29190    0.02585  11.293  < 2e-16 ***
mean          1.79170    0.12388  14.463  < 2e-16 ***
interest_mean -2.17822    0.33619  -6.479 9.22e-11 ***
unemp_mean    -2.20710    0.32494  -6.792 1.10e-11 ***
fin           0.77164    0.33571   2.299   0.0215 *
inds          0.44253    0.31827   1.390   0.1644
real_est      0.88327    0.39513   2.235   0.0254 *
tech          0.33668    0.34981   0.962   0.3358
tele          1.34270    1.43504   0.936   0.3495
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1412.08  on 1159  degrees of freedom
Residual deviance:  581.14  on 1150  degrees of freedom
AIC: 601.14

Number of Fisher Scoring iterations: 7
```

We started with a broader set of explanatory variables, but narrowed our selection **using ‘backward-selection’**

We **removed the variables with high P-Values** (highlighted in red to the left)

Step 2 – Regression Input

Logistic Regression Input

Data Point			Response	Explanatory Variables						
Ticker	Jensen's Alpha *(Monthly)*	Recession Period	Is Outperformer? *(Binary)*	LTM Company Avg. Returns	LTM Company Returns Std. Dev.	Company Is Finance? (Binary)	Company Is Industrials? (Binary)	Company Is Real Estate? (Binary)	Avg. Macro Interest Rate	Avg. Macro Unempl. Rate
AAPL	6.1%	2001	1	2.4%	21.9%	0	0	0	4.4%	4.5%
AAPL	3.2%	2007	1	0.0%	15.5%	0	0	0	1.5%	6.7%
AAPL	4.8%	2020	1	5.6%	12.8%	0	0	0	0.5%	8.6%
AIV	-0.3%	2001	0	-0.3%	4.5%	0	0	1	4.4%	4.5%
AIV	3.2%	2007	1	-2.4%	22.0%	0	0	1	1.5%	6.7%
AIV	-4.2%	2020	0	-3.7%	10.2%	0	0	1	0.5%	8.6%
APD	0.4%	2001	0	-0.1%	7.8%	0	1	0	4.4%	4.5%
APD	1.5%	2007	0	-1.3%	11.1%	0	1	0	1.5%	6.7%
APD	2.7%	2020	1	3.2%	8.9%	0	1	0	0.5%	8.6%
GS	0.4%	2001	0	-2.6%	9.8%	1	0	0	4.4%	4.5%
GS	1.8%	2007	0	-1.2%	13.6%	1	0	0	1.5%	6.7%
GS	-1.8%	2020	0	-1.0%	12.2%	1	0	0	0.5%	8.6%
see Github for all data points (1,160 total)										

Observations are **at the 'Company I Recession Period' grain**. A company which was part of the S&P 500 for all 3 recession periods would be included in 3 data points

See sources tab - 3, 4, 7, 8, 9

Step 2 – Final Regression Findings

Final Regression

```
Call:
glm(formula = performance ~ LMT_std + mean + interest_mean +
    unemp_mean + fin + inds + real_est, family = binomial(link = "logit"),
    data = combine_converted)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-4.8332  -0.3675  -0.0883   0.0569   2.6245

Coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept)  14.35772    2.76455   5.194 2.06e-07 ***
LMT_std       0.29222    0.02563  11.400  < 2e-16 ***
mean          1.78874    0.12341  14.494  < 2e-16 ***
interest_mean -2.17711    0.33501  -6.499 8.11e-11 ***
unemp_mean    -2.20535    0.32434  -6.800 1.05e-11 ***
fin           0.70444    0.32953   2.138   0.0325 *
inds          0.37719    0.31205   1.209   0.2268
real_est      0.81622    0.38980   2.094   0.0363 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1412.08  on 1159  degrees of freedom
Residual deviance:  582.79  on 1152  degrees of freedom
AIC: 598.79

Number of Fisher Scoring iterations: 7
```

Six variables are **significant at a 95% confidence interval**:

- LTM Company Avg. Returns
- LTM Company Std. Deviation
- Company is Finance?
- Company is Real Estate?
- Avg. Macro Interest Rate
- Avg. Macro Unemployment Rate

Findings Summary

Strong **performance** in the year leading up to the recession period was indicative of **outperformance**

Volatility in the year leading up to the recession period was indicative of **outperformance**

Placement in the **finance** sector was **indicative of outperformance**

Placement in the **real estate** sector was **indicative of outperformance**

As the **unemployment rises**, the log odds of **outperformance decreases**

As the **interest rate rises**, the log odds of **outperformance decreases**

Challenges

1 - **Limited Historical Data:** as our access to historical S&P 500 data was limited, we could only evaluate three recession periods. Further, within those recession periods, there were some individual stocks for which data was unavailable (e.g. for the 2001 recession period, we only had data for 340 stocks in the S&P 500). We did our best to mitigate this by using code to track the changes in the S&P 500 listed in wikipedia

2 - **Limited Operational Performance Data:** operational performance data (e.g. market cap, operating income, profit margin) may have been useful in predicting resilience during downturns. However, access to this data required significant investment

3 - **Non-stationarity:** long periods of time between recessions means the patterns we find in our training data may simply no longer exist due to naturally changing market and macroeconomic dynamics

Sources

1 - Woszczyk K, 2019, ‘Do mutual funds invest in recession-proof industries prior to crisis?’, MSc thesis, Erasmus University Rotterdam, Rotterdam (link)

2 - Ozkan F C, Xiong Y, 2009, ‘Wise Investing: Analysis of the recession-proof sin stocks’, MBA thesis, Simon Fraser University, British Columbia (link)

3 - Tidyquant, source of stock data (via Yahoo) and macroeconomic times series (via Fred) (link)

4 - Kaggle, guidance for performing S&P 500 Analysis in R (link)

5- Schwab, ‘Macro-economic factors of fundamental analysis’ (link)

6 - Stijn Claessens, M. Ayhan Kose, and Marco E. Terrones, 2008, ‘What Happens During Recessions, Crunches and Busts?’ (link)

7 - U.S. Bureau of Labor Statistics, Unemployment Rate [UNRATE], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/UNRATE, July 18, 2022 (link)

8 - Board of Governors of the Federal Reserve System (US), Federal Funds Effective Rate [FEDFUNDS], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/FEDFUNDS, July 18, 2022 (link)

9 - Hamilton, James, Dates of U.S. recessions as inferred by GDP-based recession indicator [JHDUSRGDPBR], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/JHDUSRGDPBR, July 18, 2022 (link)