The Stock Return's Drivers:

Reasons and Emotions

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Motivations & Contributions

- The Intelligent Investor: Graham (1949)
- Principle: Life and Work: Ray Dalio (2017)
- **Fundamental**
  - Fama and French (1993, 1995, 1996, 2015, 2018), Carhart (1997), Asness, Moskowitz, and Pedersen (2013), Hou, Xue, and Zhang (2015)
- **Behavioral**
  - De Bondt and Thaler (1985), Barberis, Shleifer, and Vishny (1998), Daniel, Hirshleifer, and Subrahmanyam (2001), Baker and Wurgler (2007), Verma and Soydemir (2009), Bijl, et al. (2016), Irresberger, Konig, Weib (2016)
- Not a lot of studies on rational and irrational factors simultaneously

Motivations & Contributions

Source:wikipedia.org

"The market is not a weighing machine, on which the value of each issue is recorded by an exact and impersonal mechanism, in accordance with its specific qualities. Rather should we say that the market is a voting machine, whereon countless individuals register choices which are the product partly of reason and partly of emotion."

Graham (1949)

Motivations & Contributions

"…price reflects people's expectations, so they go up when actual results are better than expected and go down when they are worse than expected."

Dalio (2017)

Source:wikipedia.org

Contributions

1) **Investor/Trader/Fund Manager**
   Long: too much pessimism
   Short: too much optimism
   Wait for the swings of pessimism/optimism

2) **Manager**
   Capital Budgeting: WACC

3) **Regulator/Stock Exchange**
   - Limit downside risk during pessimism period
   - Construct circuit breaker accordingly
   - SEC can regulate the stock market better by including irrational factor

Questions

- Do **the rational and irrational factors** influence on the US stock market returns?

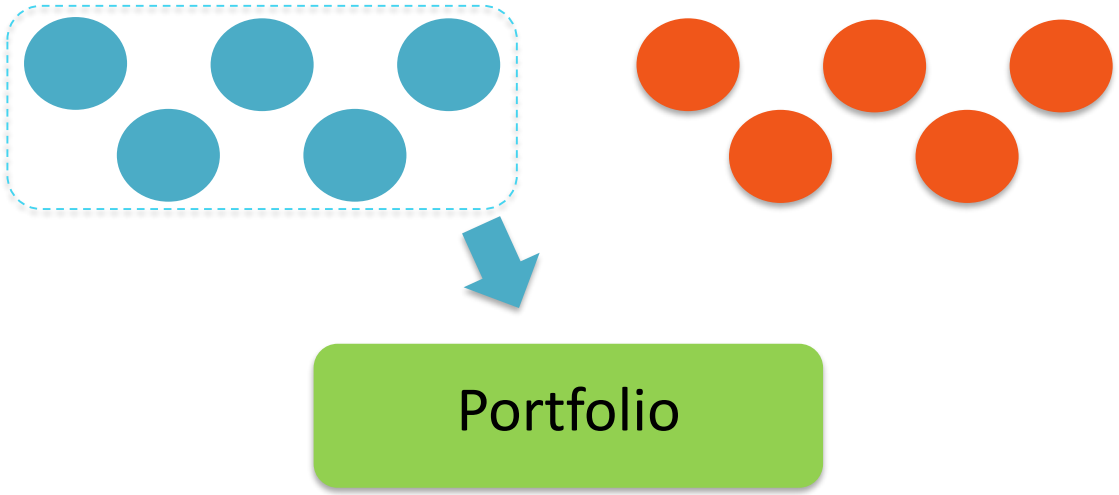
  Yes! **The rational and irrational factors simultaneously affect the US stock market return** with different weights, depending on investment styles or even investment periods.

- Is there **any anomaly on the stock market returns** during the financial crises?

  Yes! During a financial crisis, we find **a significantly increased importance of the irrational factors**.

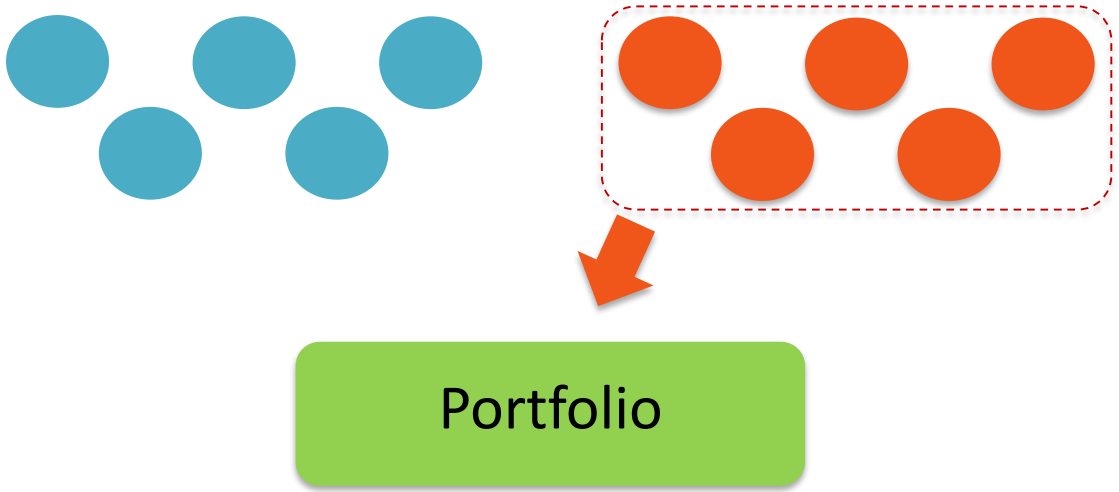
Methodology 1: Multiple Linear Regression

- Use to separately consider groups of rational and irrational factors
- Use R^2 to measure the explanatory power of rational or irrational factors



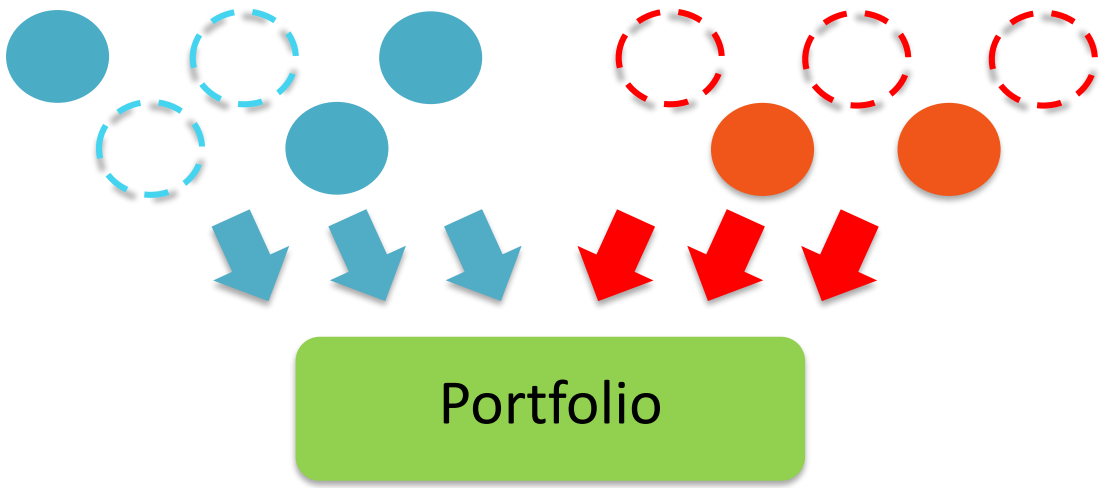
Methodology 1: Multiple Linear Regression

- Separately consider groups of rational and irrational factors
- Use R^2 to measure the explanatory power of rational or irrational factors



Methodology 2: Stepwise Linear Regression

- Simultaneously considering the rational and irrational factors
- Use R^2 to measure the explanatory power of the combination of rationalities and irrationalities



Two kinds of portfolios

I) Kenneth R. French's website

- Portfolios constructed on Value and Momentum
- Value portfolios formed on book-to-market ratio, and momentum portfolios formed on prior returns

II) Selective ETF portfolios in the US

- Four groups using Morningstar style boxes; 2004-2019
  - Large cap-value
  - Small cap-value
  - Large cap-growth
  - Small cap-growth

Summary of the Variables

	Period	Source
Conceptual Portfolios (Value and Momentum)	2004-2019	Kenneth R. French's Website
ETFs Portfolios*	2007-2019	Yahoo! Finance
Fama-French 5 Factors	2004-2019	Kenneth R. French's Website
Google Search Volume Index (GSVI)	2004-2019	Google Trends
Trading Index (TRIN)	2004-2019	Yahoo! Finance
Volatility Index (VIX)	2004-2019	Yahoo! Finance
AAII Investor Sentiment	2004-2019	The American Association of Individual Investors
Trading Volume in NYSE	2004-2019	Yahoo! Finance

Value and Momentum

Reasons

Table 1a. The results from the multiple regression model on each portfolio, with their *rational factors* during the period of 2004-2019

Portfolio	Intercept	Rational Factors					R^2	Adjusted R^2
		RPM	SMB	HML	RMW	CMA		
V01	-0.616500	0.8047***	0.040630	-0.67254**	-0.447630	-0.591190	0.2890	0.2699
(t-value)	-1.284	5.934	0.182	-3.065	-1.332	-1.566		
V10	0.527700	0.461100	1.7905***	0.456900	0.168500	-0.521600	0.1243	0.1008
(t-value)	0.462	1.431	3.370	0.876	0.211	-0.581		
M01	3.478400	-0.179200	4.3502*	0.417600	-0.209900	-1.933600	0.0455	0.0198
(t-value)	0.940	-0.171	2.524	0.247	-0.081	-0.664		
M10	0.395800	0.7483***	-0.111100	-0.375100	-0.333500	-0.767600	0.1461	0.1231
(t-value)	0.604	4.042	-0.364	-1.252	-0.727	-1.489		

Emotions

Table 1b. The results from the multiple regression model on each portfolio, with their *irrational factors* during the period of 2004-2019

Portfolio	Intercept	Irrational Factors					R^2	Adjusted R^2
		GSVI	TRIN	VIX	AAII	VOL		
V01	0.233810	-0.020970	0.266820	-9.53592***	0.035170	-8.66809*	0.1687	0.1463
(t-value)	0.451	-0.168	0.402	-4.010	0.537	-2.468		
V10	1.297143	-0.009453	-0.513825	-13.026341*	0.109026	5.539227	0.0358	0.0099
(t-value)	1.084	-0.033	-0.336	-2.375	0.722	0.684		
M01	3.808300	-0.301200	-0.996400	-12.028700	-0.177000	22.963700	0.0072	-0.0195
(t-value)	1.009	-0.332	-0.207	-0.696	-0.372	0.899		
M10	1.250680	-0.043110	-0.276880	-10.76969***	0.011200	-3.711470	0.0875	0.0630
(t-value)	1.846	-0.265	-0.320	-3.470	0.131	-0.810		

Value and Momentum

Table 1c. The results from the stepwise regression model on each portfolio, with their *rational factors and irrational factors* during the period of 2004-2019

Portfolio	Intercept	Rational Factors					Irrational Factors					R^2	Adjusted R^2
		RPM	SMB	HML	RMW	CMA	GSVI	TRIN	VIX	AAII	VOL		
V01	-0.405800	0.7169***		-0.5952**	-0.509300	-0.576000					-7.3706*	0.3106	0.2921
(t-value)	-0.845	5.321		-2.759	-1.596	-1.549					-2.421		
V10	0.521500	0.507500	1.814000									0.1203	0.1110
(t-value)	0.478	1.728	3.632***										
M01	3.321000		4.296**									0.0431	0.0381
(t-value)	0.958		2.926										
M10	0.338900	0.7132***				-1.1064*						0.1356	0.1264
(t-value)	0.540	4.617				-2.540							

ETFs

Table 2a. The results from the multiple regression model on each ETF portfolio in the US, with their *rational factors* during the period of 2007-2019

Portfolio	Intercept	Rational Factors					R^2	Adjusted R^2
		RPM	SMB	HML	RMW	CMA		
Large/Value	-0.0022454**	0.0092189***	-0.0014318***	0.0020259***	0.0012642*	0.0018342**	0.9591	0.9578
(t-value)	-3.138	49.677	-4.404	6.162	2.518	3.169		
Small/Value	0.597390	-0.010150	-0.370620	0.104540	-0.021400	-0.163490	0.0184	-0.0146
(t-value)	1.089	-0.071	-1.487	0.415	-0.056	-0.368		
Large/Growth	0.000581	0.010524***	-0.000112	-0.0025443***	0.000184	-0.0022022***	0.9672	0.9661
(t-value)	0.808	56.428	-0.344	-7.700	0.364	-3.786		
Small/Growth	-0.000128	0.009905***	0.008545***	-0.00163***	-0.000025	-0.002214***	0.9766	0.9758
(t-value)	-0.178	52.996	26.100	-4.922	-0.049	-3.799		

Reasons

Table 2b. The results from the multiple regression model on each ETF portfolio in the US, with their *irrational factors* during the period of 2007-2019

Portfolio	Intercept	Irrational Factors					R^2	Adjusted R^2
		GSVI	TRIN	VIX	AAII	VOL		
Large/Value	0.0074155**	0.000556	-0.003421	-0.1079181***	0.000402	0.009256	0.4394	0.4206
(t-value)	2.801	0.858	-1.093	-9.504	1.320	0.539		
Small/Value	0.248920	0.180340	0.303280	2.847510	0.015040	1.775790	0.0248	-0.0080
(t-value)	0.456	1.347	0.469	1.215	0.239	0.501		
Large/Growth	0.0128401***	0.000669	-0.004014	-0.1204267***	0.000505	-0.010752	0.4774	0.4599
(t-value)	4.475	0.952	-1.183	-9.787	1.527	-0.578		
Small/Growth	0.0107619**	0.0021235*	-0.005580	-0.1348013***	0.000768	0.012560	0.4434	0.4247
(t-value)	3.064	2.468	-1.344	-8.950	1.899	0.551		

Emotions

ETFs

Table 2c. The results from the stepwise regression model on each ETF portfolio in the US, with their *rational factors and irrational factors* during the period of 2007-2019

Portfolio	Intercept	Rational Factors					Irrational Factors					R^2	Adjusted R^2
		RPM	SMB	HML	RMW	CMA	GSVI	TRIN	VIX	AAII	VOL		
Large/Value	-0.0024182**	0.0093069***	-0.0014768***	0.0019504***	0.0012511*	0.0018567**					0.006617	0.9597	0.9581
(t-value)	-3.349	47.949	-4.541	5.885	2.501	3.220					1.485		
Small/Value	0.374400		-0.4541*				0.215500					0.0333	0.0206
(t-value)	0.721		-2.040				1.605						
Large/Growth	0.000179	0.0109613***		-0.0028714***		-0.0019102**	-0.000246		0.0096667*			0.9689	0.9679
(t-value)	0.241	44.841		-8.556		-3.344	-1.438		2.410				
Small/Growth	0.000112	0.009951***	0.0087018***	-0.0016730***		-0.0021636***	-0.000342					0.9772	0.9764
(t-value)	0.159	55.526	26.920	-5.127		-3.778	-1.913						

The US Subprime Mortgage Crisis (2007-2009)

Table 3a. The anomaly of the market sentiment of the Value and Momentum portfolios in the US subprime mortgage crisis (2007-2009) comparing to the overall period (2004-2019)

Portfolio	Methodology	2004-2019	2007-2009	
		Adjusted R^2	Adjusted R^2	Compare with 2004-2019 (%)
V01	Reg. Rationality	0.2699	0.0573	-78.77%
	Reg. Irrationality	0.1463	0.0917	-37.29%
	Stepwise Reg.	0.2921	0.2038	-30.23%
V10	Reg. Rationality	0.1008	0.2750	172.82%
	Reg. Irrationality	0.0099	0.1252	1163.12%
	Stepwise Reg.	0.1110	0.3595	223.87%
M01	Reg. Rationality	0.0198	0.2312	1067.68%
	Reg. Irrationality	-0.0195	0.2211	1232.68%
	Stepwise Reg.	0.0381	0.3156	728.78%
M10	Reg. Rationality	0.1231	0.2028	64.74%
	Reg. Irrationality	0.1231	-0.0294	-123.87%
	Stepwise Reg.	0.1264	0.2279	80.30%

The European Debt Crisis (2011-2013)

Table 3b. The anomaly of the market sentiment of the Value and Momentum portfolios in the European debt crisis (2011-2013) comparing to the overall period (2004-2019)

Portfolio	Methodology	2004-2019	2011-2013	
		Adjusted R^2	Adjusted R^2	Compare with 2004-2019 (%)
V01	Reg. Rationality	0.2699	0.3934	45.76%
	Reg. Irrationality	0.1463	0.1610	10.05%
	Stepwise Reg.	0.2921	0.5330	82.47%
V10	Reg. Rationality	0.1008	0.0947	-6.07%
	Reg. Irrationality	0.0099	-0.0963	-1071.95%
	Stepwise Reg.	0.1110	0.1757	58.29%
M01	Reg. Rationality	0.0198	0.0376	89.70%
	Reg. Irrationality	-0.0195	-0.0837	-328.53%
	Stepwise Reg.	0.0381	0.1023	168.64%
M10	Reg. Rationality	0.1231	0.0961	-21.96%
	Reg. Irrationality	0.1231	-0.0728	-159.16%
	Stepwise Reg.	0.1264	0.1526	20.73%

The US Subprime Mortgage Crisis (2007-2009)

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V01				
	Reg. Rationality	0.1008	0.2750	172.82%
V10				
	Reg. Rationality	0.0198	0.2312	1067.68%
M01				
	Reg. Rationality	0.1231	0.2028	64.74%
M10				

The European Debt Crisis (2011-2013)

Table 3b. The anomaly of the market sentiment of the Value and Momentum portfolios in the European debt crisis (2011-2013) comparing to the overall period (2004-2019)

Portfolio	Methodology	2004-2019	2011-2013	
		Adjusted R^2	Adjusted R^2	Compare with 2004-2019 (%)
	Reg. Rationality	0.2699	0.3934	45.76%
V01				
	Reg. Rationality	0.1008	0.0947	-6.07%
V10				
	Reg. Rationality	0.0198	0.0376	89.70%
M01				
	Reg. Rationality	0.1231	0.0961	-21.96%
M10				

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V01				
	Stepwise Reg.	0.2921	0.2038	-30.23%
V10				
	Stepwise Reg.	0.1110	0.3595	223.87%
M01				
	Stepwise Reg.	0.0381	0.3156	728.78%
M10				
	Stepwise Reg.	0.1264	0.2279	80.30%

The European Debt Crisis (2011-2013)

Table 3b. The anomaly of the market sentiment of the Value and Momentum portfolios in the European debt crisis (2011-2013) comparing to the overall period (2004-2019)

Portfolio	Methodology	2004-2019	2011-2013	
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V10				
	Stepwise Reg.	0.1110	0.1757	58.29%
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	Stepwise Reg.	0.0381	0.1023	168.64%
M10				
	Stepwise Reg.	0.1264	0.1526	20.73%

The US Subprime Mortgage Crisis (2007-2009)

ETFs

The European Debt Crisis (2011-2013)

Table 4a. The anomaly of the market sentiment of the ETF portfolios in the US subprime mortgage crisis (2007-2009) comparing to the overall period (2007-2019)

Portfolio	Methodology	2007-2019	2007-2009	
		Adjusted R^2	Adjusted R^2	Compare with 2007-2019 (%)
Large/Value	Reg. Rationality	0.9578	0.9656	0.81%
	Reg. Irrationality	0.4206	0.2740	-34.85%
	Stepwise Reg.	0.9581	0.9657	0.79%
Small/Value	Reg. Rationality	-0.0146	0.9300	6482.98%
	Reg. Irrationality	-0.0080	0.2142	2793.32%
	Stepwise Reg.	0.0206	0.9370	4448.54%
Large/Growth	Reg. Rationality	0.9661	0.9773	1.16%
	Reg. Irrationality	0.4599	0.4550	-1.07%
	Stepwise Reg.	0.9679	0.9814	1.39%
Small/Growth	Reg. Rationality	0.9758	0.9837	0.81%
	Reg. Irrationality	0.4247	0.3640	-14.29%
	Stepwise Reg.	0.9764	0.9842	0.80%

Table 4b. The anomaly of the market sentiment of the ETF portfolios in the European debt crisis (2011-2013) comparing to the overall period (2007-2019)

Portfolio	Methodology	2007-2019	2011-2013	
		Adjusted R^2	Adjusted R^2	Compare with 2007-2019 (%)
Large/Value	Reg. Rationality	0.9578	0.9533	-0.47%
	Reg. Irrationality	0.4206	0.6502	54.59%
	Stepwise Reg.	0.9581	0.9545	-0.38%
Small/Value	Reg. Rationality	-0.0146	0.8449	5898.90%
	Reg. Irrationality	-0.0080	0.7474	9497.71%
	Stepwise Reg.	0.0206	0.8877	4209.22%
Large/Growth	Reg. Rationality	0.9661	0.9720	0.61%
	Reg. Irrationality	0.4599	0.5564	20.98%
	Stepwise Reg.	0.9679	0.9739	0.62%
Small/Growth	Reg. Rationality	0.9758	0.9748	-0.10%
	Reg. Irrationality	0.4247	0.6063	42.76%
	Stepwise Reg.	0.9764	0.9770	0.06%

The US Subprime Mortgage Crisis (2007-2009)

ETFs

The European Debt Crisis (2011-2013)

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Large/Value				
	Reg. Rationality	-0.0146	0.9300	6482.98%
Small/Value				
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Large/Growth				
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Small/Growth				

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Large/Value				
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ETFs

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The European Debt Crisis (2011-2013)

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The US Subprime Mortgage Crisis (2007-2009)

ETFs

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	Stepwise Reg.	0.0206	0.9370	4448.54%
Large/Growth				
	Stepwise Reg.	0.9679	0.9814	1.39%
Small/Growth				
	Stepwise Reg.	0.9764	0.9842	0.80%

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Portfolio	Methodology	2007-2019	2011-2013	
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Large/Value				
	Stepwise Reg.	0.9581	0.9545	-0.38%
Small/Value				
	Stepwise Reg.	0.0206	0.8877	4209.22%
Large/Growth				
	Stepwise Reg.	0.9679	0.9739	0.62%
Small/Growth				
	Stepwise Reg.	0.9764	0.9770	0.06%

Conclusions and Discussions

- Rational and irrational factors simultaneously drive stock returns, depending on investor's perspectives, investment styles, and investment periods
- The rational factors always explain volatilities of portfolios' returns greater than irrational factors
- During a financial crisis, the results indicate a remarkable increase in the importance of the irrational factors, especially on the ETF portfolios

Thank you!