

Restaurant Equities Pairs Trading & The Economy

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Initial Hypothesis and Design

- Our original interest was prompted by pairs trading
- Do equities of similar companies move similarly?
- If so what factors cause these moves?
- How cyclical is the Restaurant Industry's financial performance and what specific economic factors are correlated to the Industry's performance?
- Comparing low end and high end restaurant pairs, Dominos and Papa Johns, and Ruth Chris' Steak house and Del Frisco's



Recap of Conclusion

- Inexpensive restaurants are more related to the industry movements, this could be due to the similarity between them and the index's larger components
- Expensive restaurants are more related to consumer sentiment, as hypothesised
- Company specific changes can cause volatile changes in share price, which may mute the effect of long-term economic effects
- Changes in stock price are only partially explained by our economic factors



Data

- 116 observations
- Monthly Data, 2009- 2018
 - U-6 Rates, Bureau of Labor Statistics: Unemployment rates
 - Historical Equity Prices, Yahoo Finance
 - Russell 3000, Yahoo Finance: Market
 - Industry Index, FactSet: Restaurant industry
 - Consumer Sentiment, Michigan University

Restaurant Pair's Relations



See All 986

Del Frisco's Double Eagle Steakhouse

★★★★☆ 914 Reviews

\$\$\$\$ • Steakhouses, Seafood,

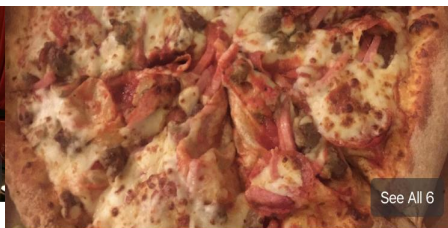


See All 109

Ruth's Chris Steak House

★★★★☆ 113 Reviews

\$\$\$\$ • Steakhouses



See All 6

Papa John's Pizza

★★★★☆ 23 Reviews

\$\$\$ • Pizza



See All 4

Domino's Pizza

★★★★☆ 32 Reviews

\$\$\$ • Pizza, Chicken



2. Chili's

★★★★☆ 130 Reviews

\$\$ • Tex-Mex, American (Traditional), Bars



1. Red Robin Gourmet Burgers and Brews

★★★★☆ 107 Reviews

\$\$ • Burgers, American (Traditional)

Cost per Person per Meal

\$ Under \$10

\$\$ \$11-\$30

\$\$\$ \$31-\$60

\$\$\$\$ Above \$61



To Get a Clearer Picture

- Including a mid ground pair of restaurants: Red Robin and Chili's
- Cointegration analysis



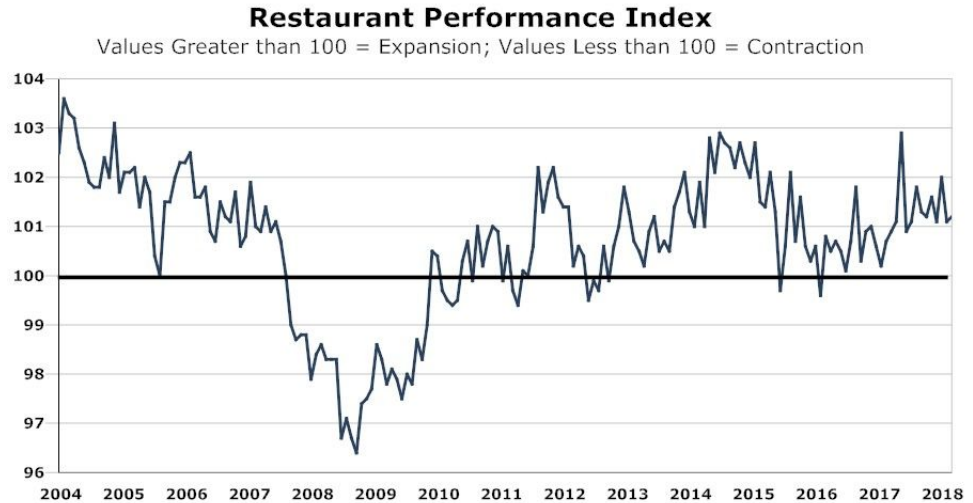
Pairs Trading

- Find a pair of stocks in the same market and that behave similarly
- Look for a long term mean/equilibrium between the pair based on their price ratio
- Observe deviations from the mean
- Trade based on the expectation that the prices will revert back to the mean



Literature

- Consumer spending makes up 68% of the U.S. economy, and restaurants are among some of the most volatile industries ⁽¹⁾
- Over the past decade, the Consumer Price Index (CPI) for all food (grocery store and restaurant food) rose by 24% — a larger increase than the 19% rise in the all-items CPI ⁽²⁾
- On average, chain restaurants have had negative same-store sales (sales growth by new store sales) for more than a year now ⁽³⁾



Source: National Restaurant Association

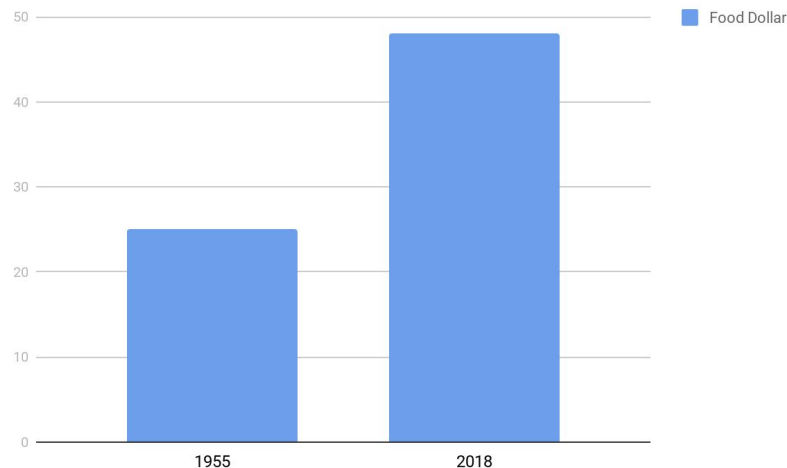




Literature

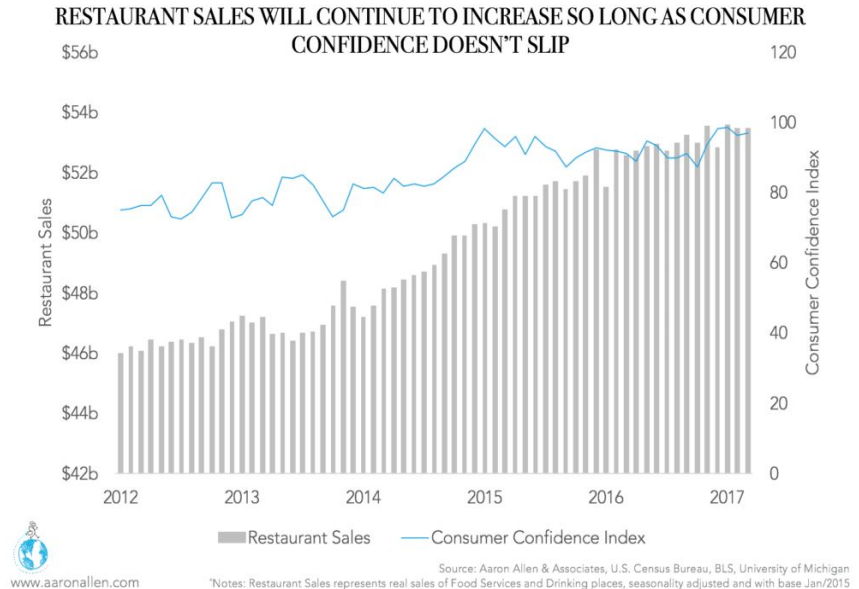
- In the past decade, the national employment rate grew 0.5 percent, but 2 percent within the restaurant industry. About 10 percent of working Americans. ⁽⁴⁾
- Restaurant sales account for 4 percent of the United States' economic output ⁽⁵⁾
- In 1955, only 25 percent of American dollars spent on food was spent at restaurants. Today, the restaurant industry's share of the American food dollar has risen to 48 percent and continues to grow

⁽⁶⁾



Literature

- Overall real sales in restaurants bare a high correlation to consumer confidence (87% since 2009). (7)
- As per our previous findings, even though consumer confidence does not prove causation, it is highly correlated



Red Robin (RRGB)

Dependent Variable: RRGBR

Method: Least Squares

Date: 03/10/19 Time: 14:32

Sample (adjusted): 2009M05 2018M12

Included observations: 116 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.019651	0.010253	-1.916526	0.0579
RRGBR(-1)	0.194988	0.085252	2.287192	0.0241
CSENR	0.026067	0.176325	0.147834	0.8827
PCER	-0.709247	1.806045	-0.392707	0.6953
RUSSELLR	0.770003	0.215632	3.570916	0.0005
INDUSTRYR	0.486503	0.239056	2.035101	0.0443
U6R	-1.328667	0.455732	-2.915456	0.0043
R-squared	0.222427	Mean dependent var		0.002646
Adjusted R-squared	0.179625	S.D. dependent var		0.093499
S.E. of regression	0.084686	Akaike info criterion		-2.041278
Sum squared resid	0.781723	Schwarz criterion		-1.875113
Log likelihood	125.3941	Hannan-Quinn criter.		-1.973824
F-statistic	5.196628	Durbin-Watson stat		1.901439
Prob(F-statistic)	0.000098			

- Durbin-Watson: near 2
- Industry and Russell returns significant and positive
- U6 rate significant and negative
 - Increasing U6, lower stock returns



Red Robin (RRGB)

Null Hypothesis:	Obs	F-Statistic	Prob.
RUSSELLR does not Granger Cause RRGBR	115	0.93002	0.3976
RRGBR does not Granger Cause RUSSELLR		0.32804	0.7210
INDUSTRYR does not Granger Cause RRGBR	115	0.17163	0.8425
RRGBR does not Granger Cause INDUSTRYR		9.36302	0.0002
U6R does not Granger Cause RRGBR	115	0.19936	0.8196
RRGBR does not Granger Cause U6R		0.42663	0.6538

- No Granger Causality between RussellR and RRGBR
- RRGBR Granger causes IndustryR
- U6R does not Granger Cause RRGB or vice versa
- Represents RRGB consumption relationship based on broader economy

Covariance Correlation	RRGBR
RRGBR	0.009731 1.000000
RUSSELLR	0.001223 0.330599
INDUSTRYR	0.000905 0.254431
U6R	-0.000310 -0.178608



Chili's and Maggiano's (EAT)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001350	0.008960	0.150651	0.8805
EATR(-1)	0.022100	0.086693	0.254925	0.7993
U6R	0.300590	0.397019	0.757117	0.4506
RUSSELLR	-0.076649	0.187849	-0.408035	0.6840
CSENTR	0.298295	0.152368	1.957733	0.0528
INDUSTRYR	0.656412	0.196435	3.341617	0.0011
PCER	0.399949	1.564046	0.255714	0.7987
R-squared	0.152053	Mean dependent var	0.010506	
Adjusted R-squared	0.105377	S.D. dependent var	0.077273	
S.E. of regression	0.073088	Akaike info criterion	-2.335853	
Sum squared resid	0.582265	Schwarz criterion	-2.169688	
Log likelihood	142.4795	Hannan-Quinn criter.	-2.268400	
F-statistic	3.257619	Durbin-Watson stat	2.055217	
Prob(F-statistic)	0.005521			

- Durbin-Watson: near 2
- Consumer Sentiment - Statistically significant and positive
- Industry - Statistically significant and positive
- U6 unemployment rate - Positive coefficient



Chili's and Maggiano's (EAT)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
EATR(-1)	-0.071760	0.088700	-0.809023	0.4203
EATR(-2)	0.112048	0.081709	1.371313	0.1732
U6R	0.387542	0.393441	0.985005	0.3269
RUSSELLR	-0.134994	0.180796	-0.746667	0.4569
CSENR	0.320655	0.151172	2.121121	0.0363
INDUSTRYR	0.631451	0.189128	3.338746	0.0012
PCER	1.644627	1.646116	0.999096	0.3200
PCER(-1)	5.033825	1.771242	2.841975	0.0054
PCER(-2)	3.814625	1.705035	2.237270	0.0274
C	-0.022704	0.011167	-2.033097	0.0446
R-squared	0.226063	Mean dependent var	0.009206	
Adjusted R-squared	0.159726	S.D. dependent var	0.076326	
S.E. of regression	0.069966	Akaike info criterion	-2.398680	
Sum squared resid	0.513997	Schwarz criterion	-2.159990	
Log likelihood	147.9241	Hannan-Quinn criter.	-2.301797	
F-statistic	3.407780	Durbin-Watson stat	1.921497	
Prob(F-statistic)	0.001039			

- Small increase in R-squared
- Consumer Sentiment became more statistically significant
- Industry remains statistically significant
- PCE with 1 and 2 lags is statistically significant
- U6 still positive coefficient



Chili's and Maggiano's (EAT)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.001688	0.009165	-0.184119	0.8543
U6R	0.264332	0.389293	0.679006	0.4986
U6R(-1)	-0.499298	0.385248	-1.296043	0.1977
RUSSELLR	-0.068840	0.184727	-0.372661	0.7101
CSENTR	0.304113	0.151088	2.012820	0.0466
INDUSTRYR	0.673289	0.195077	3.451397	0.0008
PCER	0.223567	1.550679	0.144174	0.8856
R-squared	0.164424	Mean dependent var	0.010506	
Adjusted R-squared	0.118429	S.D. dependent var	0.077273	
S.E. of regression	0.072553	Akaike info criterion	-2.350550	
Sum squared resid	0.573770	Schwarz criterion	-2.184385	
Log likelihood	143.3319	Hannan-Quinn criter.	-2.283097	
F-statistic	3.574812	Durbin-Watson stat	1.998733	
Prob(F-statistic)	0.002848			

- U6 lagged once gives the negative coefficient that was expected



Chili's and Maggiano's (EAT)

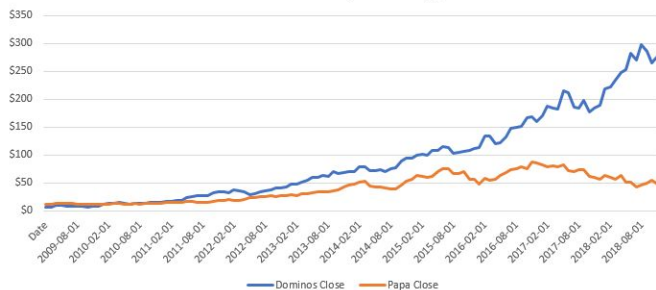
Null Hypothesis:	Obs	F-Statistic	Prob.
CSENTR does not Granger Cause EATR	115	0.06176	0.9401
EATR does not Granger Cause CSENTR		0.45150	0.6378

Null Hypothesis:	Obs	F-Statistic	Prob.
INDUSTRYR does not Granger Cause EATR	115	0.39609	0.6739
EATR does not Granger Cause INDUSTRYR		0.36075	0.6980

- Neither Prob. is below .05
- Can not reject the null for Granger Causality between Chili's and Consumer Sentiment
- Can not reject the null for Granger Causality between Chili's and Industry

Restaurant Pairs Cointegration

Domino's VS Papa John's (\$)



	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-0.542810	0.8776
Test critical values:		
1% level	-3.487046	
5% level	-2.886290	
10% level	-2.580046	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CHEAP_RESID)
Method: Least Squares
Date: 03/09/19 Time: 11:06
Sample (adjusted): 2009M04 2018M12
Included observations: 117 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CHEAP_RESID(-1)	-0.014049	0.025882	-0.542810	0.5883
C	-0.219161	0.376040	-0.582812	0.5612

R-squared	0.002556	Mean dependent var	-0.223492
Adjusted R-squared	-0.006118	S.D. dependent var	4.054197
S.E. of regression	4.066579	Akaike info criterion	5.660428
Sum squared resid	1901.763	Schwarz criterion	5.707644
Log likelihood	-329.1350	Hannan-Quinn criter.	5.679597
F-statistic	0.294642	Durbin-Watson stat	1.825827
Prob(F-statistic)	0.588311		

Del Friscos VS. Ruths (\$\$\$\$)



Null Hypothesis: EXPENSIVE_RESID has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-0.826937	0.8074
Test critical values:		
1% level	-3.487046	
5% level	-2.886290	
10% level	-2.580046	

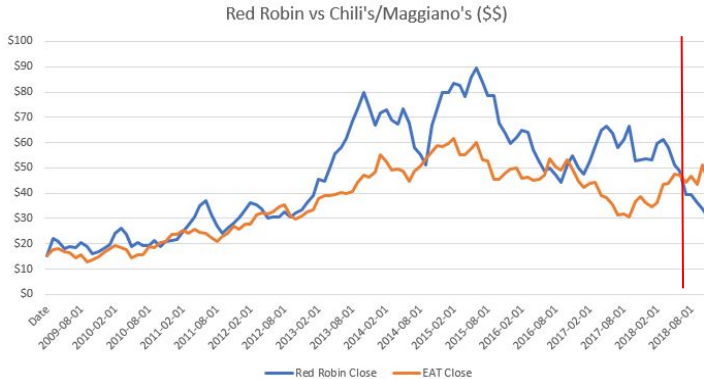
*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXPENSIVE_RESID)
Method: Least Squares
Date: 03/09/19 Time: 11:10
Sample (adjusted): 2009M04 2018M12
Included observations: 117 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXPENSIVE_RESID(-1)	-0.019403	0.023464	-0.826937	0.4100
C	-0.077310	0.169922	-0.454973	0.6500

R-squared	0.005911	Mean dependent var	-0.079431
Adjusted R-squared	-0.002733	S.D. dependent var	1.835272
S.E. of regression	1.837779	Akaike info criterion	4.071938
Sum squared resid	388.4045	Schwarz criterion	4.119158
Log likelihood	-236.2084	Hannan-Quinn criter.	4.091108
F-statistic	0.683824	Durbin-Watson stat	1.877700
Prob(F-statistic)	0.409985		

Average Expense Firm Cointegration



- Red Robin vs Chilli's and Maggiano's
- Cointegration at 1% level up until ~ 6/2018
- Monthly Error Correction of 17.10
- Slightly less than 6 months for correction

Through June 2018

Null Hypothesis: MIDDLE_RESID has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.257239	0.1877
Test critical values: 1% level	-3.487046	
5% level	-2.886290	
10% level	-2.580046	

*Mackinnon (1996) one-sided p-values.

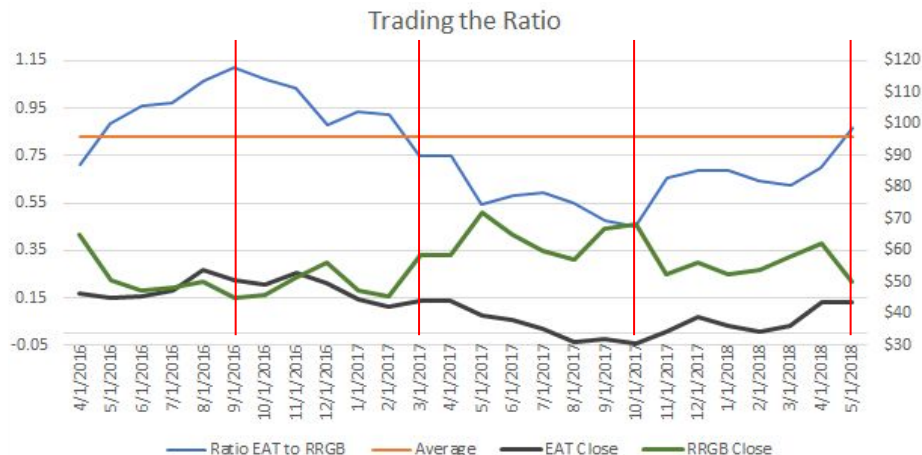
Up to June 2018

Null Hypothesis: COINRESID has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.504592	0.0096
Test critical values: 1% level	-3.490772	
5% level	-2.887909	
10% level	-2.580908	

Error Correction:	D(RED_RO...	D(EAT_CLO...
CointEq1	-0.171021 (0.04553)	0.026140 (0.03111)
	[-3.75636]	[0.84037]

The Pairs Trade



The Trade								
Date	Ratio (Avg: 0.83)	EAT	Buy or Short	EAT Profit	RRGB	Buy or Short	RRGB Profit	Holding Period
9/1/2016	1.12	\$50.43	Enter Short	\$ -	\$ 44.94	Enter Long	\$ -	
3/1/2017	0.75	\$43.96	Exit Short	\$ 6.47	\$ 58.45	Sell Long	\$ 13.51	6 Months
10/1/2017	0.45	\$30.72	Enter Long	\$ -	\$ 68.40	Enter Short	\$ -	7 Months
5/1/2018	0.87	\$43.73	Sell Long	\$ 13.01	\$ 50.35	End Short	\$ 18.05	7 Months
Total				\$ 19.48			\$ 31.56	20 Months

Profits	
Initial Capital	\$ 57.55
End Capital	\$ 108.59
Total Return	88.69%
Annualized Return	53.22%

Error Correction would be used as approximation for best holding period and holds true



Conclusion

- In addition to more expensive restaurants being statistically correlated with consumer sentiment, we have also found that mid-tier restaurants are also statistically correlated
- The mid-tier restaurants are also statistically correlated with the industry which we saw in the lower-tier restaurants
- Certain restaurant equities are not just correlated but also cointegrated, making pairs trading a viable investment strategy which if done correctly can produce great returns
- Changes in stock price are only partly due to economic factors, but using the pair trading strategy can help predict price changes and produce profits



References

- (1) Bureau of Economic Analysis
- (2) United States Department of Agriculture
- (3) Aaron Allen & Associates
- (4) Bureau of Labor Statistics
- (5) Committee for Economic Development
- (6) National Restaurant Association
- (7) Bureau of Labor Statistics