



Understanding Beta - Determinants of the US Stock Market

Summary

This study continues the analysis of Economics and Asset Valuations that was started in 2007 in *Mr*. *Shah's 'Crisis Notes'* and subsequently continued in 2016's '*The Failure of Macro Economics – Carry Trades, Money Flows and The Pricing of Assets'*.

I show that the primary determinant of the value of the US stock market is "Injected Capital". This is the driving force behind the Beta of most asset classes.

I define Injected Capital as investment capital that is not organically sourced from within the domestic economy from savings or growth. Instead it comes from three broad categories of non-indigenous sources:

- **Private Investment due to Carry Incentives from interest rate differentials**, leading to capital export (either savings or borrowings) by foreign investors;
- Holdings of US Treasuries by foreign central banks a form of Quantitative Easing ("QE") from the US' perspective;
- Quantitative Easing and asset/securities purchasing activity of central banks (including the Fed) that inject capital into their domestic economies, which is then exported to the US to purchase US financial assets instead of being invested in the local economy (I call this "QE Leakage").

I have already shown, in *The Failure of Macro Economics*, that the primary driver of US asset prices from the mid-1990s to the financial Crisis (2007) was Injected Capital from Japan – through the Yen Carry Trade, Samurai bonds, Japanese purchases of UST, and other forms of capital export from Japan.

Starting during the Financial Crisis, once the Fed lowered rates, Carry Incentives became negligible, resulting in a massive withdrawal of capital by Japan which resulted in a deleveraging event, and the declines of asset values experienced by all markets.

Quantitative Easing by the Fed in 2008 reinjected capital, replacing the withdrawal of capital and leverage, and drove asset values back upwards. Direct FED QE was supplemented by the UST purchases of other Central banks, mainly the BOJ and China, as well as by leakage from the QE programs of the BOJ, Bank of China, and, more recently, the ECB, which also delivered Capital Injection to the US markets.

In the following pages, I will conduct regression analysis to demonstrate the strength of these relationships.





The Final Models

As described above, my analysis shows that the US Stock Market behaved very differently pre- and post-QE, with most of post-QEs market performance being explained by the Fed's QE SOMA holdings. Pre-QE, however, there were many factors in play, primarily capital export from Japan.

I identify 3 models that capture the strength of relationships described above. Each of these has an R-Square of over 90%.

Model 1(95% R-Square) is a simple linear regression of all the variables I identify. Model 2A (90% R-Square) and 2B (96% R-Square) split up QE related variables into pre- and post-QE time series, and assign different coefficients to the variables for each period - Model 2A is a sequential combination of the coefficients identified for the 2 time periods, while 2B is a linear regression using the split time series.

The following graph shows the predicted values for each model.





Model Coefficients

	Model 1	Model 2A	Model 2B
R-Square	95%	90%	96%
Intercept ("IC")	2319.6	2548.3	4722.36
YCI: FF - BOJ	2228.9	1466.5	910.72
ECI: FF-ECB	-1466.6	303.4	-407.03
CCI: FF - China	70.7	-600.9	847.48
Samurai	8.5	101.2	118.87
Fed-SOMA Holdings	2.9		
BOJ-UST Holdings	7.6		
EURO-UST Holdings	3.2		
China-UST Holdings	-7.5		
Fed-SOMA PreQE		0.5	1.42
BOJ-UST PreQE		11.7	11.58
EURO-UST PreQE		-2.8	-3.39
China-UST PreQE		-24.7	-33.19
Fed-SOMA PostQE		4.94	2.59
BOJ-UST PostQE		-1.27	-1.07
EURO-UST PostQE		3.62	2.02
China-UST PostQE		-12.36	-4.62
BOJ - NON UST	0.6	-2.1	-0.21
ECB - NON UST	-1.4	-0.5	0.09
CHINA - NON UST	1.9	3.7	5.30

The 2 most significant variables each play a role in a different time period. The Yen Carry Incentive ("YCI"), including Samurai bonds, dominated valuation in the years prior to the Financial Crisis (and the onset of QE), while QE driven increases in the Fed's SOMA holdings determined valuations in the post-QE period, a relationship that still holds today. .

While all the other variables are significant, due to high degrees of correlation between variables, the coefficients are suspect and signs should not be viewed as precise.

With high explanatory power, there is not much room left in these models for other variables. As such, I believe that I have shown that these sources of Injected Capital are the primary determinants for US Stock Market Cap.





Conclusions

Currently, the Fed is looking to raise rates and withdraw QE, while Europe and Japan are simultaneously looking to lower rates into deeper negative territory, and further expand stimulus and QE. During this treacherous period, understanding the importance and workings of the Carry Incentives and Foreign QE should gain in importance in determining US investment valuations.

Stock market participants should note that the variables described are primarily from the FICC world, and in general, are likely to be foreign to them. Standard stock analysis tools, such as discount rates, PE ratios, volatility, etc. are conspicuously absent. For the past 15-20 years, they have not been necessary for aggregate valuation of stocks and market indices.

Most market participants are concerned about further rate hikes in the US. They are peering into an antiquated crystal ball – one from before the early 1990s, when rate hikes could cause money supply growth and asset inflation to slow down and reverse.

2016's stock market performance has primarily been driven by further rate cuts and QE in Japan and Europe, in conjunction with December's Fed fund's rate hike, which has pushed the YCI to 56 bps, from 18 bps in 2015. This has resulted in Japan's Outward Porfolio Investment (JIQCNUDT Index on Bloomberg) increasing, from \$500 B at the beginning of 2016 to \$5,161 B, a \$4.5 Trillion export of capital to the US (although much of it seems to be short term as the data is very volatile). Not coincidentally, the US stock market cap has gone up by about \$1T. Unfortunately, there is no corresponding data for Europe, nor is there a data series for incoming capital to the US.

In today's world, a US rate hike (with an increase in the Yen Carry Incentive) will likely lead to increasing US Money Supply from Japan and Europe, and subsequent investment inflation. Based on the coefficients measured in this study, a 50bps hike should lead to at least another \$500B increase in stock market valuation.

The greatest investment risk today comes from the Fed: were it to reduce QE, and sell its SOMA assets, there is a high likelihood that markets could crash again.

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Methodology

The Dependent Variable:

In *The Failure of Macro Economics*, I primarily used the S&P 500 Index as the benchmark, since the dataset goes back beyond 1994 when the Yen Carry Trade started.

In this study, I have used **the Bloomberg United States Exchange Market Capitalization** series *("WCAUUS Index")*. Since this is denominated in dollars, it allows for a more intuitive understanding of the magnitude of the impact of each independent variable. However, this series only starts on 9/22/2003.

The S&P 500 Index and the WCAUUS index are highly correlated, and the multiple of the Market Cap over the S&P Index has averaged 12.0, with a maximum of 12.7 and a minimum of 11.1, making them good substitutes for each other. I therefore multiple the S&P500 Index by 12 to generate an estimate for the US Exchange Market Cap for days prior to 9/22/2003.





The Independent Variables:

The following table describes the independent variables I will test, using data to 8/31/2016.

Injecting Country	Carry Incentives	US QE, incl Central	Foreign Quantitative
		Bank Holdings of	Easing
		USTs	
United States		FED System Open	
		Market Account	
		(SOMA) balance,	
		primarily USTs, agency	
		MBS and agency debt	
Japan	YCI: (Yen Carry	BOJ UST:	BOJ Non-UST:
	Incentive) Fed Funds –	BOJ Holdings of US	BOJ Balance Sheet
	BOJ Call rate	Treasuries, in \$	excluding UST holdings
			(in \$)
	Samurai Bonds (\$		
	denominated bonds		
	issued in Japan).		
Eurozone - ECB	ECI: FF – ECB Main	Euro UST: Total UST	Euro Non-UST: ECB
	Refinancing Operations	Holdings of UK, Spain,	Balance sheet, in \$, less
	Announcement Rate	France, Norway, Italy	Total UST Holdings of
		and Germany, in \$	UK, Spain, France,
			Norway, Italy, Germany
China	CCI: (China Carry	BOC UST: Bank of	BOC Non-UST: Bank
	Incentive) FF – China	China Holdings of US	of China Balance Sheet
	1yr Benchmark Lending	Securities, in \$	excluding UST
	Rate		holdings, in \$















Since I do not have the data for many of these series during the 1990s, all regressions that follow will use data from 9/1/2002 to 8/31/2016 (with the first part of the Market Cap Index, from 1/1/2002 to 9/22/2003, being estimated).

Model 1: 2002-2016 - All variables described above

As described in detail in *The Failure of Macro Economics*, the Yen Carry Trade did not significantly impact US investment pricing until after the Tiger Management and LTCM failures, when the phrase entered the vernacular, and financial newspapers and TV shows began reporting about hedge funds usage of this strategy. Banks embraced this strategy in the early 2000s to leverage their own balance sheets to take advantage Basel's Risk Based Capital guidelines, which resulted in the dominance of Carry Financing to fund US assets.

Model 1: Regression Statistics 2002-2016					
Multiple R	0.97				
R Square	0.94				
Adjusted R Square	0.94				
Standard Error	993.28				
Observations	3827				

		Standard		
Model 1	Coeffici-ents	Error	t Stat	P-value
Intercept ("IC")	2978.0	312.8	9.5	0.0
YCI: FF - BOJ	2189.0	42.2	51.9	0.0
ECI: FF-ECB	-1459.8	72.1	-20.3	0.0
CCI: FF - China	65.1	59.3	1.1	0.3
Samurai	8.3	2.8	3.0	0.0
Fed - SOMA	3.2	0.1	32.4	0.0
BOJ - UST	7.2	0.4	19.0	0.0
EURO - UST	1.3	0.3	3.6	0.0
CHINA - UST	-6.9	0.3	-25.3	0.0
BOJ - NON UST	0.5	0.1	6.1	0.0
ECB - NON UST	-1.1	0.1	-17.3	0.0
CHINA - NON UST	1.6	0.1	16.5	0.0

I expect there to be multicollinearity and auto-correlation between these variables, making most of the individual coefficients and signs suspect.







As you can see, in spite of the high R squared and T-statistics, there are still some problems, with the residuals overshooting. The residuals suggest some missing variables that we have not identified.

One obvious problem arises from the end-of-month Central Bank Balance Sheet data. Since Open Market & QE operations are announced in advance, and conducted during the month, injecting capital, moving this data forward should bring in into line with the capital injection and impact on the markets.

Other errors are from multi-correlation between the variables. For example, since the financial crisis was a global event, policy rate decisions by central banks as well as their UST & QE purchases, especially after 2007, appear correlated if not coordinated.

While these make the individual coefficients (and signs) suspect, the strength of the aggregate relationship is still interesting.











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	Mkt Cap	YCI	ECI	CCI	Samu- rai	Fed - SOMA	BOJ - UST	EURO - UST	CHINA - UST	BOJ - NON UST	ECB - NON UST	CHINA - NON UST
Mkt Cap	1.00											
YCI	-0.11	1.00										
ECI	0.45	0.67	1.00									
ССІ	-0.08	<mark>0.93</mark>	0.72	1.00								
Samurai Bonds	-0.35	-0.02	-0.30	-0.17	1.00							
Fed – SOMA	<mark>0.82</mark>	-0.58	0.13	-0.50	-0.26	1.00						
BOJ – UST	0.79	-0.53	0.17	-0.51	-0.20	0.95	1.00					
EURO – UST	0.73	-0.50	0.09	-0.45	-0.02	0.88	0.84	1.00				
CHINA – UST	0.63	-0.64	-0.03	-0.65	0.08	0.91	0.92	0.85	1.00			
BOJ - NON UST	0.78	-0.49	0.14	-0.33	-0.38	0.89	0.81	0.78	0.72	1.00		
CHINA - NON UST	0.49	-0.60	-0.10	-0.65	0.19	0.77	0.84	0.77	0.93	0.62	1.00	
ECB - NON UST	0.70	-0.62	-0.02	-0.63	0.06	0.92	0.93	0.88	0.99	0.75	0.92	1.00

Using the regression coefficients and graphs above, one sees that

- a) Prior to 2008, Interest Rate Policy and Carry Incentives played a critical role in asset valuation and appreciation in the years leading up to the Financial Crisis.
- b) The Yen Carry Incentive plus the BOJ Balance sheet explain much of the behavior and value of the stock market prior to 2008, including the large sell off (crash) in 2007 (as a result of Fed Rate Cuts).
- c) SOMA and Fed balance sheet was not a significant determinant of the stock market valuation prior to 2008.
- d) SOMA was almost totally responsible for the market's value post QE/2008!
- e) **One can see the YCI coming into play again in 2016** as negative rates in Japan (and Europe) combined with the 2015 Fed Fund hike result in the US stock market continuing its rally.
- f) The models for the 2 periods, pre- and post-US QE, are almost independent, with one set of independent variables turning on (QE) just as the prior set (Carry Incentives) turns off.





Correcting for Lagged Data

Since all the 'balance' variables are reported monthly, at the end-of-month, they lag the actual economic event of the purchasing of USTs or the injection of QE. Central bank investment programs are also usually announced ahead of time, and the market tends to respond at the time of the announcement. Therefore, we have moved all the balance data forward by 1 month.

We rerun Model 1, using this adjusted data, using all the variables defined above. This changes the period of study by 1 month.

The model's fit improves marginally. All subsequent analysis uses this time-adjusted data.

Regression Statistics 2002-2016				
Multiple R	0.97			
R Square	0.95			
Adjusted R Square	0.95			
Standard Error	952.24			
Observations	0.97			

		Standard		
Model 1 – lag corrected	Coefficients	Error	t Stat	P-value
Intercept ("IC")	2319.6	313.4	7.4	0.0
YCI: FF - BOJ	2228.9	44.1	50.5	0.0
ECI: FF-ECB	-1466.6	71.0	-20.7	0.0
CCI: FF - China	70.7	58.3	1.2	0.2
Samurai	8.5	2.7	3.2	0.0
Fed - SOMA	2.9	0.1	29.0	0.0
BOJ - UST	7.6	0.4	21.1	0.0
EURO - UST	3.2	0.3	9.3	0.0
CHINA - UST	-7.5	0.3	-28.0	0.0
BOJ - NON UST	0.6	0.1	8.4	0.0
ECB - NON UST	-1.4	0.1	-22.1	0.0
CHINA - NON UST	1.9	0.1	19.7	0.0



Model 2 - Modeling the US Market Cap as separate time periods - Pre- and Post- QE

On November 25, 2008, the Fed announced that it would purchase up to \$600B in agency mortgaged backed securities (MBS) and agency debt, commencing QE.

Model 2-Carry: The Carry Period – pre-QE:

Regression Statistics 2002-2008					
Multiple R	0.94				
R Square	0.89				
Adjusted R Square	0.89				
Standard Error	798.33				
Observations	1800.00				

	Coeffici-	Standard		
Model 2-Carry	ents	Error	t Stat	P-value
Intercept ("IC")	2548.3	832.8	3.1	0.0
YCI: FF - BOJ	1466.5	196.2	7.5	0.0
ECI: FF-ECB	303.4	139.7	2.2	0.0
CCI: FF - China	-600.9	148.6	-4.0	0.0
Samurai	101.2	9.4	10.7	0.0
Fed - SOMA	0.5	0.2	2.9	0.0
BOJ - UST	11.7	0.4	26.3	0.0
EURO - UST	-2.8	0.8	-3.7	0.0
CHINA - UST	-24.7	1.6	-15.4	0.0
BOJ - NON UST	-2.1	0.3	-7.5	0.0
ECB - NON UST	-0.5	0.3	-1.5	0.1
CHINA - NON UST	3.7	0.4	9.6	0.0





Model 2-QE: The "QE" Period –from 11/25/2008:

We regress all the variables identified above. Many of the coefficients change value and signs, compared to their coefficients in Model 2-Carry, signifying a changes in the strength of the relationship.

Regression Statistics 2008-2016				
Multiple R	0.99			
R Square	0.97			
Adjusted R Square	0.97			
Standard Error	741.34			
Observations	2004			

	Coeffici-	Standard		
Model 2-QE	ents	Error	t Stat	P-value
Intercept ("IC")	802.83	1148.79	0.70	0.48
YCI: FF - BOJ	-974.34	292.86	-3.33	0.00
ECI: FF-ECB	215.41	110.09	1.96	0.05
CCI: FF - China	872.76	79.20	11.02	0.00
Samurai	45.04	9.27	4.86	0.00
Fed - SOMA	2.07	0.13	15.53	0.00
BOJ - UST	3.58	0.73	4.91	0.00
EURO - UST	2.31	0.36	6.48	0.00
CHINA - UST	-2.22	0.29	-7.71	0.00
BOJ - NON UST	0.07	0.11	0.66	0.51
ECB - NON UST	-0.60	0.09	-6.35	0.00
CHINA - NON UST	2.96	0.22	13.37	0.00





<u>Regressing only the Fed's SOMA balance vs Market Cap, we see that it almost entirely explains the</u> market's performance since 2008.

Regression Statistics 2008-2016			
Multiple R	0.98		
R Square	0.96		
Adjusted R Square	0.96		
Standard Error	927.86		
Observations	2004		

	Coeffici-	Standard	ñ	
Model 2-Carry	ents	Error	t Stat	P-value
Intercept ("IC")	5469.13	60.98	89.69	0.00
Fed - SOMA	4.25	0.02	218.29	0.00

The coefficient of 4.25 for SOMA is almost double that computed in the prior regression, 2.07,

suggesting that many of the other variables are correlated to SOMA – the primary suspects being the UST holdings of foreign central banks, which are a form of direct QE to the US.

Combining SOMA + BOJ-UST + Euro-UST + China-UST, and conducting a regression, results in a QE coefficient of 3.12, with a T-Stat of 185, and R-squared of 0.945.



Some analysis on the impact of Japan and China's UST holdings can be found in Mr. Shah's '*Interest Rate Swaps as a Benchmark*' article, dated 2/9/2016.

In spite of the correlations, it is important to keep the other variables in the model, as future reductions in foreign UST holdings are likely to impact US Swap Spreads and other asset prices.

The true impact of the Fed's balance sheet in the post-QE period probably lies between 2 and 4. We will attempt to isolate this in the next sections.



Testing Model 2-Carry "out of period" post-QE

We then see how the Pre-QE model coefficients perform in the post-QE markets.

Using the coefficients from the Pre-QE period - Model 2-Carry (including SOMA) - on the post-QE data, we get the following projection, with not only a low correlation, but a divergence. (-7 correlation!)



Intuitively, this makes sense. The markets and asset valuations were dominated by the Carry Trade pre-2007. Once rates were cut, the Carry Incentives essentially declined to zero. Also, in the pre-QE periods, much of the Foreign Central Bank UST holdings were related to flights to quality and attempts to weaken currencies. Post QE, these were more direct injections into the respective banking systems.

However, the recent negative interest rates in other countries, in combination with the Fed Funds hike in the US, imply that the Carry Trade is not quite dead, but is rearing its head. It will be important to track this.

The decline in the predicted value starting in late 2014 is related to the reduction in the BOJ and China's UST holdings. I have discussed this in the '*Interest Rates Swaps as a Benchmark*' article, identifying these as the causes for negative swap spreads. It appears that the stock markets have not responded to these issues, that have caused much consternation in fixed income markets.



Isolating the effect of Post-QE stimulus

For the next step, we split the Post November 25th 2008 QE and UST holdings into Pre-QE and Post-QE variables: Pre- QE variables are held at a constant using November 24 levels for the following variables: SOMA, BOJ-UST, Euro-UST and China-UST.

New Constants	Level (\$B)
Fed-SOMA PreQE	\$490.86
BOJ-UST PreQE	\$625.20
Euro-UST PreQE	\$261.10
China-UST PreQE	\$713.20

The excess of each of the SOMA, BOJ-UST, Euro-UST and China-UST over these constants, for the post QE period, are the new variables, used to isolate the impact of QE during the crisis, over the prior period levels of these variables.

We reassess Model 2-Carry using these constants instead of the full post-QE SOMA and foreign UST holdings.

This prediction can be interpreted as the level that the stock market might have been without QE and UST purchasing stimulus.

The error between the market level and the predictions from the other variables will be used to assess the impact of increases in post-QE SOMA and UST stimulus.





Model 2-QE: Post QE Stimulus

Dependent Variable: Difference between Market Cap and Model-Carry prediction

	Regression Results
R-Squared	0.96
Intercept	0
Post QE Fed-SOMA	4.94
	(t: 44.7)
Post QE BOJ-UST	-1.27
	(t: -2.3)
Post QE Euro-UST	3.62
	(t : 5.0)
Post QE China-UST	-12.36
	(t: -30.8)





Model 2: Combining pre-QE and post-QE models

A. Sequentially combining Model 2-Carry and Model 2-QE



		Standard		
Model 2A	Coefficients	Error	t Stat	P-value
Intercept ("IC")	2548.3	832.8	3.1	0.0
YCI: FF - BOJ	1466.5	196.2	7.5	0.0
ECI: FF-ECB	303.4	139.7	2.2	0.0
CCI: FF - China	-600.9	148.6	-4.0	0.0
Samurai	101.2	9.4	10.7	0.0
Fed-SOMA PreQE	0.5	0.2	2.9	0.0
BOJ-UST PreQE	11.7	0.4	26.3	0.0
EURO-UST PreQE	-2.8	0.8	-3.7	0.0
China-UST PreQE	-24.7	1.6	-15.4	0.0
Fed-SOMA PostQE	4.94	0.11	44.66	0.00
BOJ-UST PostQE	-1.27	0.56	-2.26	0.02
EURO-UST PostQE	3.62	0.72	5.00	0.00
China-UST PostQE	-12.36	0.40	-30.84	0.00
BOJ - NON UST	-2.1	0.3	-7.5	0.0
ECB - NON UST	-0.5	0.3	-1.5	0.1
CHINA - NON UST	3.7	0.4	9.6	0.0

The R-Square for this model is 0.90.



B. Regression on 2002-2016 series with split QE variables



Model 2: Regression Statistics 2002-2016			
Multiple R	0.98		
R Square	0.96		
Adjusted R Square	0.96		
Standard Error	838.78		
Observations	3804		

		Standard		
Model 2B	Coefficients	Error	t Stat	P-value
Intercept ("IC")	4722.36	316.13	14.94	0.00
YCI: FF - BOJ	910.72	65.02	14.01	0.00
ECI: FF-ECB	-407.03	74.80	-5.44	0.00
CCI: FF - China	847.48	60.48	14.01	0.00
Samurai	118.87	5.40	22.03	0.00
Fed-SOMA PreQE	1.42	0.14	10.36	0.00
BOJ-UST PreQE	11.58	0.37	31.14	0.00
EURO-UST PreQE	-3.39	0.59	-5.70	0.00
China-UST PreQE	-33.19	0.88	-37.74	0.00
Fed-SOMA PostQE	2.59	0.13	19.99	0.00
BOJ-UST PostQE	-1.07	0.69	-1.55	0.12
EURO-UST PostQE	2.02	0.39	5.13	0.00
China-UST PostQE	-4.62	0.28	-16.26	0.00
BOJ - NON UST	-0.21	0.07	-2.83	0.00
ECB - NON UST	0.09	0.07	1.22	0.22
CHINA - NON UST	5.30	0.17	31.84	0.00





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