



TRADING COST MODELS ACROSS MULTIPLE ASSET CLASSES AND THEIR USE IN INVESTMENT DECISIONS

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Outline

- **Market Impact Model**
 - Model, Parameters, & Reformulation
- **Equity Trading Costs**
 - Pre-Trade, Post Trade, and Value-Add
- **Liquidity Risk**
 - LF Factor
- **Multi-Asset Trading Costs**
 - Estimating Cost & Evaluating Performance, Comparison
- **Portfolio Management**
 - Back-Testing, Historical TCA & Imbalance Data
 - What-If / Sensitivity Analysis

SECTION 1

I-Star Market Impact Model

I-Star Market Impact Model - Transparency

$$I_{bp}^* = \hat{a}_1 \cdot Size^{\hat{a}_2} \cdot \sigma^{\hat{a}_3}$$
$$MI_{bp} = \hat{b}_1 \cdot I^* \cdot POV^{\hat{a}_4} + (1 - \hat{b}_1) \cdot I^*$$

Variables:

Size = % ADV (expressed as a decimal)

σ = annualized volatility (expressed as a decimal)

POV = percentage of volume (expressed as a decimal)

a_1, a_2, a_3, a_4, b_1 = model parameters

Constraints: $a_k > 0$; $0 \leq b_1 \leq 1$

Source: Optimal Trading Strategies, Science of Algorithmic Trading and Portfolio Management

I-Star Market Impact Model - Transparency

$$MI_{bp} = \underbrace{\hat{b}_1 \cdot I^* \cdot POV^{\hat{a}_4}}_{\text{Temporary Impact}} + \underbrace{(1 - \hat{b}_1) \cdot I^*}_{\text{Permanent Impact}}$$

I-Star (Factored)

$$I_{bp}^* = a_1 \cdot \left(\frac{1}{ADV} \right)^{a_2} \cdot Shares^{a_2} \cdot \sigma^{a_3}$$

$$Shares = \$Dollars/Price$$

$$I_{bp}^* = a_1 \cdot \left(\frac{1}{ADV} \right)^{a_2} \cdot \left(\frac{1}{Price} \right)^{a_2} \cdot \sigma^{a_3} \cdot Dollars^{a_2}$$

I-Star Impact Model (Reformulated)

$$I_{bp}^* = a_1 \cdot \underbrace{\left(\frac{1}{ADV}\right)^{a2} \cdot \left(\frac{1}{Price}\right)^{a2} \cdot \sigma^{a3}}_{k_1} \cdot Dollars^{a2}$$

$$I_{bp}^* = k_1 \cdot Dollars^{a2}$$

$$POV = f(time)$$

$$MI = b_1 \cdot (I^* \cdot time^{k2}) + (1 - b_1) \cdot (I^*)$$

Developing a MI Factor Score

Starting with I-Star Model:

$$I^* = \hat{a}_1 \cdot \left(\frac{S}{ADV} \right)^{\hat{a}_2} \cdot \sigma^{\hat{a}_3}$$

Rearrange the equation:

$$I^*(Share) = \left\{ \hat{a}_1 \cdot \sigma^{\hat{a}_3} \cdot \left(\frac{1}{ADV} \right)^{\hat{a}_2} \right\} \cdot S^{\hat{a}_2}$$

$$I^*(Dollar\$) = \left\{ \hat{a}_1 \cdot \sigma^{\hat{a}_3} \cdot \left(\frac{1}{ADV} \right)^{\hat{a}_2} \right\} \cdot \left(\frac{Dollars\$}{P} \right)^{\hat{a}_2}$$

We have our MI LF Factor score:

$$\alpha^*(Shares) = \hat{a}_1 \cdot \sigma^{\hat{a}_3} \cdot \left(\frac{1}{ADV} \right)^{\hat{a}_2}$$

$$\alpha^*(Dollars\$) = \hat{a}_1 \cdot \sigma^{\hat{a}_3} \cdot \left(\frac{1}{ADV} \right)^{\hat{a}_2} \cdot \left(\frac{1}{P} \right)^{\hat{a}_2}$$

SECTION 2

Global Equity Trading Costs

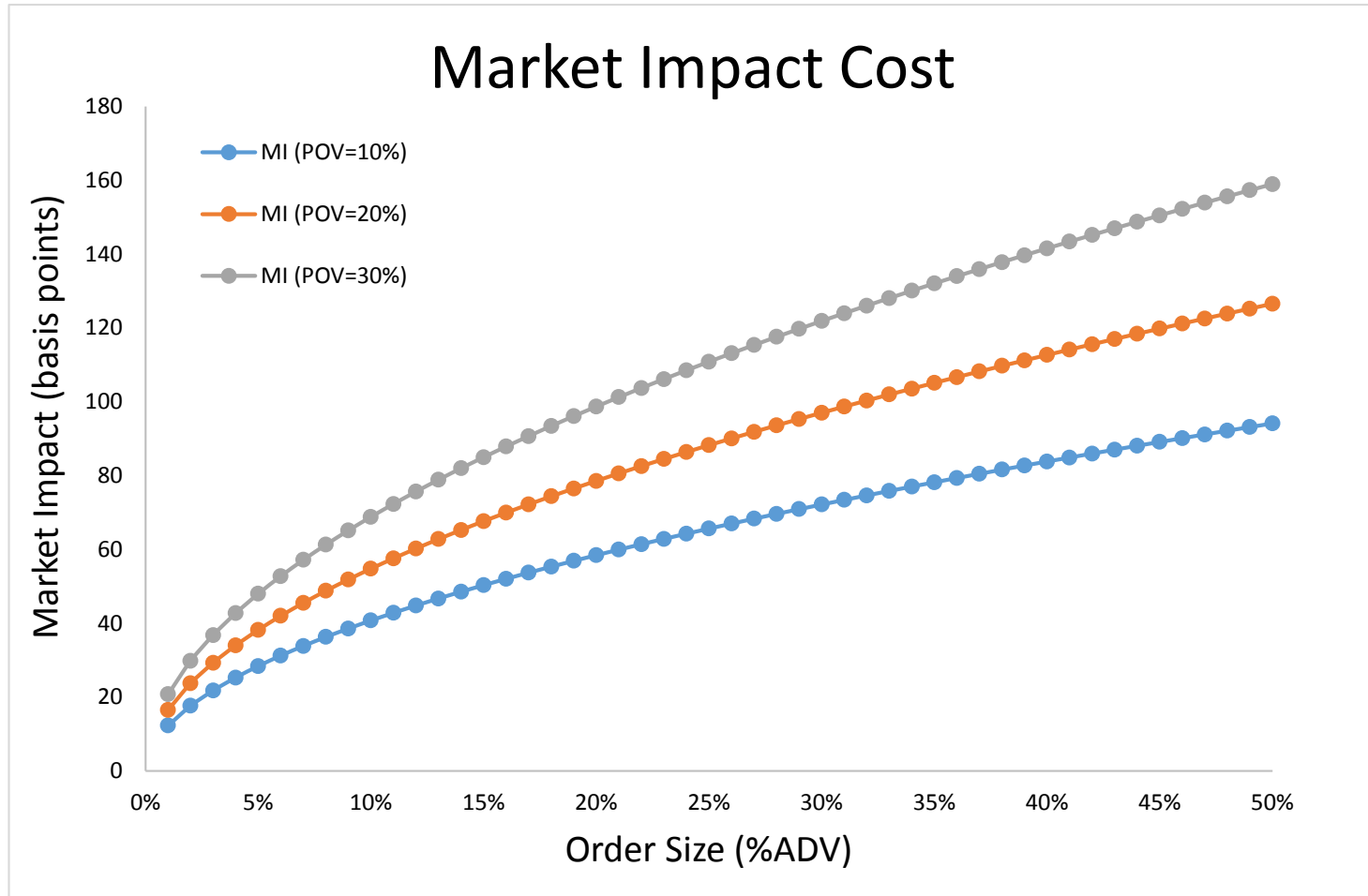
Global Trading Cost Parameters

Global Trading Costs													
Quantity expressed in terms of Order Size (%ADV)													
Parameter	Developed							Emerging		Emerging		Latam	Frontier
	US-LC	US-SC	Canada	Europe	Australia	Hong Kong	Japan	China	Europe	Asia			
a1:	1507.5	1831.7	1525.6	1772.7	1809.9	1333.4	1543.7	1351.2	1945.9	2431.9	2356.0	2756.0	
a2:	0.38	0.45	0.41	0.60	0.65	0.50	0.49	0.41	0.56	0.52	0.52	0.42	
a3:	0.94	0.91	0.95	0.81	0.60	0.81	0.85	0.91	0.74	0.92	1.05	1.05	
a4:	1.05	1.04	0.94	1.05	0.94	0.95	0.93	0.96	1.00	1.00	0.80	0.80	
b1:	0.97	0.93	0.97	0.90	0.95	0.94	0.95	0.90	0.83	0.84	0.81	0.82	
Size (%ADV)	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	
Volatility	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	
POV Rate	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%	
I-Star (bp)	169.6	183.1	159.0	144.1	177.5	137.4	152.3	148.9	192.1	205.1	166.0	244.4	
MI (bp)	18.4	27.0	21.0	24.8	26.6	21.5	23.0	28.3	46.8	48.5	51.3	73.4	

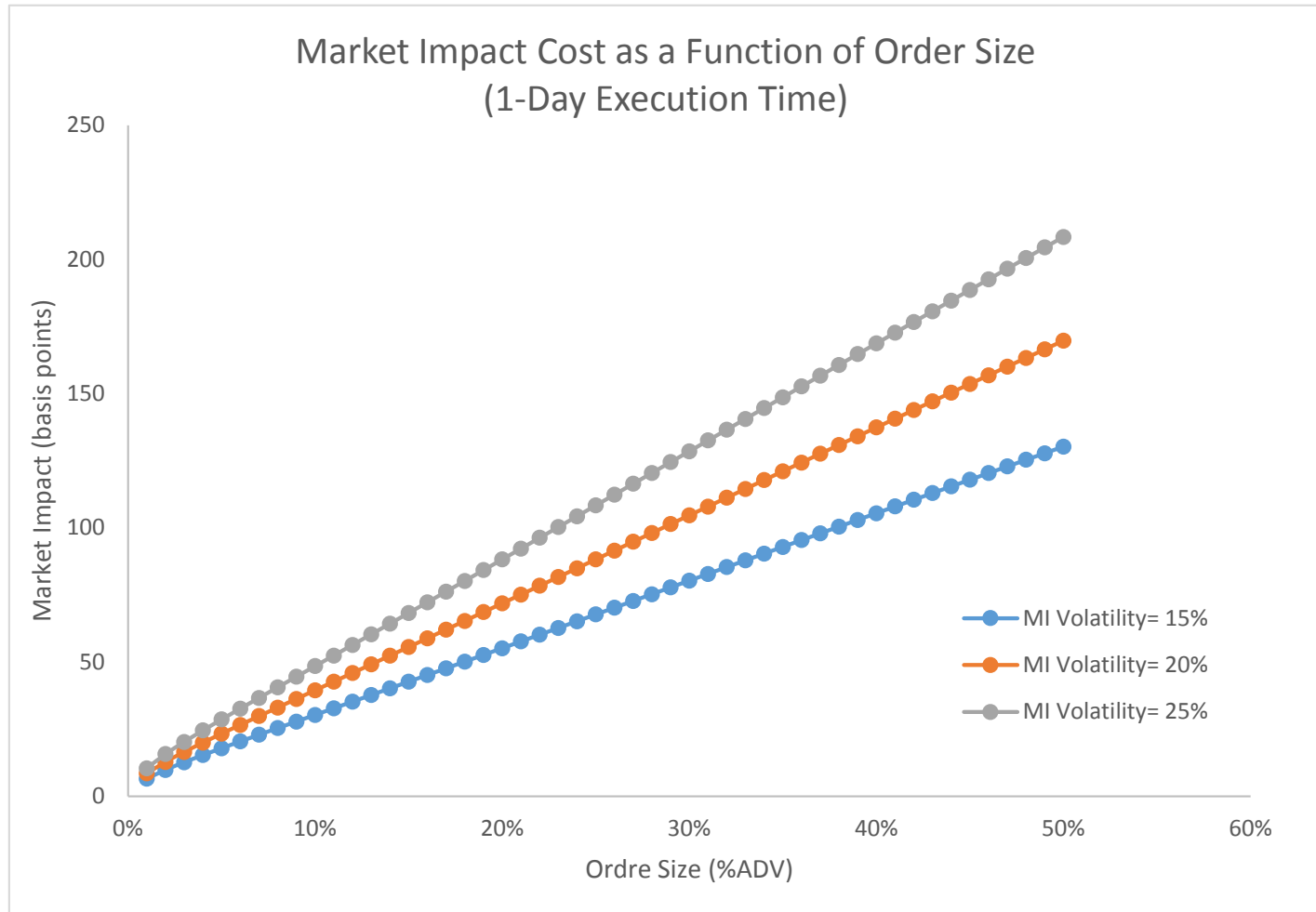
$$I_{bp}^* = \hat{a}_1 \cdot Size^{\hat{a}_2} \cdot \sigma^{\hat{a}_3}$$

$$MI_{bp} = \hat{b}_1 \cdot I^* \cdot POV^{\hat{a}_4} + (1 - \hat{b}_1) \cdot I^*$$

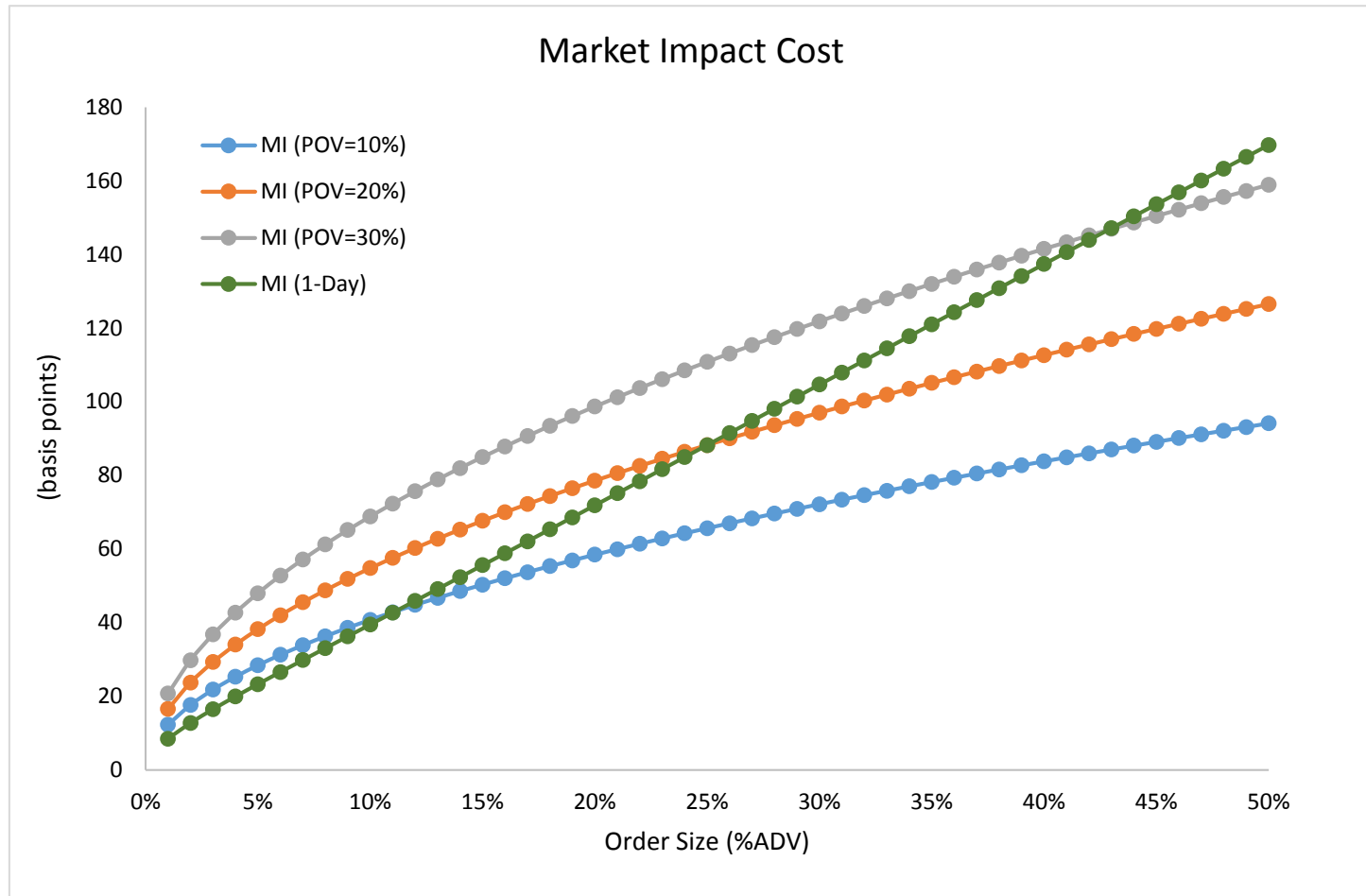
Market Impact Cost – Emerging Asia



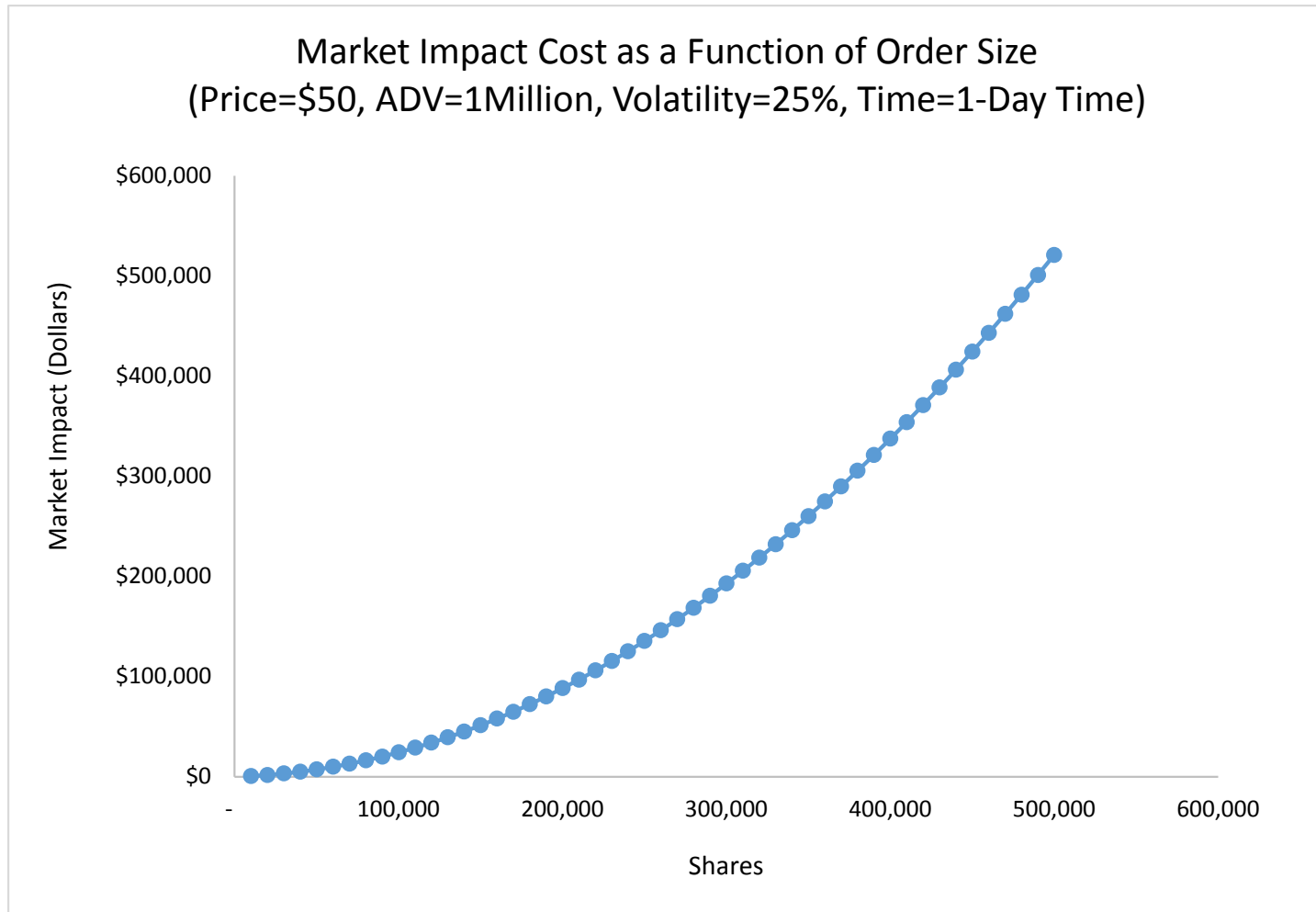
Market Impact Cost – Emerging Asia



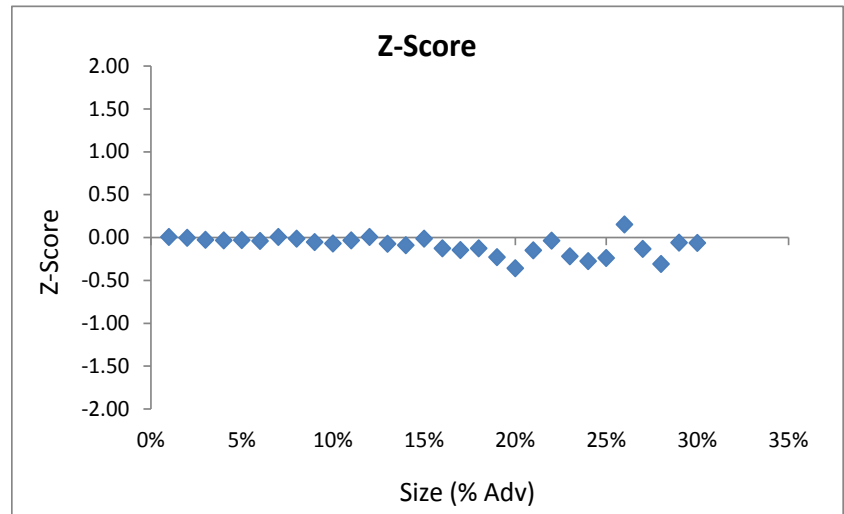
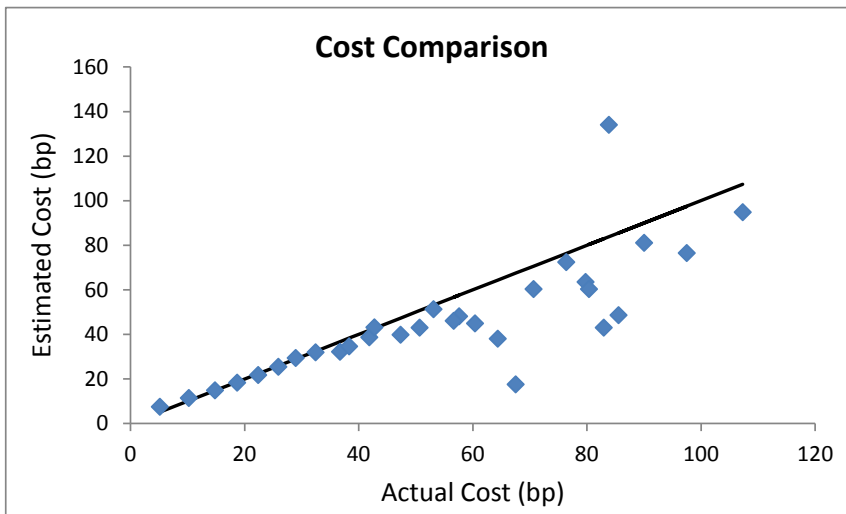
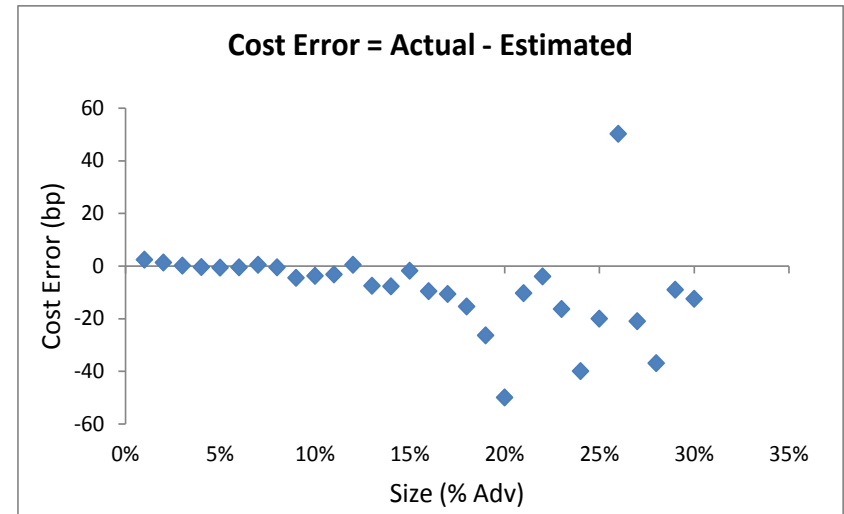
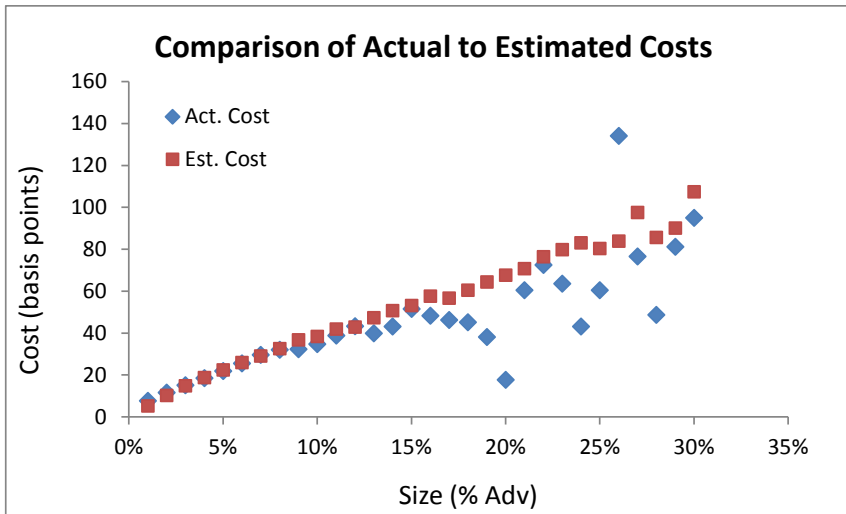
Market Impact Cost – Emerging Asia



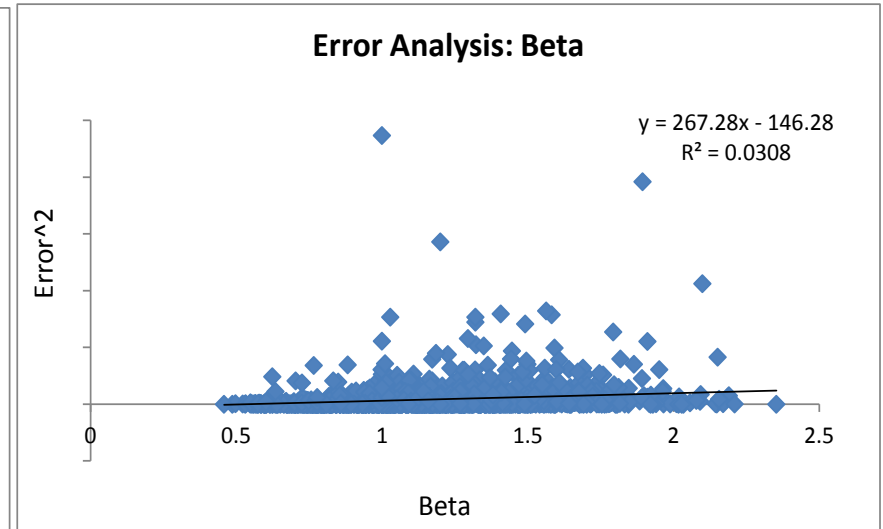
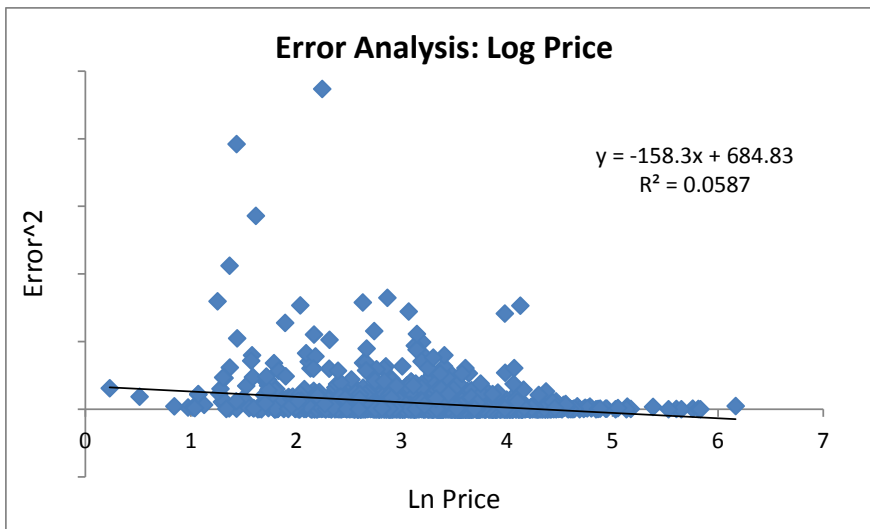
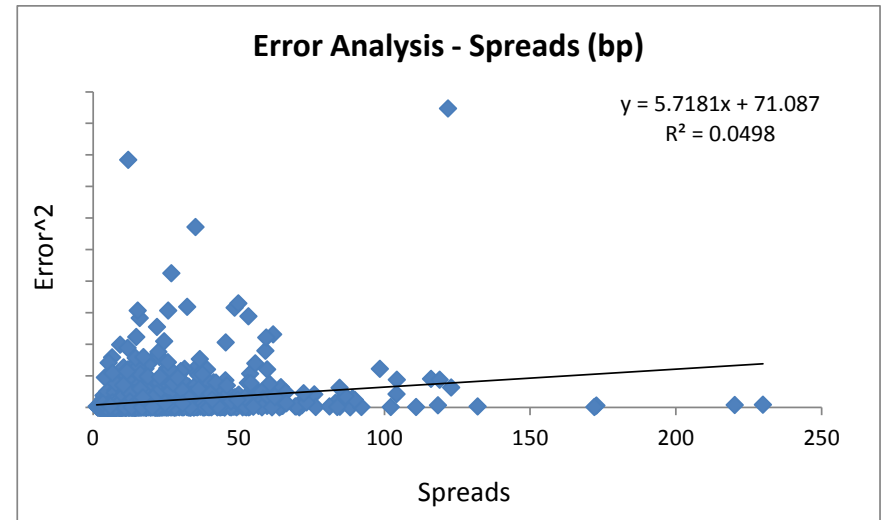
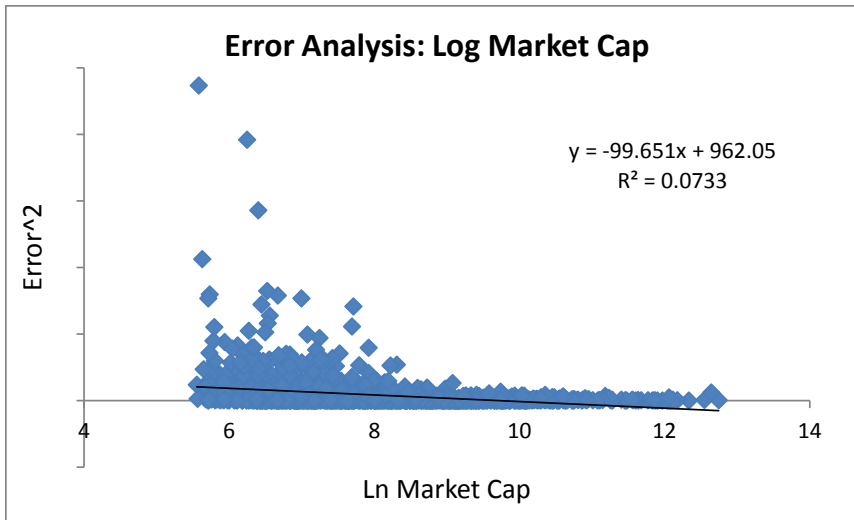
Market Impact Cost – Emerging Asia



Model Performance

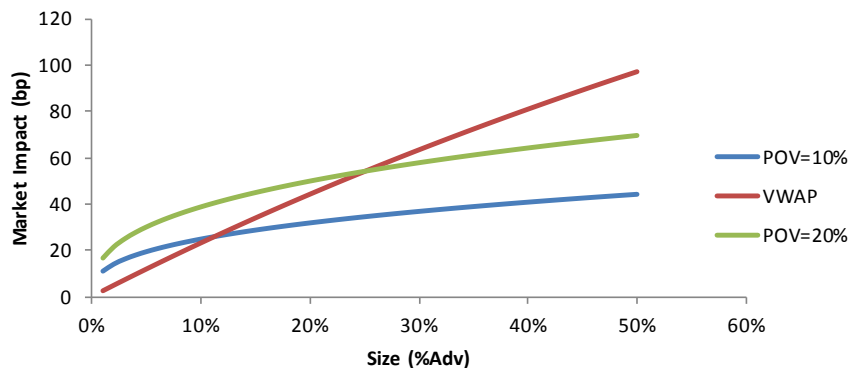


Error Analysis

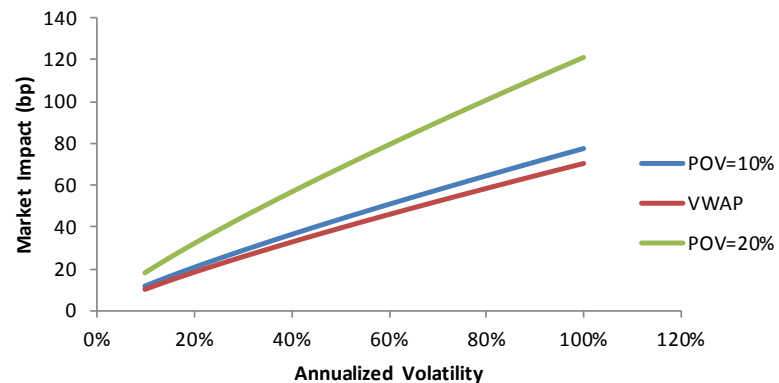


Cost Analysis – Single Stock

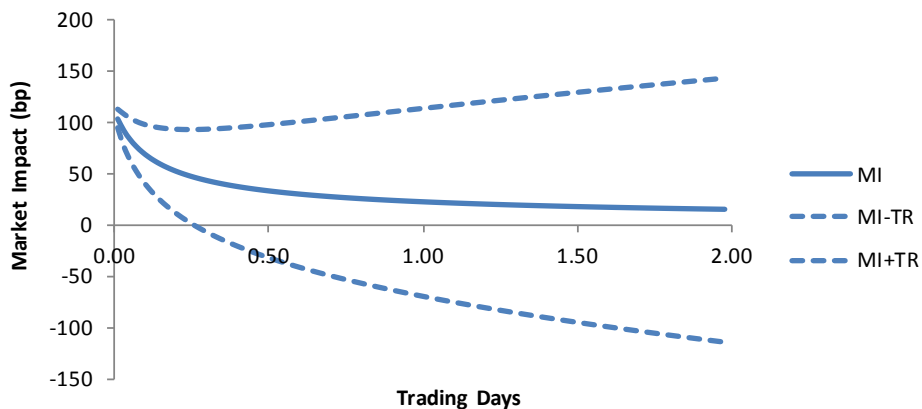
Market Impact as a function of Size (%Adv)



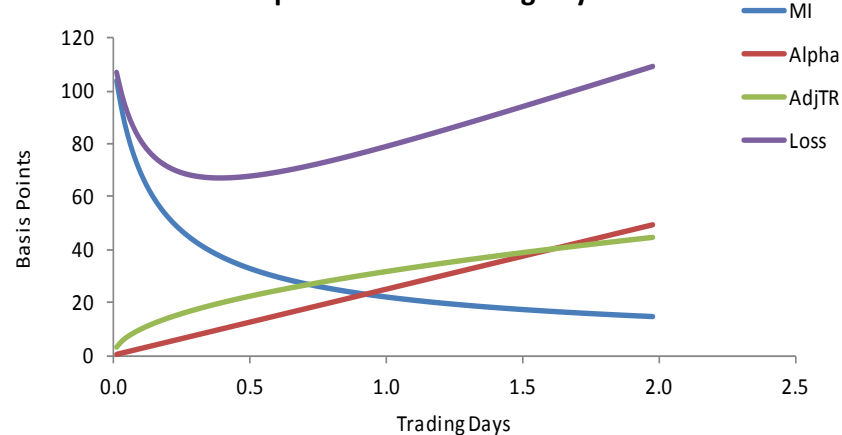
Market Impact as a function of Volatility



Market Impact as a function of Time



Optimization - Trading Days



Cost Curves – Global Stocks & ETFs

Trade List			
Symbol:	MA	Cost Units:	\$/share
Data:	KRG	Strategy:	Time

Stock Characteristics			
Price:	\$96.00	Spread:	4.4
Volatility:	35%	Beta:	1.25
		ADV:	4,550,000
		Mkt Cap:	67,570

Goto Intro

Single Stock Cost Curves														
%ADV	Shares	Trading Strategy - % of Trade Day in \$/share												
		0.10	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
0.5%	22,750	\$0.07	\$0.04	\$0.03	\$0.02	\$0.02	\$0.02	\$0.02	\$0.01	\$0.01	\$0.01	\$0.01	\$0.01	\$0.01
1%	45,500	\$0.13	\$0.08	\$0.05	\$0.04	\$0.03	\$0.03	\$0.03	\$0.03	\$0.02	\$0.02	\$0.02	\$0.02	\$0.02
2%	91,000	\$0.25	\$0.15	\$0.10	\$0.08	\$0.06	\$0.06	\$0.05	\$0.05	\$0.04	\$0.04	\$0.04	\$0.04	\$0.04
3%	136,500	\$0.35	\$0.21	\$0.14	\$0.11	\$0.09	\$0.08	\$0.07	\$0.07	\$0.06	\$0.06	\$0.06	\$0.05	\$0.05
4%	182,000	\$0.45	\$0.28	\$0.19	\$0.15	\$0.12	\$0.11	\$0.10	\$0.09	\$0.08	\$0.08	\$0.07	\$0.07	\$0.07
5%	227,500	\$0.54	\$0.34	\$0.23	\$0.18	\$0.15	\$0.13	\$0.12	\$0.11	\$0.10	\$0.10	\$0.09	\$0.08	\$0.08
6%	273,000	\$0.62	\$0.40	\$0.27	\$0.22	\$0.18	\$0.16	\$0.14	\$0.13	\$0.12	\$0.11	\$0.11	\$0.10	\$0.10
7%	318,500	\$0.70	\$0.46	\$0.32	\$0.25	\$0.21	\$0.19	\$0.17	\$0.15	\$0.14	\$0.13	\$0.12	\$0.12	\$0.11
8%	364,000	\$0.77	\$0.52	\$0.36	\$0.28	\$0.24	\$0.21	\$0.19	\$0.17	\$0.16	\$0.15	\$0.14	\$0.13	\$0.13
9%	409,500	\$0.84	\$0.57	\$0.40	\$0.32	\$0.27	\$0.24	\$0.21	\$0.19	\$0.18	\$0.17	\$0.16	\$0.15	\$0.14
10%	455,000	\$0.91	\$0.63	\$0.44	\$0.35	\$0.30	\$0.26	\$0.23	\$0.21	\$0.20	\$0.18	\$0.17	\$0.16	\$0.15
12%	546,000	\$1.00	\$0.70	\$0.49	\$0.40	\$0.34	\$0.29	\$0.26	\$0.24	\$0.22	\$0.21	\$0.20	\$0.18	\$0.18
14%	637,000	\$1.08	\$0.77	\$0.55	\$0.44	\$0.37	\$0.33	\$0.29	\$0.27	\$0.25	\$0.23	\$0.22	\$0.21	\$0.19
16%	728,000	\$1.16	\$0.83	\$0.60	\$0.48	\$0.41	\$0.36	\$0.32	\$0.30	\$0.27	\$0.25	\$0.24	\$0.23	\$0.21
18%	819,000	\$1.24	\$0.90	\$0.65	\$0.52	\$0.45	\$0.39	\$0.35	\$0.32	\$0.30	\$0.28	\$0.26	\$0.25	\$0.23
20%	910,000	\$1.31	\$0.96	\$0.70	\$0.56	\$0.48	\$0.42	\$0.38	\$0.35	\$0.32	\$0.30	\$0.28	\$0.27	\$0.25
22%	1,001,000	\$1.38	\$1.02	\$0.75	\$0.60	\$0.52	\$0.45	\$0.41	\$0.37	\$0.35	\$0.32	\$0.30	\$0.29	\$0.27
24%	1,092,000	\$1.45	\$1.08	\$0.79	\$0.64	\$0.55	\$0.49	\$0.44	\$0.40	\$0.37	\$0.35	\$0.32	\$0.31	\$0.29
26%	1,183,000	\$1.51	\$1.14	\$0.84	\$0.68	\$0.59	\$0.52	\$0.47	\$0.43	\$0.39	\$0.37	\$0.35	\$0.33	\$0.31
28%	1,274,000	\$1.57	\$1.19	\$0.88	\$0.72	\$0.62	\$0.55	\$0.49	\$0.45	\$0.42	\$0.39	\$0.37	\$0.35	\$0.33
30%	1,365,000	\$1.63	\$1.24	\$0.93	\$0.76	\$0.65	\$0.58	\$0.52	\$0.48	\$0.44	\$0.41	\$0.39	\$0.37	\$0.35
32%	1,456,000	\$1.68	\$1.30	\$0.97	\$0.80	\$0.69	\$0.61	\$0.55	\$0.50	\$0.46	\$0.43	\$0.41	\$0.39	\$0.37
34%	1,547,000	\$1.74	\$1.35	\$1.02	\$0.84	\$0.72	\$0.64	\$0.58	\$0.53	\$0.49	\$0.46	\$0.43	\$0.40	\$0.38
36%	1,638,000	\$1.79	\$1.40	\$1.06	\$0.87	\$0.75	\$0.67	\$0.60	\$0.55	\$0.51	\$0.48	\$0.45	\$0.42	\$0.40
38%	1,729,000	\$1.84	\$1.44	\$1.10	\$0.91	\$0.78	\$0.70	\$0.63	\$0.58	\$0.53	\$0.50	\$0.47	\$0.44	\$0.42
40%	1,820,000	\$1.89	\$1.49	\$1.14	\$0.94	\$0.82	\$0.72	\$0.66	\$0.60	\$0.56	\$0.52	\$0.49	\$0.46	\$0.44
42%	1,911,000	\$1.94	\$1.54	\$1.18	\$0.98	\$0.85	\$0.75	\$0.68	\$0.63	\$0.58	\$0.54	\$0.51	\$0.48	\$0.46
44%	2,002,000	\$1.98	\$1.58	\$1.22	\$1.01	\$0.88	\$0.78	\$0.71	\$0.65	\$0.60	\$0.56	\$0.53	\$0.50	\$0.48
46%	2,093,000	\$2.03	\$1.63	\$1.26	\$1.05	\$0.91	\$0.81	\$0.73	\$0.67	\$0.62	\$0.58	\$0.55	\$0.52	\$0.49
48%	2,184,000	\$2.07	\$1.67	\$1.30	\$1.08	\$0.94	\$0.84	\$0.76	\$0.70	\$0.65	\$0.60	\$0.57	\$0.54	\$0.51
50%	2,275,000	\$2.12	\$1.71	\$1.34	\$1.12	\$0.97	\$0.87	\$0.78	\$0.72	\$0.67	\$0.63	\$0.59	\$0.56	\$0.53

Source: Science of Algorithmic Trading and Portfolio Management, Elsevier (2013)

Post Trade Analysis

Company ABC Transaction Cost Analysis Summary



User Selected Filtering Criteria (Pull Down Options)									
Broker:	All Brokers	Order Size:	All Sizes	Sector:	All Sectors	Side:	All Trades	Start Date:	1/1/2014
Manager:	All PMs	Volatility:	All Volatility	Market Cap:	All MktCap	Min. Time:	5	End Date:	6/30/2014
Trader:	All Traders	POV Rate:	All Trades	Stock Momentum:	All Momentum	Min. Qty:	1	Units:	bp
Algorithm:	All Algorithms	Exec Type:	All Trade Types	Mkt Movement:	All Mkt Movement	Min. Value:	1		

Category	Order Characteristics							Implementation Shortfall					Benchmark Performance					Broker
	Count	Shares	Value (\$)	Weight %	Size %	Volt. %	POV %	Fixed (bp)	Delay (bp)	Trading (bp)	Opport. (bp)	Total IS (bp)	Arrival (bp)	Mkt Adj (bp)	Open (bp)	Close (bp)	VWAP (bp)	Value-Add (bp)
Total	1,864	46,938,184	\$2,504,902,703	100%	5%	24%	12%	-7.5	13.6	-27.4	-0.2	-21.6	-27.4	-24.2	-13.9	7.9	-0.6	-6.4
Side																		
Buy	764	24,546,255	\$1,328,926,111	53%	7%	25%	13%	-7.3	31.3	-30.1	0.3	-5.8	-30.1	-27.1	1.2	11.2	-0.4	-5.2
Sell	1,100	22,391,929	\$1,175,976,592	47%	4%	23%	10%	-7.7	-6.3	-24.5	-0.7	-39.3	-24.5	-20.8	-30.8	4.2	-0.7	-7.6
Order Size																		
Small	1,596	28,668,181	\$1,606,323,305	64%	2%	24%	8%	-7.7	17.3	-13.6	0.5	-3.6	-13.6	-11.0	3.6	6.8	0.4	-1.4
Medium	240	15,507,924	\$771,955,919	31%	10%	23%	18%	-6.8	6.1	-45.2	-1.6	-47.6	-45.2	-41.4	-39.1	10.9	-1.8	-11.6
Large	28	2,762,079	\$126,623,479	5%	26%	27%	20%	-8.8	12.3	-94.9	-0.3	-91.6	-94.9	-86.9	-82.6	3.0	-5.3	-37.6
Market Capitalization																		
LC	917	22,416,421	\$1,409,652,611	56%	4%	21%	9%	-6.6	2.2	-22.6	0.1	-26.9	-22.6	-18.1	-20.3	5.6	-0.7	-8.1
MC	452	7,362,377	\$610,310,526	24%	6%	25%	15%	-5.6	19.5	-18.6	-0.7	-5.4	-18.6	-19.2	0.9	15.1	0.5	5.3
SC	495	17,159,386	\$484,939,566	19%	10%	31%	16%	-12.5	39.1	-52.8	-0.4	-26.6	-52.8	-48.3	-13.7	5.5	-1.6	-15.9
Volatility																		
Low	583	14,501,132	\$983,579,750	39%	4%	14%	11%	-6.1	19.5	-11.4	0.4	2.3	-11.4	-8.6	8.0	6.8	-0.4	2.8
Medium	1,079	26,337,457	\$1,335,486,106	53%	6%	28%	13%	-7.9	5.7	-32.5	-0.9	-35.7	-32.5	-28.4	-26.9	5.3	-1.4	-7.5
High	202	6,099,595	\$185,836,847	7%	4%	51%	8%	-11.8	39.2	-75.8	2.1	-46.3	-75.8	-75.8	-36.5	32.4	4.5	-46.6
Trade Urgency (POV Rate)																		
Passive	1,376	25,332,885	\$1,371,538,264	55%	3%	24%	4%	-7.8	3.0	-17.2	-0.9	-22.9	-17.2	-13.2	-14.2	5.8	0.3	-6.8
Normal	248	13,038,632	\$648,528,534	26%	9%	25%	15%	-7.1	3.4	-47.4	-1.1	-52.2	-47.4	-43.0	-44.0	12.1	-1.4	-16.6
Aggressive	240	8,566,667	\$484,835,905	19%	9%	23%	31%	-7.1	57.2	-30.0	3.1	23.3	-30.0	-30.1	27.2	8.2	-1.9	8.8

SECTION 3

Liquidity Risk

What is Liquidity Risk Analysis?

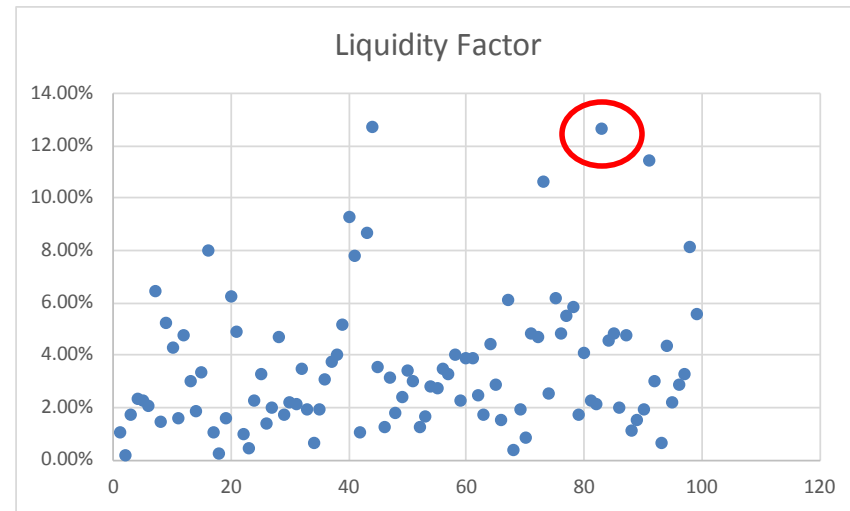
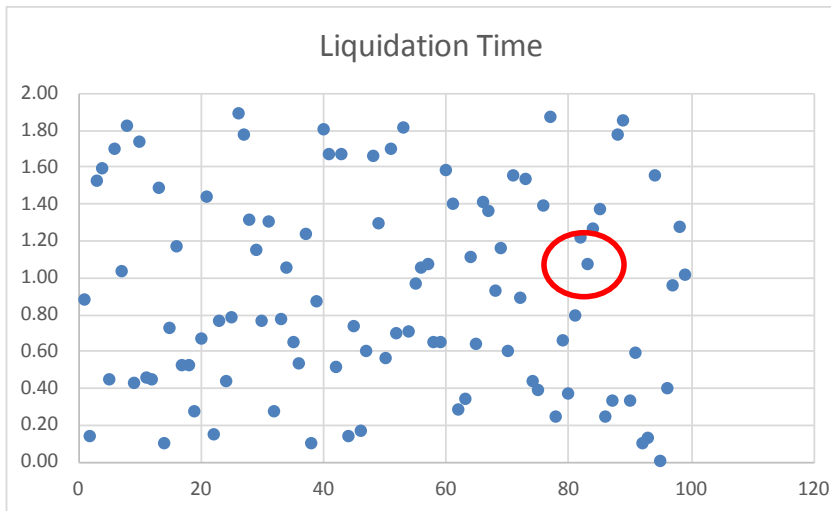
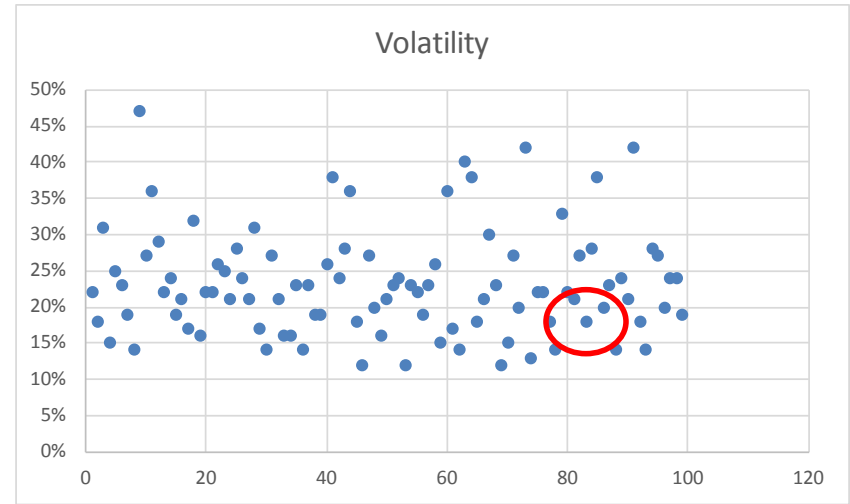
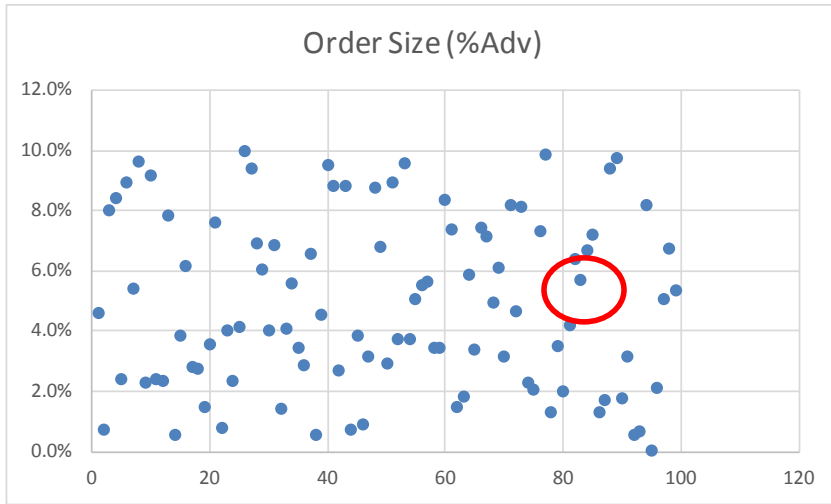
- **Liquidity Risk Analysis**
 - Evaluate various execution strategies (cost to liquidate, and corresponding timeframe).
 - Which stocks will be the most costly to liquidate.
 - Provides the sensitivity of price movement to order flow.
 - Allows PM's to perform “what-if” and “sensitivity” analysis, e.g., what will be the cost to liquidate under changing market conditions such as spiking volatility, decreasing liquidity, or under an increased level of high frequency trading.
 - Back-test and calculate liquidation cost during stressed market environments (such as financial crisis, flash crisis, and macro economic events).
 - Compute Price and Liquidity risk metrics.
 - Adhere to regulatory requirement.

Portfolio Liquidity Cost Analysis

Portfolio Characteristics															
Portfolio	Shares	Count	Weight	Value	%Adv	Volatility	Price	Beta	Spread	ADV	Liq Factor	POV	Time (days)	MI	TR
Long	19,049,523	99.0	100%	196,497,618	5.6%	9.8%	\$150.56	0.39	5.5	14,477,236	3.7%	10.0%	0.51	18.2	24.3
Short	5,948,000	43.0	-199%	-390,800,298	5.5%	24.4%	\$206.03	1.16	5.4	3,755,208	4.2%	10.0%	0.49	18.9	60.5

Symbol	Shares	Side	Weight	Value USD	%Adv	Volatility	Price USD	Beta	Spread	ADV	Liquidity Factor	POV	Time(days)	MI	TR
AA	753,123	Long	3.26%	6,401,546	4.6%	22%	8.50	2.24	0.1	16,292,000	1.90%	10.0%	0.42	16.9	51.8
AAPL	146,000	Long	31.86%	62,612,100	0.7%	18%	428.85	1.09	6.1	19,569,000	0.34%	10.0%	0.07	7.4	17.0
ABBV	-497,700	Short	-11.66%	-22,909,131	8.0%	31%	46.03	1.16	7.0	6,199,000	3.08%	10.0%	0.72	27.5	96.2
ADP	145,300	Long	5.30%	10,423,822	8.4%	15%	71.74	0.78	7.5	1,728,000	4.16%	10.0%	0.76	15.3	47.6
AES	149,600	Long	1.00%	1,956,768	2.4%	25%	13.08	1.49	9.2	6,281,000	4.01%	10.0%	0.21	14.8	42.3
AET	-293,600	Short	-8.94%	-17,566,088	8.9%	23%	59.83	1.25	5.2	3,288,000	3.71%	10.0%	0.80	22.3	75.3
AIZ	41,100	Long	1.04%	2,037,327	5.4%	19%	49.57	1.47	3.9	756,000	11.50%	10.0%	0.49	15.9	48.5
ALL	326,000	Long	8.40%	16,515,160	9.6%	14%	50.66	1.51	8.4	3,392,000	2.54%	10.0%	0.86	15.1	47.5
ALXN	-39,900	Short	-2.14%	-4,197,799	2.3%	47%	105.21	0.54	3.6	1,751,000	9.27%	10.0%	0.21	24.7	77.7
AMP	-131,100	Short	-5.44%	-10,689,894	9.2%	27%	81.54	2.11	9.3	1,431,000	7.57%	10.0%	0.82	25.7	89.5
AMZN	-89,300	Short	-12.11%	-23,803,808	2.4%	36%	266.56	0.84	9.0	3,740,000	2.82%	10.0%	0.21	20.1	60.9
ANF	-37,500	Short	-1.02%	-2,013,375	2.3%	29%	53.69	1.77	7.2	1,596,000	8.53%	10.0%	0.21	16.7	48.7
AON	-149,700	Short	-5.06%	-9,946,068	7.8%	22%	66.44	0.69	3.4	1,916,000	5.39%	10.0%	0.70	20.4	67.4
APC	-17,400	Short	-0.78%	-1,534,158	0.5%	24%	88.17	1.62	7.5	3,298,000	3.33%	10.0%	0.05	8.3	19.1
APD	49,000	Long	2.30%	4,526,620	3.8%	19%	92.38	1.28	8.8	1,281,000	5.93%	10.0%	0.34	14.0	40.7
ARG	29,400	Long	1.50%	2,953,818	6.2%	21%	100.47	1.12	3.3	477,000	14.22%	10.0%	0.55	18.1	57.1
AXP	-146,000	Short	-5.41%	-10,625,880	2.8%	17%	72.78	1.84	2.1	5,239,000	1.82%	10.0%	0.25	11.4	31.1
BAC	3,809,300	Long	26.05%	51,196,992	2.8%	32%	13.44	2.44	3.4	138,493,000	0.37%	10.0%	0.25	19.2	58.1
BBT	-59,400	Short	-0.98%	-1,929,906	1.5%	16%	32.49	1.01	5.8	4,093,000	2.85%	10.0%	0.13	8.6	21.1
BEN	19,000	Long	1.61%	3,165,210	3.5%	22%	166.59	1.52	8.3	538,000	11.15%	10.0%	0.32	15.4	45.3
BLL	95,600	Long	2.22%	4,356,492	7.6%	22%	45.57	0.60	8.8	1,260,000	8.76%	10.0%	0.68	20.2	66.4
BMJ	80,800	Long	1.82%	3,582,672	0.8%	26%	44.34	0.44	3.9	10,185,000	1.78%	10.0%	0.07	10.3	25.4
C	1,035,700	Long	27.06%	53,172,838	4.0%	25%	51.34	2.62	7.7	25,816,000	0.76%	10.0%	0.36	17.9	54.9
CA	-87,400	Short	-1.22%	-2,395,634	2.3%	21%	27.41	1.09	5.8	3,761,000	4.07%	10.0%	0.21	12.7	35.1
CAM	93,600	Long	3.01%	5,921,136	4.1%	28%	63.26	1.67	4.8	2,277,000	5.81%	10.0%	0.37	19.8	62.2
CBS	617,100	Long	15.83%	31,101,840	10.0%	24%	50.40	2.38	8.8	6,184,000	2.42%	10.0%	0.90	24.0	83.1
CCL	-374,600	Short	-6.68%	-13,129,730	9.4%	21%	35.05	1.49	4.1	3,998,000	3.54%	10.0%	0.84	21.0	70.4
CHRW	-116,400	Short	-3.42%	-6,711,624	6.9%	31%	57.66	0.66	3.5	1,684,000	8.41%	10.0%	0.62	26.0	89.3
CL	-184,500	Short	-5.85%	-11,489,738	6.0%	17%	62.28	0.43	2.6	3,056,000	3.02%	10.0%	0.54	15.0	45.8
CNP	-113,400	Short	-1.41%	-2,768,094	4.0%	14%	24.41	0.62	0.3	2,818,000	3.85%	10.0%	0.36	11.0	30.8

Liquidity Risk



SECTION 4

Multi-Asset Trading Costs

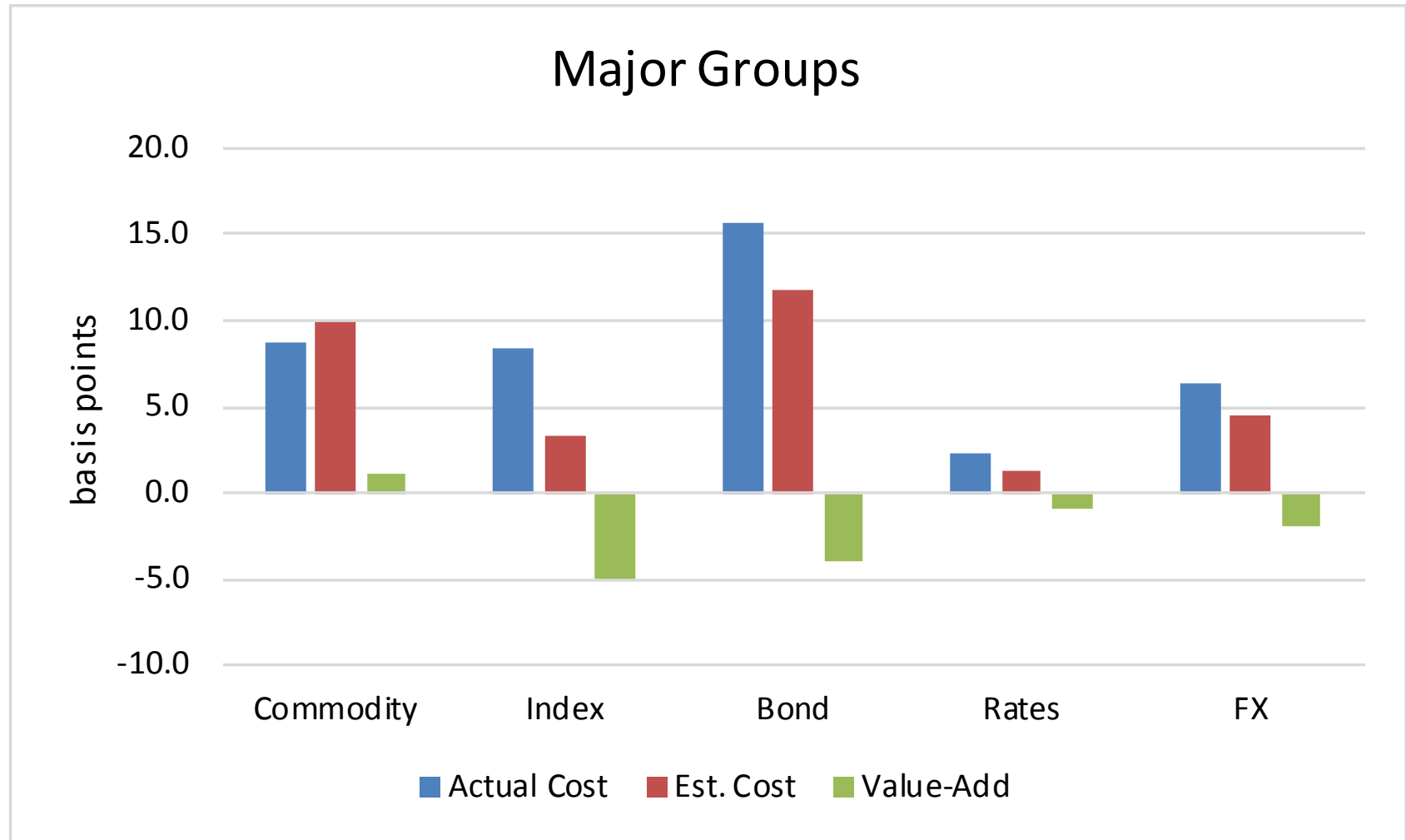
Multi-Asset Trading Cost Parameters

Multi-Asset Trading Costs									
Quantity expressed in terms of constant \$USD Value									
<u>Parameter</u>	<u>US-LC</u>	<u>US-SC</u>	<u>Liquid ETF</u>	<u>Illiquid ETF</u>	<u>Futures</u>	<u>Gov't Bond</u>	<u>Corp. Bond</u>	<u>Comm- odity</u>	<u>Currency</u>
a1:	0.97	1.13	0.24	0.41	0.22	0.19	2.76	0.54	0.15
a2:	0.38	0.45	0.38	0.40	0.38	0.37	0.38	0.38	0.41
a3:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
a4:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
b1:	0.97	0.93	0.99	0.94	0.99	1.00	0.80	0.99	0.90
Dollars	\$10,000,000	\$10,000,000	\$10,000,000	\$10,000,000	\$10,000,000	\$10,000,000	\$10,000,000	\$10,000,000	\$10,000,000
Volatility	25%	25%	25%	25%	25%	25%	25%	25%	25%
POV Rate	10%	10%	10%	10%	10%	10%	10%	10%	10%
I-Star (bp)	110.9	399.6	27.7	65.2	24.7	18.9	314.9	62.1	27.7
MI (bp)	14.1	65.1	3.0	10.0	2.7	1.9	88.2	6.8	5.3

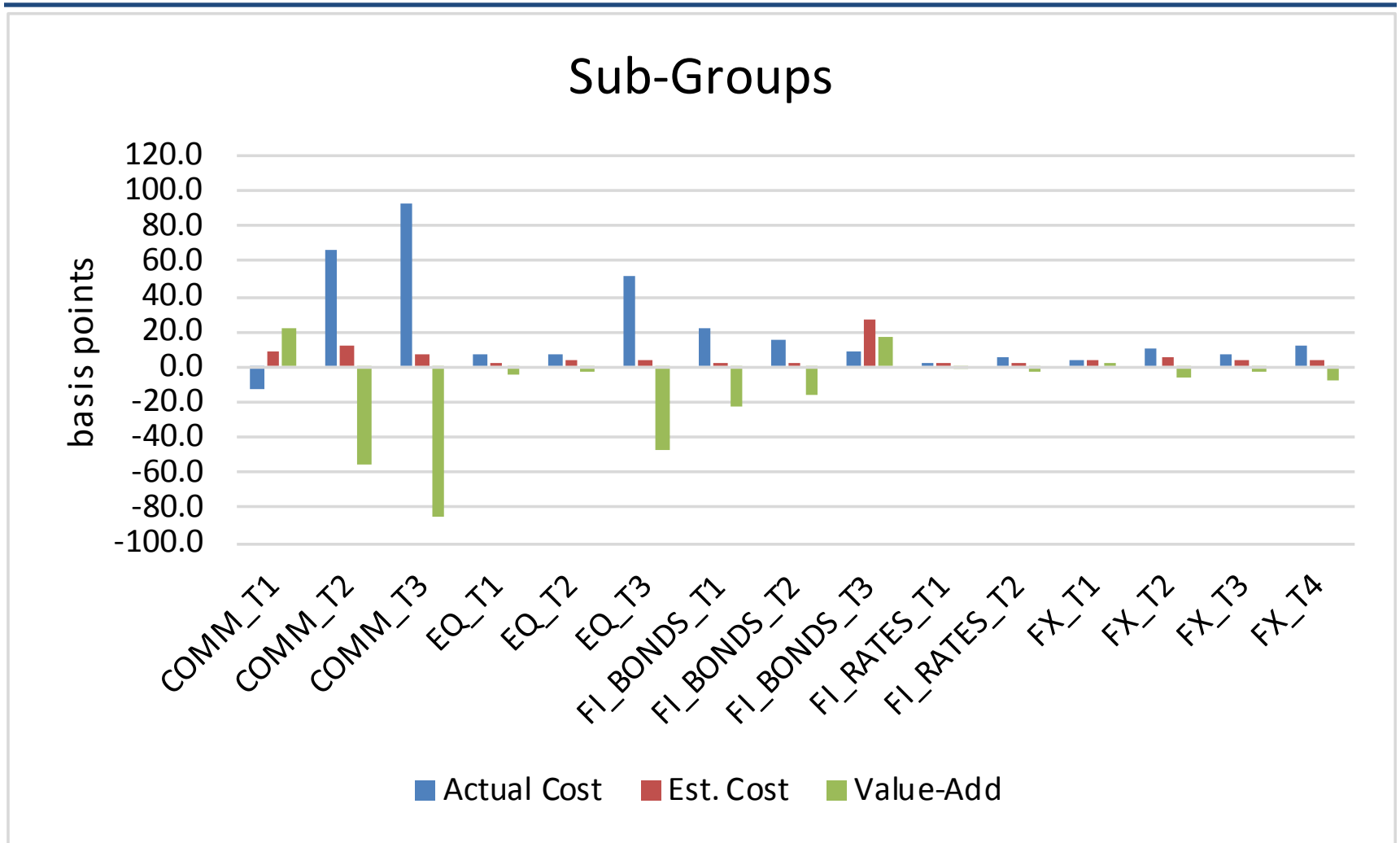
Multi-Asset Post Trade Analysis

<u>Category</u>	<u>Count</u>	<u>Wt.</u>	<u>Trade Value (USD)</u>	<u>Trade Cost (USD)</u>	<u>Est. Cost (USD)</u>	<u>Value-Add (USD)</u>	<u>Trade Cost (bp)</u>	<u>Est. Cost (bp)</u>	<u>Value-Add (bp)</u>	<u>Eq. Wt. Z-Score</u>
Total	10000	100%	149,132,768,866	155,138,519	110,994,193	44,144,326	10.4	7.4	-3.0	0.03
Side										
Buy	5036	48%	70,852,678,766	85,056,064	38,234,614	46,821,449	12.0	5.4	-6.6	0.01
Sell	4964	52%	78,280,090,100	70,082,455	72,759,579	-2,677,123	9.0	9.3	0.3	0.05
Major Group										
Commodity	3100	7%	10,571,066,388	9,228,442	10,433,512	-1,205,071	8.7	9.9	1.1	0.05
Index	2630	17%	25,378,353,241	21,109,775	8,399,973	12,709,802	8.3	3.3	-5.0	0.05
Bond	2010	45%	66,782,120,023	104,986,362	78,773,342	26,213,020	15.7	11.8	-3.9	0.00
Rates	1014	16%	23,402,751,246	5,229,847	3,157,578	2,072,269	2.2	1.3	-0.9	0.01
FX	1246	15%	22,998,477,968	14,584,093	10,229,787	4,354,306	6.3	4.4	-1.9	0.00
Cost Group										
COMM_T1	1687	5%	8,026,213,980	-10,015,882	7,686,791	-17,702,673	-12.5	9.6	22.1	0.01
COMM_T2	870	1%	1,705,044,460	11,466,157	2,155,332	9,310,824	67.2	12.6	-54.6	0.10
COMM_T3	543	1%	839,807,948	7,778,167	591,389	7,186,778	92.6	7.0	-85.6	0.10
EQ_T1	1719	12%	17,863,876,462	11,924,803	5,189,352	6,735,451	6.7	2.9	-3.8	0.03
EQ_T2	585	4%	6,587,432,277	4,408,437	2,776,737	1,631,700	6.7	4.2	-2.5	0.03
EQ_T3	326	1%	927,044,502	4,776,535	433,884	4,342,651	51.5	4.7	-46.8	0.15
FI_BONDS_T1	1143	18%	26,599,878,745	59,632,745	1,071,903	58,560,842	22.4	0.4	-22.0	0.00
FI_BONDS_T2	346	7%	10,876,774,159	17,515,455	937,806	16,577,649	16.1	0.9	-15.2	0.00
FI_BONDS_T3	521	20%	29,305,467,120	27,838,162	76,763,633	-48,925,471	9.5	26.2	16.7	0.00
FI_RATES_T1	364	12%	18,102,248,045	2,682,238	2,090,872	591,366	1.5	1.2	-0.3	0.00
FI_RATES_T2	650	4%	5,300,503,201	2,547,609	1,066,706	1,480,903	4.8	2.0	-2.8	0.01
FX_T1	488	9%	12,758,414,478	4,643,846	5,422,646	-778,800	3.6	4.3	0.6	-0.05
FX_T2	323	5%	7,547,404,296	7,966,360	3,654,679	4,311,681	10.6	4.8	-5.7	0.01
FX_T3	290	2%	2,319,886,862	1,545,752	1,034,612	511,140	6.7	4.5	-2.2	0.03
FX_T4	145	0%	372,772,332	428,135	117,850	310,286	11.5	3.2	-8.3	0.05

Multi-Asset Post Trade Analysis



Multi-Asset Post Trade Analysis



SECTION 5

Portfolio Analysis

Portfolio Analysis

User Input:			
Strategy:	VWAP	ADV Adj:	0.50
POV Rate:	10%	Volatility Adj:	2.00
VWAP Days:	1.00	Data Source:	KRG

	bp	\$/Share	dollars
Current MI:	13	\$0.19	\$3,603,676
What-If MI:	43	\$0.65	\$12,304,850
Difference:	30	\$0.46	\$8,701,174

Goto Intro	Clear Data	Portfolio Liquidity
Update Data	Portfolio Cost Curves	

Portfolio Characteristics																	
Portfolio	Shares	Count	Weight	Value	%Adv	Volatility	Price	Beta	Spread	ADV	Liq Factor	POV	Time (days)	MI	TR	What-If MI	Diff MI
Long	19,049,523	99.0	100%	196,497,618	5.6%	9.8%	\$150.56	0.39	5.5	14,477,236	3.7%	5.2%	1.00	12.6	35.9	42.9	30.3
Short	13,101,523	56.0	299%	587,297,915	5.7%	22.9%	\$113.65	1.41	5.6	21,611,897	3.3%	5.3%	1.00	12.4	83.6	42.2	29.8
Short	5,948,000	43.0	-199%	-390,800,298	5.5%	24.4%	\$206.03	1.16	5.4	3,755,208	4.2%	5.1%	1.00	12.9	89.0	43.9	31.1

Symbol	Shares	Side	Weight	Value USD	%Adv	Volatility	Price USD	Beta	Spread	ADV	Liquidity Factor	POV	Time(days)	MI	TR	What-If MI	Difference MI
AA	753,123	Long	3.26%	6,401,546	4.6%	22%	8.50	2.24	0.1	16,292,000	1.90%	4.4%	1.00	10.1	80.3	34.75	24.67
AAPL	146,000	Long	31.86%	62,612,100	0.7%	18%	428.85	1.09	6.1	19,569,000	0.34%	0.7%	1.00	1.6	65.7	5.22	3.66
ABBV	-497,700	Short	-11.66%	-22,909,131	8.0%	31%	46.03	1.16	7.0	6,199,000	3.08%	7.4%	1.00	22.7	113.2	77.42	54.71
ADP	145,300	Long	5.30%	10,423,822	8.4%	15%	71.74	0.78	7.5	1,728,000	4.16%	7.8%	1.00	13.0	54.8	44.14	31.18
AES	149,600	Long	1.00%	1,956,768	2.4%	25%	13.08	1.49	9.2	6,281,000	4.01%	2.3%	1.00	6.0	91.3	20.55	14.58
AET	-293,600	Short	-8.94%	-17,566,088	8.9%	23%	59.83	1.25	5.2	3,288,000	3.71%	8.2%	1.00	19.6	84.0	66.57	46.97
AIZ	41,100	Long	1.04%	2,037,327	5.4%	19%	49.57	1.47	3.9	756,000	11.50%	5.2%	1.00	10.4	69.4	35.84	25.42
ALL	326,000	Long	8.40%	16,515,160	9.6%	14%	50.66	1.51	8.4	3,392,000	2.54%	8.8%	1.00	13.9	51.1	47.08	33.18
ALXN	-39,900	Short	-2.14%	-4,197,799	2.3%	47%	105.21	0.54	3.6	1,751,000	9.27%	2.2%	1.00	9.7	171.6	33.32	23.64
AMP	-131,100	Short	-5.44%	-10,689,894	9.2%	27%	81.54	2.11	9.3	1,431,000	7.57%	8.4%	1.00	22.9	98.6	77.87	54.93
AMZN	-89,300	Short	-12.11%	-23,803,808	2.4%	36%	266.56	0.84	9.0	3,740,000	2.82%	2.3%	1.00	8.1	131.5	27.91	19.80
ANF	-37,500	Short	-1.02%	-2,013,375	2.3%	29%	53.69	1.77	7.2	1,596,000	8.53%	2.3%	1.00	6.7	105.9	22.95	16.29
AON	-149,700	Short	-5.06%	-9,946,068	7.8%	22%	66.44	0.69	3.4	1,916,000	5.39%	7.2%	1.00	16.6	80.3	56.76	40.12
APC	-17,400	Short	-0.78%	-1,534,158	0.5%	24%	88.17	1.62	7.5	3,298,000	3.33%	0.5%	1.00	1.5	87.6	4.82	3.36
APD	49,000	Long	2.30%	4,526,620	3.8%	19%	92.38	1.28	8.8	1,281,000	5.93%	3.7%	1.00	7.4	69.4	25.70	18.25
ARG	29,400	Long	1.50%	2,953,818	6.2%	21%	100.47	1.12	3.3	477,000	14.22%	5.8%	1.00	12.8	76.7	43.81	31.05
AXP	-146,000	Short	-5.41%	-10,625,880	2.8%	17%	72.78	1.84	2.1	5,239,000	1.82%	2.7%	1.00	5.0	62.1	17.32	12.30
BAC	3,809,300	Long	26.05%	51,196,992	2.8%	32%	13.44	2.44	3.4	138,493,000	0.37%	2.7%	1.00	8.4	116.8	28.96	20.56
BBT	-59,400	Short	-0.98%	-1,929,906	1.5%	16%	32.49	1.01	5.8	4,093,000	2.85%	1.4%	1.00	2.6	58.4	8.84	6.25
BEN	19,000	Long	1.61%	3,165,210	3.5%	22%	166.59	1.52	8.3	538,000	11.15%	3.4%	1.00	7.8	80.3	26.91	19.11
BLL	95,600	Long	2.22%	4,356,492	7.6%	22%	45.57	0.60	8.8	1,260,000	8.76%	7.1%	1.00	16.2	80.3	55.24	39.06
BMY	80,800	Long	1.82%	3,582,672	0.8%	26%	44.34	0.44	3.9	10,185,000	1.78%	0.8%	1.00	2.2	94.9	7.50	5.26
C	1,035,700	Long	27.06%	53,172,838	4.0%	25%	51.34	2.62	7.7	25,816,000	0.76%	3.9%	1.00	9.8	91.3	33.79	24.00
CA	-87,400	Short	-1.22%	-2,395,634	2.3%	21%	27.41	1.09	5.8	3,761,000	4.07%	2.3%	1.00	5.0	76.7	17.36	12.32

Portfolio Cost Curves

Portfolio Characteristics								
	Count	Shares	Dollars	Weight	%Adv	Volatility	Price	Beta
Portfolio	99.0	19,049,523	181,764,130	100%	5.6%	9.6%	\$158.27	0.37
Long	56.0	13,101,523	587,297,915	323%	5.7%	22.9%	\$113.65	1.41
Short	43.0	5,948,000	-405,533,786	-223%	5.5%	24.1%	\$222.90	1.15

User Selection	
Cost Units:	bp
Strategy:	Time

Cost Adjustments	
ADV Adj:	1.00
Volatility Adj:	1.00

Goto Intro

Portfolio Analysis

Portfolio Liquidity

Portfolio Cost Curves																
% Port.	Portfolio Value	Total Shares	Trading Strategy - % of Trade Day in bp													
			0.10	0.25	0.50	0.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00	
0.5%	\$908,821	95,248	11.0	8.1	6.2	5.2	4.5	4.0	3.6	3.3	3.1	2.9	2.7	2.6	2.4	
1%	\$1,817,641	190,495	14.1	10.3	8.0	6.7	5.8	5.1	4.7	4.3	4.0	3.7	3.5	3.3	3.1	
5%	\$9,088,206	952,476	25.3	18.5	14.3	11.9	10.3	9.2	8.3	7.6	7.1	6.6	6.2	5.9	5.6	
10%	\$18,176,413	1,904,952	32.4	23.7	18.4	15.3	13.3	11.8	10.7	9.8	9.1	8.5	8.0	7.6	7.2	
15%	\$27,264,619	2,857,428	37.5	27.4	21.2	17.7	15.3	13.7	12.4	11.4	10.5	9.9	9.3	8.8	8.3	
20%	\$36,352,826	3,809,905	41.6	30.4	23.6	19.6	17.0	15.1	13.7	12.6	11.7	10.9	10.3	9.7	9.3	
25%	\$45,441,032	4,762,381	45.1	33.0	25.5	21.3	18.4	16.4	14.9	13.7	12.7	11.8	11.1	10.5	10.0	
30%	\$54,529,239	5,714,857	48.2	35.2	27.3	22.7	19.7	17.5	15.9	14.6	13.5	12.6	11.9	11.3	10.7	
35%	\$63,617,445	6,667,333	50.9	37.2	28.8	24.0	20.8	18.5	16.8	15.4	14.3	13.4	12.6	11.9	11.3	
40%	\$72,705,652	7,619,809	53.4	39.0	30.2	25.2	21.8	19.4	17.6	16.2	15.0	14.0	13.2	12.5	11.9	
45%	\$81,793,858	8,572,285	55.7	40.7	31.6	26.3	22.8	20.3	18.4	16.9	15.7	14.6	13.8	13.0	12.4	
50%	\$90,882,065	9,524,762	57.9	42.3	32.8	27.3	23.7	21.1	19.1	17.5	16.3	15.2	14.3	13.5	12.9	
55%	\$99,970,271	10,477,238	59.9	43.8	33.9	28.3	24.5	21.8	19.8	18.1	16.8	15.7	14.8	14.0	13.3	
60%	\$109,058,478	11,429,714	61.8	45.2	35.0	29.2	25.3	22.5	20.4	18.7	17.4	16.2	15.3	14.5	13.7	
65%	\$118,146,684	12,382,190	63.6	46.5	36.0	30.0	26.0	23.2	21.0	19.3	17.9	16.7	15.7	14.9	14.1	
70%	\$127,234,891	13,334,666	65.4	47.8	37.0	30.8	26.7	23.8	21.6	19.8	18.4	17.2	16.2	15.3	14.5	
75%	\$136,323,097	14,287,142	67.0	49.0	37.9	31.6	27.4	24.4	22.1	20.3	18.8	17.6	16.6	15.7	14.9	
80%	\$145,411,304	15,239,618	68.6	50.1	38.8	32.3	28.0	25.0	22.6	20.8	19.3	18.0	16.9	16.0	15.2	
85%	\$154,499,510	16,192,095	70.1	51.2	39.7	33.0	28.7	25.5	23.1	21.2	19.7	18.4	17.3	16.4	15.6	
90%	\$163,587,717	17,144,571	71.6	52.3	40.5	33.7	29.3	26.0	23.6	21.7	20.1	18.8	17.7	16.7	15.9	
95%	\$172,675,923	18,097,047	73.0	53.3	41.3	34.4	29.8	26.5	24.1	22.1	20.5	19.2	18.0	17.1	16.2	
100%	\$181,764,130	19,049,523	74.3	54.3	42.1	35.0	30.4	27.0	24.5	22.5	20.9	19.5	18.4	17.4	16.5	
105%	\$190,852,336	20,001,999	75.6	55.3	42.8	35.7	30.9	27.5	24.9	22.9	21.2	19.9	18.7	17.7	16.8	
110%	\$199,940,543	20,954,475	76.9	56.2	43.5	36.3	31.4	28.0	25.4	23.3	21.6	20.2	19.0	18.0	17.1	
115%	\$209,028,749	21,906,951	78.2	57.1	44.2	36.9	32.0	28.4	25.8	23.7	21.9	20.5	19.3	18.3	17.4	
120%	\$218,116,956	22,859,428	79.4	58.0	44.9	37.4	32.5	28.9	26.2	24.0	22.3	20.8	19.6	18.6	17.6	
125%	\$227,205,162	23,811,904	80.5	58.8	45.6	38.0	32.9	29.3	26.6	24.4	22.6	21.1	19.9	18.8	17.9	

Portfolio Cost Curves

Portfolio Characteristics								
	Count	Shares	Dollars	Weight	%Adv	Volatility	Price	Beta
Portfolio	99.0	19,049,523	196,497,618	100%	5.6%	9.8%	\$150.56	0.39
Long	56.0	13,101,523	587,297,915	299%	5.7%	22.9%	\$113.65	1.41
Short	43.0	5,948,000	-390,800,298	-199%	5.5%	24.4%	\$206.03	1.16

User Selection	
Cost Units:	bp
Strategy:	Time

Cost Adjustments	
ADV Adj:	0.50
Volatility Adj:	2.00

Goto Intro

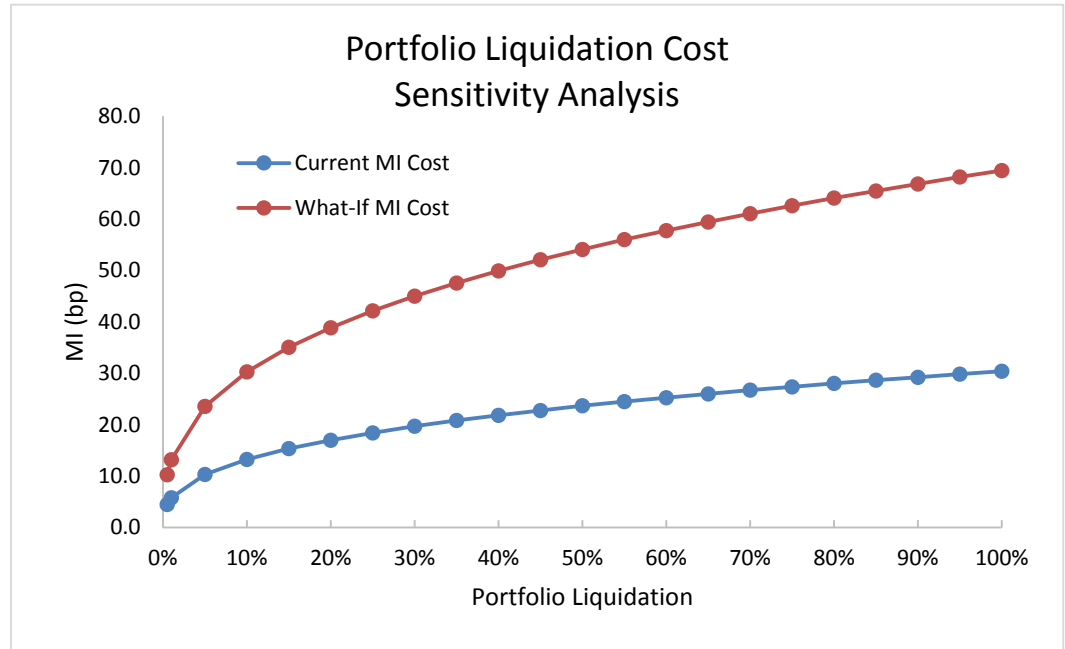
Portfolio Analysis

Portfolio Liquidity

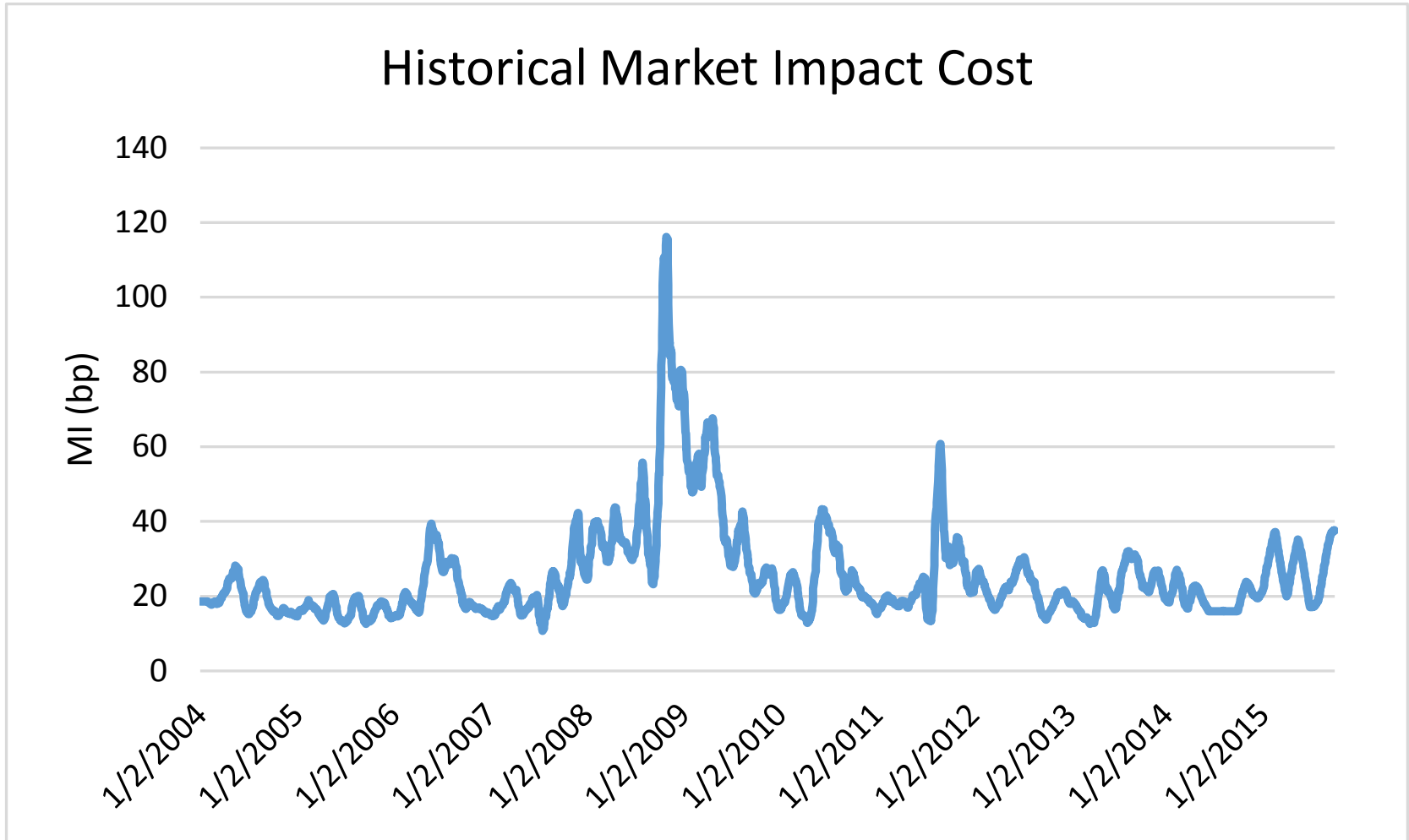
Portfolio Cost Curves															
% Port. Value	Portfolio Value	Total Shares	Trading Strategy - % of Trade Day in bp												
			0.10	0.25	0.50	0.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00
0.5%	\$982,488	95,248	25.2	18.4	14.3	11.9	10.3	9.2	8.3	7.6	7.1	6.6	6.2	5.9	5.6
1%	\$1,964,976	190,495	32.4	23.6	18.3	15.2	13.2	11.8	10.7	9.8	9.1	8.5	8.0	7.6	7.2
5%	\$9,824,881	952,476	57.8	42.2	32.7	27.2	23.6	21.0	19.0	17.5	16.2	15.2	14.3	13.5	12.8
10%	\$19,649,762	1,904,952	74.2	54.2	42.0	34.9	30.3	27.0	24.4	22.4	20.8	19.5	18.3	17.3	16.5
15%	\$29,474,643	2,857,428	85.9	62.7	48.6	40.4	35.1	31.2	28.3	26.0	24.1	22.5	21.2	20.1	19.1
20%	\$39,299,524	3,809,905	95.2	69.5	53.9	44.9	38.9	34.6	31.4	28.8	26.7	25.0	23.5	22.2	21.1
25%	\$49,124,404	4,762,381	103.2	75.4	58.4	48.6	42.2	37.5	34.0	31.2	28.9	27.1	25.5	24.1	22.9
30%	\$58,949,285	5,714,857	110.2	80.5	62.3	51.9	45.0	40.1	36.3	33.3	30.9	28.9	27.2	25.7	24.5
35%	\$68,774,166	6,667,333	116.5	85.1	65.9	54.9	47.6	42.3	38.4	35.2	32.7	30.6	28.8	27.2	25.9
40%	\$78,599,047	7,619,809	122.2	89.3	69.1	57.6	49.9	44.4	40.3	37.0	34.3	32.1	30.2	28.5	27.1
45%	\$88,423,928	8,572,285	127.5	93.1	72.1	60.1	52.1	46.4	42.0	38.6	35.8	33.4	31.5	29.8	28.3
50%	\$98,248,809	9,524,762	132.5	96.7	74.9	62.4	54.1	48.2	43.6	40.1	37.2	34.7	32.7	30.9	29.4
55%	\$108,073,690	10,477,238	137.1	100.1	77.6	64.6	56.0	49.8	45.2	41.5	38.5	36.0	33.8	32.0	30.4
60%	\$117,898,571	11,429,714	141.5	103.3	80.0	66.6	57.8	51.4	46.6	42.8	39.7	37.1	34.9	33.0	31.4
65%	\$127,723,452	12,382,190	145.6	106.3	82.4	68.6	59.5	52.9	48.0	44.0	40.8	38.2	35.9	34.0	32.3
70%	\$137,548,332	13,334,666	149.5	109.2	84.6	70.4	61.1	54.4	49.3	45.2	41.9	39.2	36.9	34.9	33.2
75%	\$147,373,213	14,287,142	153.3	112.0	86.7	72.2	62.6	55.7	50.5	46.4	43.0	40.2	37.8	35.8	34.0
80%	\$157,198,094	15,239,618	156.9	114.6	88.8	73.9	64.1	57.0	51.7	47.5	44.0	41.2	38.7	36.6	34.8
85%	\$167,022,975	16,192,095	160.4	117.1	90.7	75.5	65.5	58.3	52.8	48.5	45.0	42.1	39.6	37.5	35.6
90%	\$176,847,856	17,144,571	163.7	119.6	92.6	77.1	66.9	59.5	53.9	49.5	45.9	42.9	40.4	38.2	36.3
95%	\$186,672,737	18,097,047	166.9	121.9	94.4	78.6	68.2	60.7	55.0	50.5	46.8	43.8	41.2	39.0	37.1
100%	\$196,497,618	19,049,523	170.0	124.2	96.2	80.1	69.5	61.8	56.0	51.4	47.7	44.6	42.0	39.7	37.7
105%	\$206,322,499	20,001,999	173.1	126.4	97.9	81.5	70.7	62.9	57.0	52.3	48.5	45.4	42.7	40.4	38.4
110%	\$216,147,379	20,954,475	176.0	128.5	99.5	82.9	71.9	64.0	58.0	53.2	49.4	46.2	43.4	41.1	39.1
115%	\$225,972,260	21,906,951	178.8	130.6	101.2	84.2	73.0	65.0	58.9	54.1	50.2	46.9	44.1	41.8	39.7
120%	\$235,797,141	22,859,428	181.6	132.6	102.7	85.5	74.2	66.0	59.8	54.9	50.9	47.6	44.8	42.4	40.3
125%	\$245,622,022	23,811,904	184.3	134.6	104.2	86.8	75.3	67.0	60.7	55.7	51.7	48.3	45.5	43.0	40.9

Portfolio Liquidation Cost

Portfolio Liquidation Cost (basis points)					
Sensitivity Analysis (Volatility 2x Volume=50%)					
% Port. Value	Portfolio Value	Total Shares	Current 1-Day	What-If 1-Day	Cost Diff
0.5%	\$982,488	95,248	4.5	10.3	5.8
1%	\$1,964,976	190,495	5.8	13.2	7.4
5%	\$9,824,881	952,476	10.3	23.6	13.3
10%	\$19,649,762	1,904,952	13.3	30.3	17.0
15%	\$29,474,643	2,857,428	15.3	35.1	19.7
20%	\$39,299,524	3,809,905	17.0	38.9	21.9
25%	\$49,124,404	4,762,381	18.4	42.2	23.7
30%	\$58,949,285	5,714,857	19.7	45.0	25.3
35%	\$68,774,166	6,667,333	20.8	47.6	26.8
40%	\$78,599,047	7,619,809	21.8	49.9	28.1
45%	\$88,423,928	8,572,285	22.8	52.1	29.3
50%	\$98,248,809	9,524,762	23.7	54.1	30.4
55%	\$108,073,690	10,477,238	24.5	56.0	31.5
60%	\$117,898,571	11,429,714	25.3	57.8	32.5
65%	\$127,723,452	12,382,190	26.0	59.5	33.5
70%	\$137,548,332	13,334,666	26.7	61.1	34.4
75%	\$147,373,213	14,287,142	27.4	62.6	35.2
80%	\$157,198,094	15,239,618	28.0	64.1	36.1
85%	\$167,022,975	16,192,095	28.7	65.5	36.8
90%	\$176,847,856	17,144,571	29.3	66.9	37.6
95%	\$186,672,737	18,097,047	29.8	68.2	38.4
100%	\$196,497,618	19,049,523	30.4	69.5	39.1



Back-Testing



TCA Cost Index Database (1990-Present)

Symbol	Date	Imbalance Side	BuySell Imbalance (\$)	BuySell %ADV	Market Impact (bp)	Beta Cost (bp)	TCA Cost (bp)	Excess Cost (bp)	Trade Difficulty
AAMC	8/17/2014	1	2,052,427	0.28	276.17	-20.25	255.92	-48.37	High
AAOI	8/17/2014	1	2,296,647	0.54	226.02	-60.43	165.59	39.15	Low
AAON	8/17/2014	-1	476,183	0.17	-49.5	-53.22	-102.72	9.28	Low
AAT	8/17/2014	-1	4,573,899	0.89	-100.77	-33.98	-134.75	51.42	Low
AAWW	8/17/2014	-1	2,099,340	0.27	-84.49	-47.9	-132.39	46.45	Low
ABAX	8/17/2014	-1	4,834,499	0.6	-130.08	-28.13	-158.21	12.68	High
ABCB	8/17/2014	-1	642,746	0.33	-53.52	-27.78	-81.3	-14.61	Low
ABCO	8/17/2014	-1	13,026,549	0.83	-178.15	-48.82	-226.97	64.6	High
ABG	8/17/2014	-1	8,183,988	0.44	-105.34	-48.21	-153.55	98.6	Med
ABM	8/17/2014	-1	1,612,813	0.25	-55.6	-42.41	-98.01	25.64	Low
ABMD	8/17/2014	-1	3,499,160	0.7	-135.21	-46.25	-181.46	23.26	Low
ACAD	8/17/2014	-1	8,642,734	0.25	-124.75	-51.17	-175.92	70.2	High
ACAT	8/17/2014	-1	1,848,330	0.37	-123.61	-61.2	-184.81	38.24	High
ACCO	8/17/2014	-1	2,427,652	0.25	-86.06	-37.94	-124	16.84	High
ACET	8/17/2014	-1	1,111,488	0.3	-90.03	-49.97	-140.01	4.92	Low
ACHC	8/17/2014	-1	6,087,701	0.46	-154.52	-38.15	-192.67	7.33	Low
ACHN	8/17/2014	-1	22,953,831	0.23	-104.56	-44.88	-149.44	-0.35	High
ACI	8/17/2014	-1	1,342,147	0.08	-36.71	-43.75	-80.46	-17.17	Low
ACIW	8/17/2014	1	366,482	0.04	7.87	-37.5	-29.63	-0.31	Low
ACLS	8/17/2014	-1	168,318	0.22	-129	-38.68	-167.68	54.54	Low
ACOR	8/17/2014	-1	456,572	0.02	-7.63	-40.48	-48.11	2.24	Low
ACRE	8/17/2014	-1	1,010,215	0.61	-98.69	-27.51	-126.2	1.8	Low
ACRX	8/17/2014	-1	286,711	0.06	-58.87	-76.28	-135.15	1.84	Low

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