

VAR Price and Trade 01.sas
Signed trades in MTZ, October, 2005

Stock Symbol=MTZ Transaction Date=20051003

TIME	PRICE	SIZE	EX	qmid	q	effcost	p
9:30:56	10.84	3300	N	10.840	0	0.000	10.84
9:30:57	10.84	200	T	10.840	0	0.000	10.84
9:30:57	10.84	1200	T	10.840	0	0.000	10.84
9:30:57	10.84	1500	M	10.840	0	0.000	10.84
9:30:57	10.84	100	T	10.840	0	0.000	10.84
9:33:55	10.85	300	N	10.865	- 1	0.015	10.85
9:36:19	10.88	100	N	10.870	1	0.010	10.88
9:36:55	10.90	100	N	10.895	1	0.005	10.90
9:41:59	10.94	200	N	10.910	1	0.030	10.94
9:44:15	10.94	100	N	10.915	1	0.025	10.94
9:44:16	10.95	400	N	10.945	1	0.005	10.95
9:44:18	10.95	100	N	10.960	- 1	0.010	10.95
9:44:34	10.96	100	N	10.970	- 1	0.010	10.96
9:44:35	10.95	300	N	10.965	- 1	0.015	10.95
9:44:47	10.95	100	N	10.965	- 1	0.015	10.95
9:45:03	10.98	200	N	10.960	1	0.020	10.98
9:45:44	10.95	200	M	10.970	- 1	0.020	10.95
9:47:22	10.99	100	N	10.985	1	0.005	10.99
9:47:23	11.00	100	N	10.990	1	0.010	11.00
9:48:45	11.00	100	N	10.995	1	0.005	11.00
9:48:46	11.00	400	N	10.995	1	0.005	11.00
9:49:25	11.00	200	N	11.015	- 1	0.015	11.00
9:52:24	11.00	100	N	10.995	1	0.005	11.00
9:57:42	11.00	200	N	10.995	1	0.005	11.00
9:58:01	11.00	400	N	10.995	1	0.005	11.00
9:58:10	11.00	100	N	10.995	1	0.005	11.00
9:58:46	11.00	100	N	10.995	1	0.005	11.00
9:58:49	11.01	100	P	11.005	1	0.005	11.01
9:59:04	11.01	100	N	11.000	1	0.010	11.01
9:59:08	11.01	200	N	11.000	1	0.010	11.01
9:59:09	11.02	100	N	11.010	1	0.010	11.02
10:00:02	11.00	300	N	11.015	- 1	0.015	11.00
10:00:33	11.00	100	N	10.995	1	0.005	11.00
10:00:34	11.01	100	N	11.005	1	0.005	11.01
10:00:50	11.02	100	N	11.020	0	0.000	11.02

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10:02:02	11.02	200	N	11.015	1	0.005	11.02
10:02:32	11.02	200	N	11.015	1	0.005	11.02
10:02:42	11.03	200	T	11.020	1	0.010	11.03
10:02:42	11.03	100	P	11.020	1	0.010	11.03
10:02:42	11.03	100	T	11.020	1	0.010	11.03
10:02:45	11.02	100	N	11.020	0	0.000	11.02
10:02:46	11.01	400	N	11.020	- 1	0.010	11.01
10:03:18	11.02	300	N	11.025	- 1	0.005	11.02
10:03:20	11.02	200	N	11.020	0	0.000	11.02
10:03:46	11.02	100	N	11.015	1	0.005	11.02
10:05:22	11.01	300	N	11.015	- 1	0.005	11.01
10:06:07	11.01	500	N	11.015	- 1	0.005	11.01
10:06:07	11.01	100	M	11.015	- 1	0.005	11.01
10:06:07	11.01	100	M	11.015	- 1	0.005	11.01
10:06:07	11.01	300	M	11.015	- 1	0.005	11.01
10:06:20	11.01	400	N	11.015	- 1	0.005	11.01
10:06:25	10.99	100	N	11.005	- 1	0.015	10.99
10:06:27	10.96	700	N	10.990	- 1	0.030	10.96
10:06:28	11.00	200	M	10.990	1	0.010	11.00
10:06:28	10.99	100	N	10.990	0	0.000	10.99
10:06:46	10.99	200	N	10.975	1	0.015	10.99
10:07:01	10.99	100	N	10.975	1	0.015	10.99
10:07:57	10.96	300	N	10.970	- 1	0.010	10.96
10:08:33	10.97	100	N	10.970	0	0.000	10.97
10:11:51	10.98	100	N	10.970	1	0.010	10.98

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The UNIVARIATE Procedure
Variable: effcost

Moments			
N	14474	Sum Weights	14474
Mean	0.00750528	Sum Observations	108.6314
Std Deviation	0.00658299	Variance	0.00004334
Skewness	4.19315495	Kurtosis	39.2692479
Uncorrected SS	1.4425077	Corrected SS	0.6271988
Coeff Variation	87.7114961	Std Error Mean	0.00005472

Basic Statistical Measures			
Location		Variability	
Mean	0.007505	Std Deviation	0.00658
Median	0.005000	Variance	0.0000433
Mode	0.005000	Range	0.14570
		Interquartile Range	0.00500

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	137.1632	Pr > t	<.0001
Sign	M	6765	Pr >= M	<.0001
Signed Rank	S	45768608	Pr >= S	<.0001

Quantiles (Definition 5)	
Quantile	Estimate
100% Max	0.1457
99%	0.0300
95%	0.0200
90%	0.0150
75% Q3	0.0100
50% Median	0.0050
25% Q1	0.0050
10%	0.0050
5%	0.0000

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The UNIVARIATE Procedure
Variable: effcost

Quantiles (Definition 5)	
Quantile	Estimate
1%	0.0000
0% Min	0.0000

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
0	14445	0.0850	5655
0	14405	0.0850	13998
0	14360	0.1052	2776
0	14322	0.1200	2583
0	14321	0.1457	10860

VAR Price and Trade 01.sas
Analysis of prices and order flow.

The VARMAX Procedure

Number of Observations	14473
Number of Pairwise Missing	0
Observation(s) eliminated by differencing	1

Simple Summary Statistics							
Variable	Type	N	Mean	Standard Deviation	Min	Max	Difference
q	Dependent	14473	0.12465	0.95523	- 1.00000	1.00000	
p	Dependent	14473	- 0.00004	0.01040	- 0.18000	0.15020	1

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The VARMAX Procedure

Type of Model	VAR(4)
Estimation Method	Least Squares Estimation

AR Coefficient Estimates			
Lag	Variable	q	p
1	q	0.29466	- 1.39682
	p	- 0.00120	- 0.15033
2	q	0.10928	- 2.98245
	p	0.00026	- 0.02031
3	q	0.03947	- 2.58988
	p	0.00021	0.00704
4	q	0.06228	- 2.22700
	p	0.00045	- 0.00087

Schematic Representation of Parameter Estimates				
Variable/Lag	AR1	AR2	AR3	AR4
q	+. .	+- .	+- .	+- .
p	-- .	+-	+. .
+ is > 2*std error, - is < - 2*stderror, . is between, * is N/A				

Model Parameter Estimates						
Equation	Parameter	Estimate	Standard Error	t Value	Pr > t	Variable
q	AR1_1_1	0.29466	0.00923	31.92	0.0001	q(t- 1)
	AR1_1_2	- 1.39682	0.81437	- 1.72	0.0863	p(t- 1)
	AR2_1_1	0.10928	0.00979	11.17	0.0001	q(t- 2)
	AR2_1_2	- 2.98245	0.82260	- 3.63	0.0003	p(t- 2)
	AR3_1_1	0.03947	0.00979	4.03	0.0001	q(t- 3)
	AR3_1_2	- 2.58988	0.82309	- 3.15	0.0017	p(t- 3)
	AR4_1_1	0.06228	0.00915	6.81	0.0001	q(t- 4)
	AR4_1_2	- 2.22700	0.77686	- 2.87	0.0042	p(t- 4)
p	AR1_2_1	- 0.00120	0.00010	- 11.50	0.0001	q(t- 1)
	AR1_2_2	- 0.15033	0.00924	- 16.27	0.0001	p(t- 1)

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Model Parameter Estimates						
Equation	Parameter	Estimate	Standard Error	t Value	Pr > t	Variable
	AR2_2_1	0.00026	0.00011	2.39	0.0170	q(t- 2)
	AR2_2_2	- 0.02031	0.00933	- 2.18	0.0296	p(t- 2)
	AR3_2_1	0.00021	0.00011	1.88	0.0600	q(t- 3)
	AR3_2_2	0.00704	0.00934	0.75	0.4511	p(t- 3)
	AR4_2_1	0.00045	0.00010	4.33	0.0001	q(t- 4)
	AR4_2_2	- 0.00087	0.00881	- 0.10	0.9214	p(t- 4)

Covariances of Innovations		
Variable	q	p
q	0.80118	0.00397
p	0.00397	0.00010

Information Criteria	
AICC	- 9.61108
HQC	- 9.6083
AIC	- 9.61109
SBC	- 9.6027
FPEC	0.000067

Cross Covariances of Residuals			
Lag	Variable	q	p
0	q	0.79698	0.00396
	p	0.00396	0.00010

VAR Price and Trade 01.sas
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The VARMAX Procedure

Cross Correlations of Residuals			
Lag	Variable	q	p
0	q	1.00000	0.43738
	p	0.43738	1.00000

Schematic Representation of Cross Correlations of Residuals	
Variable/Lag	0
q	++
p	++
+ is > 2*std error, - is < - 2*stderror, . is between	

Univariate Model ANOVA Diagnostics				
Variable	R- Square	Standard Deviation	F Value	Pr > F
q	0.1267	0.89509	299.81	<.0001
p	0.0470	0.01016	101.81	<.0001

Univariate Model White Noise Diagnostics					
Variable	Durbin Watson	Normality		ARCH	
		Chi- Square	Pr > ChiSq	F Value	Pr > F
q	2.01150	1050.87	<.0001	251.46	<.0001
p	2.00099	9999.99	<.0001	1655.63	<.0001

Univariate Model AR Diagnostics								
Variable	AR1		AR2		AR3		AR4	
	F Value	Pr > F	F Value	Pr > F	F Value	Pr > F	F Value	Pr > F
q	0.49	0.4842	0.56	0.5711	0.84	0.4693	1.73	0.1393
p	0.01	0.9434	0.01	0.9946	0.01	0.9986	0.07	0.9920

VAR Price and Trade 01.sas
Analysis of prices and order flow.

The VARMAX Procedure

Accumulated Impulse Response			
Lag	Variable	q	p
1	q	1.29466	- 1.39682
	p	- 0.00120	0.84967
2	q	1.49246	- 4.58087
	p	- 0.00111	0.85364
3	q	1.62587	- 7.81882
	p	- 0.00105	0.86660
4	q	1.76348	- 11.04363
	p	- 0.00067	0.86541
5	q	1.84650	- 12.27287
	p	- 0.00068	0.86721
6	q	1.90211	- 13.35499
	p	- 0.00064	0.86557
7	q	1.94016	- 14.16601
	p	- 0.00060	0.86462
8	q	1.96828	- 14.76841
	p	- 0.00056	0.86379
9	q	1.98782	- 15.14958
	p	- 0.00054	0.86365
10	q	2.00126	- 15.41835
	p	- 0.00052	0.86333

Orthogonalized Impulse Response			
Lag	Variable	q	p
0	q	0.89509	0.00000
	p	0.00443	0.00914
1	q	0.25756	- 0.01276
	p	- 0.00174	- 0.00137
2	q	0.16293	- 0.02910
	p	0.00010	0.00004
3	q	0.10508	- 0.02959

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Orthogonalized Impulse Response			
Lag	Variable	q	p
	p	0.00011	0.00012
4	q	0.10888	- 0.02947
	p	0.00034	- 0.00001
5	q	0.06886	- 0.01123
	p	- 0.00000	0.00002
6	q	0.04498	- 0.00989
	p	0.00004	- 0.00001
7	q	0.03046	- 0.00741
	p	0.00003	- 0.00001
8	q	0.02250	- 0.00551
	p	0.00003	- 0.00001
9	q	0.01580	- 0.00348
	p	0.00002	- 0.00000
10	q	0.01084	- 0.00246
	p	0.00001	- 0.00000

Variance Decomposition

Coefficient matrix		
	q	p
p	- 0.000525	0.8633307

Covariance matrix		
	q	p
q	0.8011782	0.0039656
p	0.0039656	0.0001031

Correlation matrix		
	q	p
q	1.000	0.436
p	0.436	1.000

Purmutation used in decomposition / ordering of variables:	
q	p

Permuted coefficients		
	q	p
p	- 0.000525	0.8633307

Permuted covariance matrix		
	q	p
q	0.8011782	0.0039656
p	0.0039656	0.0001031

Cholesky factor of permuted covariance matrix		
	q	p
p	0.8950856	0
	0.0044304	0.0091385

Variance Decomposition

Variance contributions (ordered)		
	q	p
p	0.0000113	0.0000622

Total variance	
p	0.0000735

Proportional contributions		
	q	p
p	0.153	0.847

Variance Decomposition

Coefficient matrix		
	q	p
p	- 0.000525	0.8633307

Covariance matrix		
	q	p
q	0.8011782	0.0039656
p	0.0039656	0.0001031

Correlation matrix		
	q	p
q	1.000	0.436
p	0.436	1.000

Purmutation used in decomposition / ordering of variables:	
p	q

Permuted coefficients		
	p	q
p	0.8633307	- 0.000525

Permuted covariance matrix		
	p	q
p	0.0001031	0.0039656
q	0.0039656	0.8011782

Cholesky factor of permuted covariance matrix		
	p	q
p	0.0101558	0
	0.390477	0.8054228

Variance Decomposition

Variance contributions (ordered)		
	p	q
p	0.0000733	1.7855E- 7

Total variance	
p	0.0000735

Proportional contributions		
	p	q
p	0.998	0.002

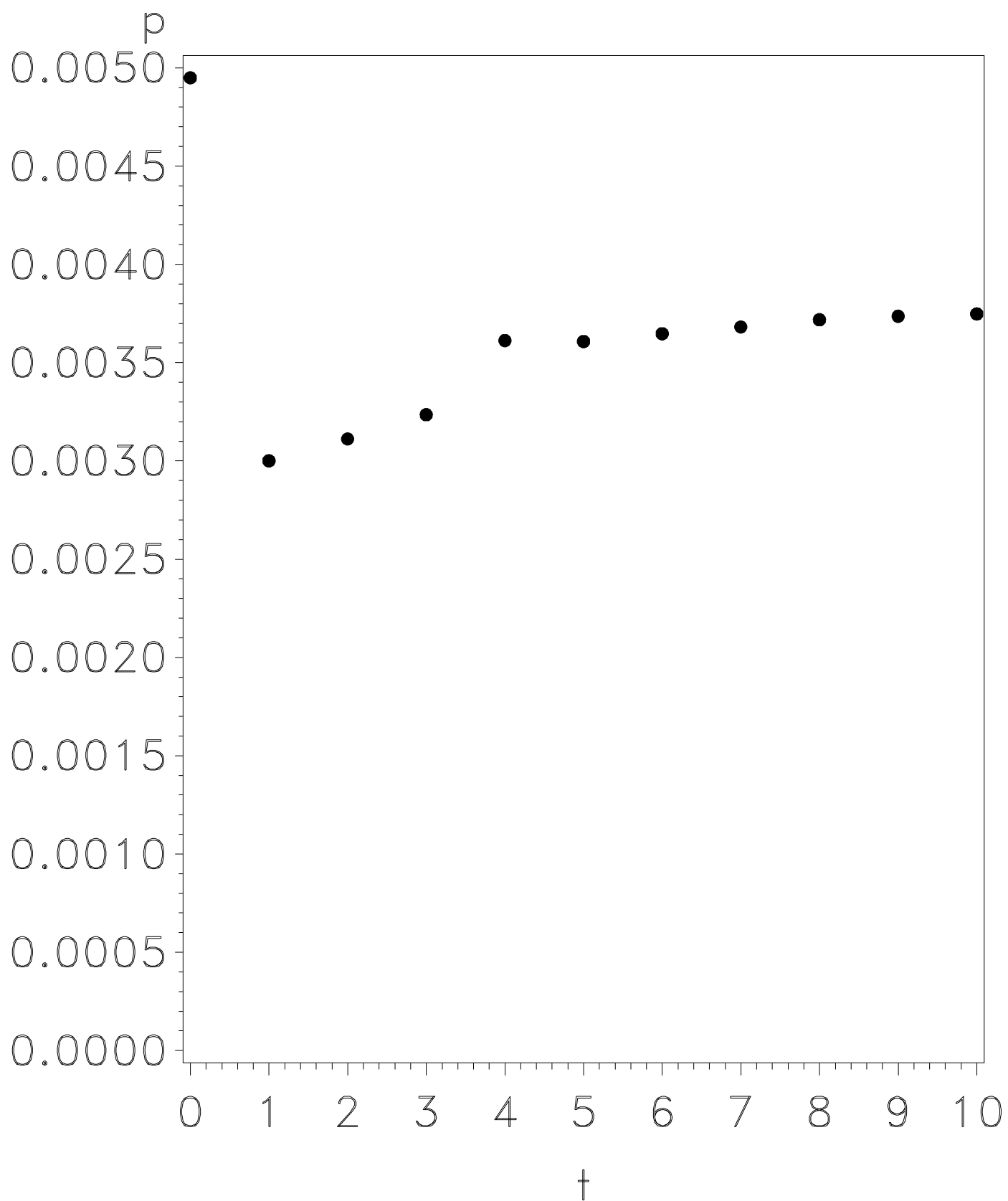
Variance Decomposition

Impact of a buy order ($q=+1$ at time 0)

Obs	q	p	t	qCurrent	pCurrent
1	1.00000	.004949731	0	1.00000	0.00495
2	1.28775	.003001262	1	0.28775	- 0.00195
3	1.46978	.003112068	2	0.18203	0.00011
4	1.58717	.003235747	3	0.11739	0.00012
5	1.70882	.003612831	4	0.12164	0.00038
6	1.78575	.003607933	5	0.07694	- 0.00000
7	1.83600	.003647611	6	0.05025	0.00004
8	1.87004	.003682279	7	0.03403	0.00003
9	1.89518	.003718913	8	0.02514	0.00004
10	1.91283	.003736767	9	0.01766	0.00002
11	1.92495	.003748617	10	0.01211	0.00001

Variance Decomposition

Impact of a buy order ($q=+1$ at time 0)



Variance Decomposition

Impact of a buy order ($q=+1$ at time 0)

