Appendix Table I
Estimates of Bivariate Model

x_{t+8}	x_{t+7}	x_{t+6}	x_{t+5}	x_{t+4}	x_{t+3}	x_{t+2}	x_{t+1}	x_t	x_{t-1}	x_{t-2}
0.0172	0.0333	0.0404	0.0535	0.0741	0.0830	0.1124	0.0367	-0.1753	-0.0024	-0.002
(0.001)	(0.0099)	(0.0100)	(0.0098)	(0.0099)	(0.0100)	(0.0105)	(0.0111)	(0.0102)	(0.0096)	(0.0094)

$(\Sigma_\varepsilon)^{1/2}$	0.0292	(0.0007)	$(\Sigma_\omega)^{1/2}$	0.0407	(0.0004)
$D(1)$	0.2526	(0.0228)	J-statistic	10.8595	(0.9002)

Notes: The table reports GMM estimates of the Bivariate model:

$$\begin{bmatrix}\Delta p_t^a \\ \Delta p_t^b\end{bmatrix} = \begin{bmatrix}1 \\ 1\end{bmatrix} D(L)x_t + \begin{bmatrix}1 \\ 1\end{bmatrix}\varepsilon_t + \begin{bmatrix}\omega_t^a - \omega_t^a \\ \omega_t^b - \omega_{t-1}^b\end{bmatrix}.$$

where w_t^a, w_t^b and ε_t are mutually independent and serially uncorrelated shocks with $E\omega_t^a = \omega^a$, $E\omega_t^b = \omega^b$, $E\varepsilon_t = 0$ and $Var(\varepsilon_t) = \Sigma_\varepsilon$, $Var(\omega_t^a) = Var(\omega_t^b) = \Sigma_\omega$. The estimates are derived from data series based on a two-and-a-half minute observation window, rather than the five-minute window used to derive the estimates in Table V.

Appendix Table II
Price Distribution Regressions

Dependent Variable	Coefficients (Standard errors)							
	$\exp(-n_t^s)$	$1-\exp(-n_t^s)$	const.	$\hat{\Sigma}_\omega(n_t)$	n_t^s	R^2	SEE	Test
$\hat{\Omega}^a$	0.268					0.003	0.382	
	(0.004)							
$\hat{\Omega}_t^a$	0.259	0.057				0.004	0.382	
	(0.007)	(0.029)						
$\hat{\Omega}_t^a$			0.057	0.881		0.004	0.382	
			(0.029)	(0.153)				
$\hat{\Omega}_t^a$ - $\hat{\Sigma}_\omega(n_t)$			0.021		0.072	0.001	0.382	130.294
			(0.006)		(0.026)			(<0.001)
$\hat{\Omega}_t^b$	0.273					0.004	0.382	
	(0.004)							
$\hat{\Omega}_t^b$	0.268	0.035				0.004	0.382	
	(0.007)	(0.033)						
$\hat{\Omega}_t^b$			0.034	1.015		0.004	0.382	
			(0.033)	(0.017)				
$\hat{\Omega}_t^b$ - $\hat{\Sigma}_\omega(n_t)$			0.028		0.056	0.001	0.397	134.887
			(0.006)		(0.029)			(<0.001)

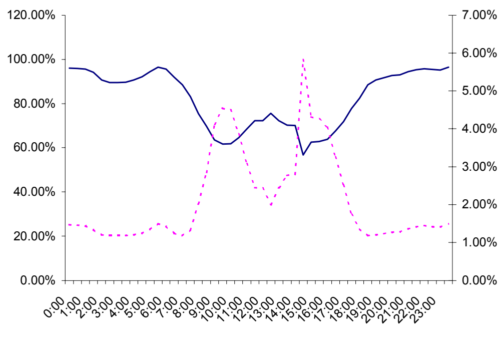
Notes: The table reports OLS estimates for regressions of the dispersion of purchase and sales prices, $\hat{\Omega}_t^a$ and $\hat{\Omega}_t^b$, on functions of trade intensity, $n_t^s \equiv n_t / 100$ and estimates of the sampling variance, $\hat{\Sigma}_\omega(n_t)$, calculated from the GMM estimates of the state-dependent Bivariate model in Table VIII. The coefficicents and standard errors are multiplied by 100 on all variables except $\hat{\Sigma}_\omega(n_t)$. $\hat{\Omega}_t^a$ and $\hat{\Omega}_t^b$ are calculated as the variance of purchase and sales prices during five-minute observation interval *t*. Asymptotic standard errors are reported in parentheses corrected for heteroskedasticity. The column headed Test reports the χ^2 statistic and p-value for null hypothesis that the constant and coeffcient on n_t^s are both zero.

Appendix Table III
Variance Ratios

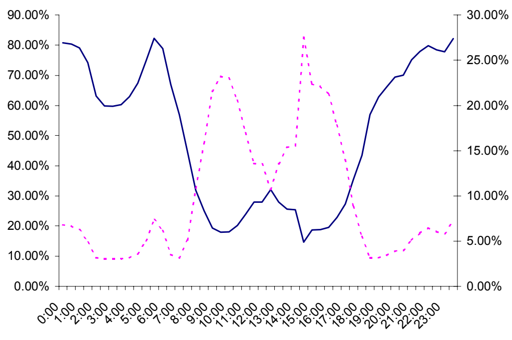
$R_{\omega}(k,n) = Var(\omega_t^o - \omega_{t-k}^o) / Var(\Delta^k p_t^o)$					
n \ k	5	30	60	120	∞
2	95.21%	77.64%	65.35%	49.64%	0.00%
5	90.62%	62.82%	46.87%	31.09%	0.00%
10	83.26%	44.98%	29.26%	17.22%	0.00%
20	69.91%	25.25%	14.20%	7.57%	0.00%
30	58.57%	15.76%	8.26%	4.23%	0.00%
40	49.15%	10.63%	5.36%	2.69%	0.00%
60	35.04%	5.66%	2.74%	1.35%	0.00%
80	25.50%	3.44%	1.63%	0.79%	0.00%
all	67.11%	20.13%	10.72%	5.54%	0.00%
$R_{v}(k,n) = Var(B(L,k,n)v_t) / Var(\Delta^k p_t^o)$					
n \ k	5	30	60	120	∞
2	1.41%	5.79%	6.75%	7.99%	11.88%
5	1.20%	3.14%	2.35%	1.56%	0.00%
10	1.32%	5.03%	5.70%	6.22%	6.96%
20	2.83%	15.68%	19.36%	21.57%	24.09%
30	5.34%	25.99%	30.68%	33.20%	35.84%
40	8.29%	34.11%	38.96%	41.41%	43.89%
60	14.25%	45.17%	49.71%	51.87%	53.96%
80	19.48%	52.03%	56.16%	58.07%	59.89%
all	5.53%	30.62%	36.81%	40.22%	43.87%
$R_{v^*}(k,n) = Var(B^*(L,k,n)v_t) / Var(\Delta^k p_t^o)$					
n \ k	5	30	60	120	∞
2	1.36%	3.98%	2.81%	2.13%	0.00%
5	1.20%	3.15%	2.36%	1.56%	0.00%
10	1.21%	4.06%	3.29%	1.96%	0.00%
20	1.95%	7.84%	5.84%	3.23%	0.00%
30	3.09%	10.92%	7.68%	4.15%	0.00%
40	4.22%	13.08%	8.92%	4.79%	0.00%
60	6.02%	15.71%	10.44%	5.57%	0.00%
80	7.21%	17.19%	11.30%	6.03%	0.00%
all	3.13%	12.16%	8.64%	4.75%	0.00%

Notes: Variance decompositions derived from estimates of the State-Dependent Bivariate model in Table VIII and the ARMA(2,2) model for order flow in Table II. (Unlike Table IX, this version assumes homoskedastic variance for order flow shocks). The column headings show the horizon k measured in minutes. $R_{\omega}(k,n)$ and $R_{v}(k,n)$ respectively measure the contribution of sampling and order flow shocks to the variance of observed price changes. $R_{v^*}(k,n)$ measures the contribution of order flow shocks that only affect the price level temporarily.

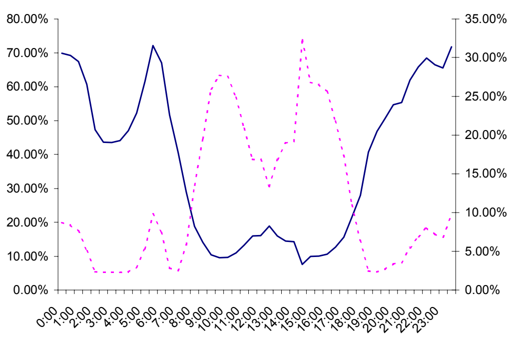
Appendix Figure 1:
Variance Decompositions Over a Typical Trading Day



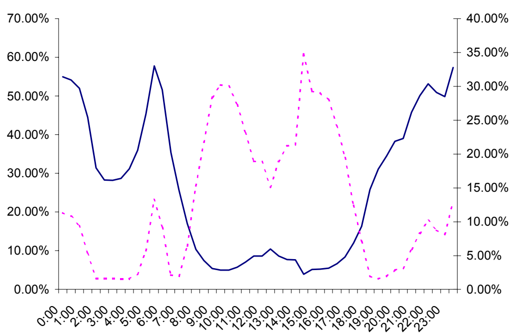
A: 5 minute Horizon (*k*-=1)



B: 30 Minute Horizon (*k*=6)



C: 60 Minute Horizon (*k*=12)



D: 120 Minute Horizon (*k*=24)

Solid lines plot $R_\omega(k,n_t)$ against the left hand axis. Dashed lines plot $R_v(k,n_t)$ against the right-hand axis. n_t is the average transaction rate over the sample during the each five-minute interval. Calculations assume homoskedastic order flow.