Internet Appendix A:

Table A1 - Average Country Level Measures

Developed Countries

Country	Reversals (bps)	PEAD (%)	Mom. (bps)	Delay (%)	|VR5-1|	LOT (%)
Luxembourg				-0.1	0.125	1.3
Norway	30.6	-3.3	43.9	1.5	0.164	5.6
Switzerland	4.6	7.2	33.9	3.9	0.175	5.3
Denmark	3.9	4.3	41.9	3.6	0.138	4.5
United States	29.6	2.1	32.4	7.2	0.162	2.7
Ireland				5.6	0.181	8.2
Sweden	30.2	9.1	32.8	3.2	0.156	3.9
Netherlands	5.0	4.5	30.6	4.6	0.162	3.9
Japan	30.6	4.0	0.4	4.7	0.184	4.7
Finland	21.6	-1.0	30.0	2.4	0.170	5.0
United Kingdom	6.1	-1.7	38.8	10.7	0.171	8.5
Austria	9.4	16.1	16.4	0.8	0.220	6.3
Belgium	24.4	4.8	40.3	3.5	0.174	4.8
France	34.4	7.2	35.1	10.7	0.196	5.2
Germany	14.3	-1.4	47.0	4.6	0.154	4.5
Canada	75.4	7.0	11.4	4.9	0.201	7.7
Italy	0.3	4.4	32.8	4.4	0.137	2.9
Australia	36.3	8.0	37.4	5.3	0.157	5.5
Hong Kong	-6.5	7.7	23.1	4.0	0.138	6.8
Singapore	40.7	8.0	5.3	2.6	0.190	6.0
Spain	3.1	-3.7	6.4	2.9	0.131	2.3
Greece	5.9		26.4	0.5	0.169	1.1
New Zealand	27.1	8.6	45.7	2.2	0.162	5.3
Cyprus	-33.6		-3.1	1.7	0.257	4.1
Israel	57.4	-0.6	22.2	1.5	0.129	4.7
Portugal	-0.4	0.3	15.2	1.9	0.213	3.9
South Korea	-22.0	8.5	16.7	1.8	0.127	1.8
Taiwan	-28.4	-0.7	12.0	2.6	0.171	1.3
Developed Avg.	15.4	4.1	26.0	3.7	0.168	4.6

Emerging Countries

Country	Reversals (bps)	PEAD (%)	Mom. (bps)	Delay (%)	|VR5-1|	LOT (%)
Czech Republic				6.2	0.177	4.9
Hungary		9.0		2.1	0.182	4.4
Mexico		5.5		0.8	0.169	2.2
Poland	7.5	0.8	38.9	0.9	0.119	2.2
Lithuania				0.6	0.185	5.2
Turkey	-12.2	9.6	-17.1	1.6	0.118	2.5
Chile	5.9	-2.8	30.8	3.5	0.151	8.2
Malaysia	39.0	6.8	-5.2	1.2	0.135	3.3
Venezuela				0.1	0.093	
South Africa	53.9	7.3	42.9	3.8	0.181	8.8
Argentina	82.4	5.1	-51.7	0.9	0.123	7.3
Brazil	9.6	5.2	9.9	1.2	0.164	10.2
Romania				2.9	0.128	10.0
Bulgaria				0.2		2.2
Peru				0.4	0.119	5.5
Thailand	5.9	5.0	14.0	1.7	0.199	5.0
Columbia				-0.6	0.256	4.6
Morocco				1.1	0.123	4.7
China	-28.9	3.4	9.0	-0.8	0.110	0.9
Egypt	-15.7		10.9	0.1	0.179	2.4
Philippines	7.5	5.2	19.9	1.5	0.175	11.7
Indonesia	13.6	3.2	8.1	2.3	0.152	14.0
Sri Lanka	11.2		6.3	-0.1	0.150	8.7
India	51.3	-4.0	30.7	0.0	0.142	3.8
Pakistan	66.5		-2.0	0.5	0.135	5.6
Kenya				0.5	0.142	8.3
Bangladesh	6.2		83.4	1.0	0.116	3.3
Zimbabwe	278.4			0.4	0.143	13.1
Emerging Avg.	34.2	4.2	14.3	1.2	0.151	6.0

Country averages are calculated as in Table 6. Countries are ordered from highest (top) to lowest (bottom) 2005 GNI per capita within the developed and emerging market groupings.

Internet Appendix B:

Table B1 - MYY(2000) R^2, efficiency and information generation

Dependent	Morck, Yeung, Yu (2000) R^2			
Intercept	-1.45	-1.15	0.62	1.95
	(0.00)	(0.00)	(0.49)	(0.05)
Regulatory				
Short Sales Dummy				
Insider Trading Dummy				
UK Law	-0.24			
	(0.02)			
Good Gov. MYY (2000)	x	x		
Economic & Financial Development				
Market Cap./GDP				
Market Turnover/GDP				
GNI per Capita				
Deposit Bank Assets	x	x	-1.90	-3.00
			(0.02)	(0.00)
Private Credit/GDP	x	x		
Market Turnover			-0.32	
			(0.00)	
Country Risk				
Geographical Size (ln)	-0.06		-0.08	-0.08
	(0.01)		(0.00)	(0.00)
Informational Environment				
Analyst Coverage (÷100)			0.41	0.44
			(0.00)	(0.00)
Corruption				
Trading Costs				
Hasbrouck Trading Cost	x	x		
LOT Trading Cost	x	x	-0.07	-0.06
			(0.00)	(0.00)
Characteristics of Equity Market				
Market Volatility	0.20	x	**21.31**	x
	(0.00)		**(0.00)**	
Corr. w/ World Market				
Company Herfindahl				
No. of Firms (ln)		-0.10		
		(0.03)		
Number of Obs.	55	55	40	40
Adjusted R^2	0.33	0.07	0.61	0.40

We extend Table 6 and examine cross-country regressions of the Morck et al. (2000) R^2 measure on measures of development, efficiency and information generation. We estimate a model selection program, PCGive, to select the variables that best fit the data. If a variable is selected (using default target size, α=0.05, and the default diagnostic test *p*-value, 0.01), we report the coefficient with its p-value in parentheses, otherwise we leave the coefficient blank. MYY(2000) R^2 is the SST weighted average R^2 of simple market model regressions including the local and the US market for each stock in our sample calculated following Morck, et al. (2000) for each year in our sample and averaged over all years. All variables are as defined in Table 6, except that we also include a "Good Government" measure, which is the sum of the "corruption," "risk of expropriation," and "repudiation of contracts" constructed following Morck, Yeung, and Yu. (2000), using data reported by La Porta el al. (1998). For each dependent variable, we run PCGive on all listed variables, an 'x' indicates the variable was not included so as to increase sample size. If a variable is selected (using default target size, α=0.05, and the default diagnostic test *p*-value, 0.01), we report the coefficient with its p-value in parentheses, otherwise we leave the coefficient blank.

Internet Appendix C: Mapping with Specific Efficiency Measures

Recall that the model in Section 6, equations (5) and (6),

$$r_1 = \mu + \delta\eta_1 + e_1, \tag{5}$$

$$r_2 = \mu + (1-\delta)\eta_1 + \delta\eta_2 + e_2, \tag{6}$$

relates returns as a function of news (η) and the speed of information incorporation (δ>0) to a generic empirical efficiency measure, which is a function of the covariance between current and future returns:

$$M^E = \left|f\left(Cov(r_{t+1}, r_t)\right)\right|. \tag{4'}$$

Previous literature has interpreted the measures we use in this paper as tests (or indications) of the speed of information incorporation, where high autocorrelation means slower information incorporation. Section 6 shows that these measures of efficiency are not merely driven by how quickly or slowly information is incorporated, but also by the quantity of information or news revealed or produced in the market. In this Appendix, we show how each of our measures of efficiency, variance ratios and delay, and each of our trading strategies designed to exploit weak or semi-strong form inefficiencies, reversal, momentum and post earnings announcement drift (PEAD), is related to this generic efficiency measure and, more specifically, to the amount of news present in a given market. We demonstrate that the amount of news can also drive the empirically measured appearance of inefficiency.

A. Variance Ratio

Variance ratios are specifically designed to capture the sort of autocovariance our general measure in equation (4') reflects. A variance ratio is:

$$VR(N) = \frac{Var(\sum_{n=1}^{N} r_n)}{N \cdot Var(r_1)}, \tag{IA.1}$$

where *r* represents continuously compounded returns, so that (IA.1) is the ratio of the variance of *N* period returns to *N* times the variance of a one period return. The equation is easily restated in terms of the variances and autocovariances:

$$VR(N) = \frac{Var(\sum_{n=1}^{N} r_n)}{N \cdot Var(r_1)} = \frac{\sum_{i=1}^{N}\sum_{j=1}^{N} Cov(r_i, r_j)}{N \cdot Var(r_1)}. \quad \text{(IA.2)}$$

This equation can be restated in terms of speed and news. For simplicity, consider a VR(2):

$$VR(2) = \frac{Var(r_1 + r_2)}{2 \cdot Var(r_1)} = \frac{Var(r_1) + Var(r_2) + 2 \cdot Cov(r_1, r_2)}{2 \cdot Var(r_1)}. \quad \text{(IA.3)}$$

Substituting in equations (5) and (6), we have:

$$VR(2) = \frac{Var(\mu + \delta\eta_1 + e_1) + Var(\mu + (1-\delta)\eta_1 + \delta\eta_2 + e_2) + 2Cov(\mu + \delta\eta_1 + e_1, \mu + (1-\delta)\eta_1 + \delta\eta_2 + e_2)}{2 \cdot Var(r_1)}. \quad \text{(IA.4)}$$

If we assume that expected return (μ) is constant, news is not autocorrelated, and the variance of news and noise is constant over time, $Var(\eta_1) = Var(\eta_2)$ and $Var(e_1) = Var(e_2)$, this reduces to:

$$VR(2) = \frac{\delta^2 Var(\eta) + Var(e) + (1-\delta)^2 Var(\eta) + \delta^2 Var(\eta) + Var(e) + 2[(1-\delta)\delta Var(\eta) + Cov(e_1, e_2)]}{2 \cdot Var(r_1)}. \quad \text{(IA.5)}$$

Further rearranging yields:

$$VR(2) = 1 + \frac{(1-\delta^2) Var(\eta) + 2 \cdot Cov(e_1, e_2)}{2 \cdot Var(r_1)}. \quad \text{(IA.6)}$$

Now we can easily see that variance ratios are affected, not merely by the speed of information incorporation, but also by the volatility of the news revealed or generated in the market ($Var(\eta)$). For a given $\delta<1$, higher $Var(\eta)$ will make the *VR* higher than one, implying more apparent positive autocorrelation in observed returns. The reverse is true if $\delta>1$: higher $Var(\eta)$ will make the *VR* lower than one suggesting relatively more negative autocorrelation in observed returns. That is, higher autocorrelation does not itself mean slower information incorporation, because if two markets (or two firms) have the same speed of information incorporation differences in the variance of news could drive differences in empirically measured autocorrelation.

More generally, we can also express $VR(N)$ in terms of news and noise. If we assume, as we do in the model, there is no autocorrelation beyond one lag, even in the noise terms, $VR(N)$ becomes:

$$VR(N) = \frac{\sum_{n=1}^{N} Var(r_n) + 2\sum_{n=1}^{N-1} Cov(r_n, r_{n+1})}{NVar(r_1)}. \tag{IA.7}$$

Making the same assumptions as above, $VR(N)$ can be shown to be:

$$\frac{\delta^2 Var(\eta_1) + Var(e_1) + \sum_{n=2}^{N}[\delta^2 Var(\eta_n) + (1-\delta)^2 Var(\eta_{n-1}) + Var(e_n)] + \sum_{n=1}^{N-1} 2[(1-\delta)\delta Var(\eta_n) + Cov(e_n, e_{n+1})]}{NVar(r_1)}. \tag{IA.8}$$

Letting the variance of news and noise be constant, we obtain:

$$VR(N) = \frac{(\delta^2 + N - 1)Var(\eta) + NVar(e) + 2\sum_{n=1}^{N-1} Cov(e_n, e_{n+1})}{NVar(r_1)}. \tag{IA.9}$$

Like $VR(2)$, higher order variance ratios are also a function of news, and as a result differences in variance ratios are not merely a function of the speed of incorporation, but also the variance of the news itself.

B. Delay

Delay is measured as:.

$$Delay = Adj.R^2_{unrestricted} - Adj.R^2_{restricted}. \tag{A.3}$$

Because R^2 and adjusted R^2 are extremely similar, we focus on plain (unadjusted) R^2s to simplify the math. In addition, delay has no meaning for period 1, because period 1 in our model is the start of time, so we only discuss delay in the context of second period returns r_2.

In the context of our model, the unrestricted R^2 is the R^2 from a regression of returns regressed on a constant (μ), contemporaneous returns ($r_{m,2}$), and prior period returns ($r_{m,1}$), where only market-wide returns is assumed to systematically affect stock returns. For comparability to our model, we restrict the coefficient on prior period news to be (1-δ):

Unrestricted Regression: $$r_2 = \mu + \hat{\delta} r_{m,2} + \widehat{(1-\delta)} r_{m,1} + e_2. \quad \text{(IA.10)}$$

The restricted R^2 is from:

Restricted Regression: $$r_2 = \mu + \hat{\delta} r_{m,2} + e_2. \quad \text{(IA.11)}$$

The market realized return is a function of expected return, market wide news, and market noise in a similar manner to individual stock returns:

$$r_{m,2} = \mu_m + \delta_m \eta_{m,2} + (1-\delta_m)\eta_{m,1} + e_{m,2}. \quad \text{(IA.12)}$$

We assume that market related news is incorporated instantaneously in the market return, so that $\delta_m = 1$. This means that equation (IA12) reduces to:

$$r_{m,t} = \mu_M + \eta_{m,t} + e_{m,t}. \quad \text{(IA.13)}$$

R^2 is defined as the variance of the fitted value of r_2 to the actual variance of r_2. That is:

$$R^2 = \frac{Var(\hat{r}_2)}{Var(r_2)}. \quad \text{(IA.14)}$$

Considered in this way, Delay (A.3) becomes:

$$Delay = R_A^2 - R_B^2 = \frac{Var(\hat{r}_{2,Unrest}) - Var(\hat{r}_{2,Rest})}{Var(r_2)}. \quad \text{(IA.15)}$$

If we substitute in the fitted versions of (IA.10), and (IA.11):

$$Delay = \frac{Var(\mu + \delta r_{m,2} + (1-\delta) r_{m,1}) - Var(\mu + \delta r_{m,2})}{Var(r_2)}. \quad \text{(IA.16)}$$

Substituting in market returns for news (IA.13), we have:

$$Delay = \frac{Var\left(\mu + \delta(\mu_m + \eta_{m,2} + e_{m,2}) + (1-\delta)(\mu_m + \eta_{m,1} + e_{m,1})\right) - Var\left(\mu + \delta(\mu_m + \eta_{m,2} + e_{m,2})\right)}{Var(r_2)}. \quad \text{(IA.17)}$$

Since μ and μ_m are constants, and $cov(\eta_{m,1}, \eta_{m,2})=0$, and $cov(e_1, e_2)=0$, (IA.17) reduces to:

$$Delay = \frac{\delta^2 Var(\eta_{m,2}) + \delta^2 Var(e_{m,2}) + (1-\delta)^2 Var(\eta_{m,1}) + (1-\delta)^2 Var(e_{m,1}) - \delta^2 Var(\eta_{m,2}) - \delta^2 Var(e_{m,2})}{Var(r_2)}. \quad \text{(IA.18)}$$

If we assume that the variance of news and noise is constant over time. $Var(e_{m,1})=Var(e_{m,2})$ and $Var(\eta_{m,1})=Var(\eta_{m,2})$ and (IA18) becomes:

$$Delay = \frac{(1-\delta)^2\left(Var(\eta_m)+Var(e_m)\right)}{Var(r_2)}. \tag{IA.19}$$

In this form it is clear that Delay is not merely a function of the speed of information incorporation, but also the amount of news. For instance, a higher variance of η_m will lead to a higher measured delay, all other things equal and, in particular, for any given δ.

C. Reversals and Momentum

Momentum and reversals strategies are similar in term of their reliance on past returns, but they are implemented over different time horizons, and with different expectations about the sign of the serial correlation of the components of the long-short strategy. As such we can characterize the profits to momentum or reversal portfolios as:

$$Reversal = M^E = \left[r_{L-W,2} | r_{L-W,1} < 0\right] > 0, \quad \text{(IA.20)}$$

$$Momentum = M^E = \left[r_{W-L,2} | r_{W-L,1} > 0\right] > 0, \quad \text{(IA.21)}$$

where $r_{L-W,1}$ is the return to a portfolio long period 1 losers and short period 1 winners and $r_{L-W,2}$ is the return to a portfolio long and short the same stocks as $r_{L-W,1}$. If we can assume that, to the extent there is a relation between past and current returns, that this relation is linear, then the expected reversal or momentum portfolio returns, conditional on past returns is:

$$E[r_2 | r_1] = \beta r_1 \quad \text{(IA.22)}$$

or

$$E[r_2 | r_1] = \frac{Cov(r_2, r_1)}{Var(r_1)} r_1 \ , \quad \text{(IA.23)}$$

where β is negative if returns are for the reversal portfolio and positive if the momentum portfolio. For notational generality, we drop the labels "L-W" and "W-L". Substituting in equations (7) (without the absolute value) into (IA.23) yields:

$$E[M^E] = E[r_2 | r_1] = \frac{\delta(1-\delta)Var(\eta_1) + Cov(e_1, e_2)}{Var(r_1)} r_1 \ . \quad \text{(IA.24)}$$

Once again, the efficiency measure is not a merely a function of the completeness of information incorporation (δ), but it is also a function of the volatility of firm related news. Additionally, as with our generic efficiency measure, the profits can be increasing or decreasing in δ, depending whether δ is greater or less than 0.5.

D. PEAD

A trading strategy that exploits Post Earnings Announcement Drift (PEAD) buys stocks immediately following strong positive surprise earnings announcements (a.k.a. news) and shorts stocks immediately following strong negative earnings news:

$$PEAD = M^E = [r_2 | \eta_1 > 0] > 0, \tag{IA.25}$$

or

$$PEAD = M^E = [-r_2 | \eta_1 < 0] > 0. \tag{IA.26}$$

Relating post earnings announcement drift to our model is simple if we treat the earnings announcement as the news (η_1), the announcement return is then r_1 and the fraction of the news incorporated around the announcement as ($\delta\eta_1$). As such PEAD, measured as the abnormal return, is:

$$PEAD = r_2 - \mu \tag{IA.27}$$

Substituting (6) in for r_2 yields:

$$PEAD = (1 - \delta)\eta_1 + \delta\eta_2 + e_2 \tag{IA.28}$$

Once again, our measure of the profits to exploiting weak or semi-strong form efficiency, in this case the level of PEAD, is not merely a function of how slowly information is incorporated, but also a function of the quantity of information.