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The delay of stock price adjustment to information: A country-level analysis

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Abstract

This study measures the speed with which the aggregate stock market in 49 countries responds to global market-wide public information. Our empirical results show that there are wide variations in the aggregate price delay values over time and across countries. Subsequent panel analysis confirms previous firm-level evidence that market size, trading volume, short sales restrictions and the degree of investability are significant determinants of price delay even at the country level.

1. INTRODUCTION

The speed of information incorporation is central to market efficiency, given that an efficient market is characterized as one in which stock prices respond instantaneously to the arrival of new information. Since the seminal work of Fama *et al*. (1969), event studies have become the primary tool for assessing the speed of stock price adjustment to specific types of events such as news announcements related to earnings, stock splits, mergers and acquisitions. Another strand of emerging literature considers more general information signals using the price delay measure popularized by Hou and Moskowitz (2005). Unlike standard event study methodology, the price delay not only enables previous studies to gauge the speed of information incorporation, but also to identify those factors responsible for delaying stock price reactions to local market-wide information. Among the important determinants identified via their cross-sectional or panel regressions are firm size, analyst coverage, transaction cost, trading volume, short sales restrictions, and the degree of stock accessibility to foreign investors (for details and references, see the survey paper by Lim, 2009).

The extant price delay studies are largely confined to the U.S. market using firm-level data, measuring the speed with which each individual stock responds to local market-wide news. We extend the existing literature by computing the price delay at the aggregate level as alluded to in Lim (2009), using world market returns as the common benchmark. Our country-level analysis is motivated by the growing interest in comparing the relative efficiency of international stock markets. At present, the market model R-square statistic is the most popular measure of relative efficiency, with the associated cross-country studies provide valuable input to policymakers and market regulators.[1] More specifically, previous country-level R^2 studies find that the informational efficiency of stock market is associated with private property rights protection, public investor protection, financial liberalization, corporate transparency, securities laws, short sales restrictions, and insider trading laws (see references cited in Lim and Brooks, 2009). However, there has been much controversy surrounding the efficiency interpretation of market model R-square. For instance, Alves *et al*. (2010) analyze the behavior of R^2 across forty countries over the twenty-year period of 1985-2004. Their aggregation and decomposition exercises clearly demonstrate the inadequacy of R^2 as a metric of informational efficiency (for other critics, see references cited therein).

Given the mounting criticism, the price delay measure provides a good alternative to the market model R^2 since the former captures the essence of informational efficiency. Our proposed country-level indicator avoids the aggregation problem and counterintuitive cross-country findings in Griffin *et al*. (2010). Briefly, these authors employ, among others, the price delay to compare the relative efficiency of 56 international stock markets over the sample period of 1994-2005. Their firm-level analysis yields intuitive results: delay is lower among large market capitalization stocks and it is generally decreasing in size, confirming the widely acknowledged inverse relation between firm size and price delay. For comparison at the country level, Griffin *et al*. (2010) average the delay across the five size portfolios for each individual country. However, their aggregation procedure produces paradoxical results in which the stock prices in emerging markets incorporate local market-wide information more quickly than prices in developed markets. Subsequently, their cross-sectional regression

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[1] One of the main objectives of securities regulation is to promote market efficiency, in which the dissemination of relevant information is timely and is reflected in the price formation process. The objectives and principles of securities regulation can be downloaded from the web site of International Organization of Securities Commissions (IOSCO), the leading international grouping of securities market regulators, at http://www.iosco.org/library/pubdocs/pdf/IOSCOPD154.pdf.

result shows that the country-level delay is positively and significantly related to the number of firms, short sales and trading costs. This indicates that a stock market is more efficient in the country that has more listed firms and where short selling is allowed, a result that contradicts well-documented firm-level evidence.

To ensure comparability at the country level, we instead advocate the use of world market returns as the common information set. In this proposed framework, our delay measure captures the speed with which the aggregate stock market in each country reacts to global market-wide public information that has common effects across countries. Using country indices for 49 stock markets over 1995-2007, the computed aggregate delay values for most developed markets are lower than their emerging counterparts, confirming the conventional wisdom that the former are relatively more efficient. Our subsequent panel regression analysis finds that those significant firm-level determinants of price delay can explain the documented variation at the country level.

This paper is organized as follows. Section 2 briefly describes the aggregate country-level price delay measure. Using data from 49 countries, Section 3 explores whether the reactions to global market-wide public news vary widely over time and across countries, and then proceeds to examine the underlying determinants via panel regression analysis. The final section concludes this paper.

2. THE AGGREGATE COUNTRY-LEVEL PRICE DELAY MEASURE

All previous price delay studies assess the speed of individual stock price adjustment to information, using domestic market index returns as the relevant local market-wide news to which stock responds. The only exception is Bae *et al.* (2009) who also consider global market-wide public information by regressing individual stock returns on contemporaneous and lagged world market returns.[2] Two interesting findings from their paper are noted here. First, the average global delay is greater than the average local delay, suggesting that global public news is more slowly incorporated into stock prices. Second, financial liberalization in the form of greater investibility reduces the delay with which stock prices in emerging markets respond to value-relevant global market information. In contrast, these authors find no relationship between local delay and the degree of investibility, implying that financial liberalization is important only for the processing of information that is global in nature. The importance of global information is also acknowledged by existing R^2 studies but they generally use U.S. market index returns as the proxy (see, for example, Morck *et al.*, 2000; Jin and Myers, 2006; Fernandes and Ferreira, 2009).

For cross-country comparison of informational efficiency, it is more appropriate to use global market-wide public news so that the price delay captures the relative speed with which each aggregate stock market reacts to this common information set. Our proposed aggregate measure involves the following unrestricted model:

$$r_{i,t}^{m} = \alpha_i + \beta_i r_t^{w} + \sum_{k=1}^{4} \delta_{i,k} r_{t-k}^{w} + \varepsilon_{i,t} \tag{1}$$

where $r_{i,t}^{m}$ is the domestic market index return for country i and r_t^{w} is the world market return in week t.

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[2] This type of information set differs from the global market-wide private information documented by Albuquerque *et al.* (2009).

The restricted model constrains the coefficients on the lagged world market returns to zero:

$$r_{i,t}^m = \alpha_i + \beta_i r_t^w + \varepsilon_{i,t} \tag{2}$$

The *R*-squares from equations (1) and (2) are used to calculate the commonly used price delay measure:

$$Delay = 1 - \frac{R_{restricted}^2}{R_{unrestricted}^2} \tag{3}$$

The larger the value of the delay measure, the more variation in the domestic market index returns that is explained by lagged world market returns, indicating greater delay in the response of aggregate stock market to global market-wide news that has common effects across countries.

3. EMPIRICAL RESULTS

3.1 The stock data

We collect country indices at the weekly frequency (Wednesday price) for 49 stock markets over the sample period of 1995-2007 from Morgan Stanley Capital International (MSCI). The MSCI All-Country World Index is used as a proxy for world portfolio. All the indices are transformed into continuously compounded percentage return series. The country-level price delay measure is computed annually for each country.

3.2 Time-series variation in the country-level price delay values

Figure 1 plots the evolution of the computed country-level price delay values, averaged across all countries in three different groups- all markets, developed markets, and emerging markets. The figure shows that, in all our sampled 13 years, emerging markets always respond slower than developed markets to global market information. However, the gap between these two groups is becoming narrower since 2004.

Figure 1: The Evolution of Country-level Price Delay over the 1995-2007 Period
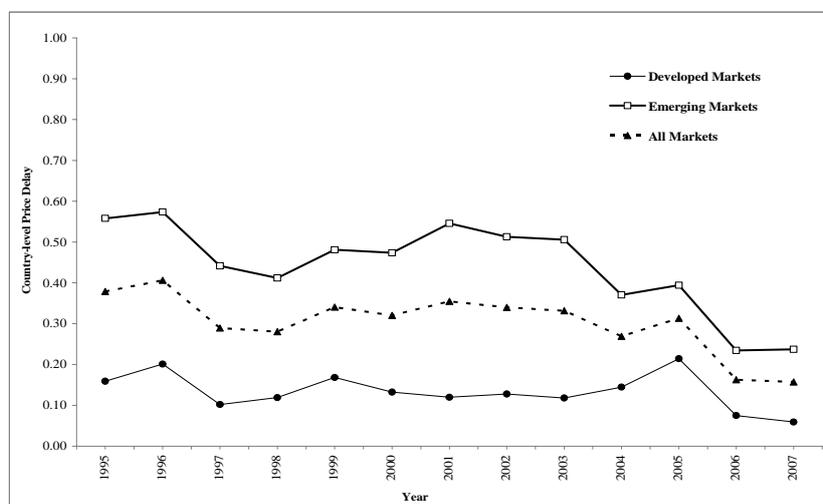
3.3 Cross-sectional variation in the country-level price delay values

The computed values of price delay for developed and emerging markets are averaged over the 1995-2007 period, and plotted in Figure 2 and Figure 3, respectively. As expected, most developed markets exhibit lower values of price delay than their emerging counterparts, confirming the conventional wisdom that the former are more efficient in incorporating information into stock prices. In unreported exercise of sorting all markets in descending order, Mexico is the only representative from emerging category that manages to break into the top-10 list, occupying the fifth spot. At the tail end of the chart, the final 11 spots are all taken up by stock markets from developing countries. Figure 4 compares our result with other country-level studies using market model R^2 statistic, and it is clear that the difference between developed and emerging group is the largest for our price delay measure.

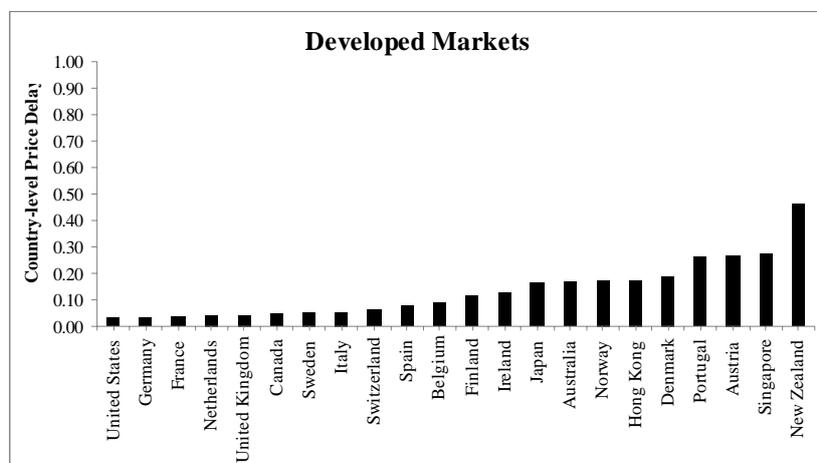**Figure 2: The Country-level Price Delay across Developed Markets**

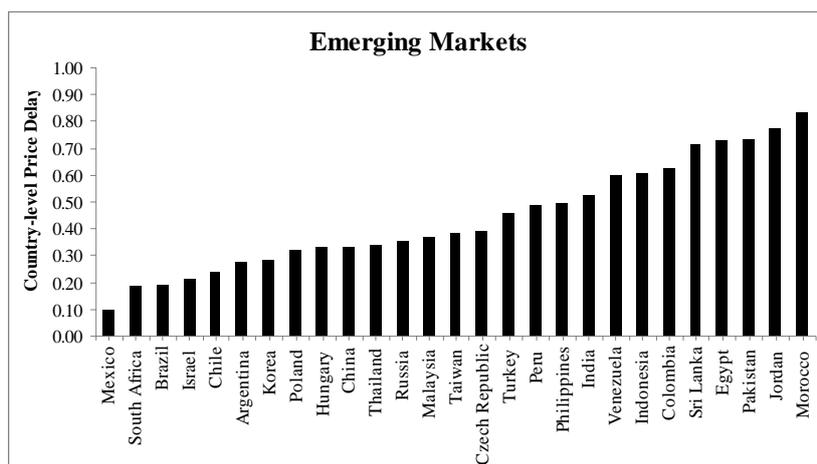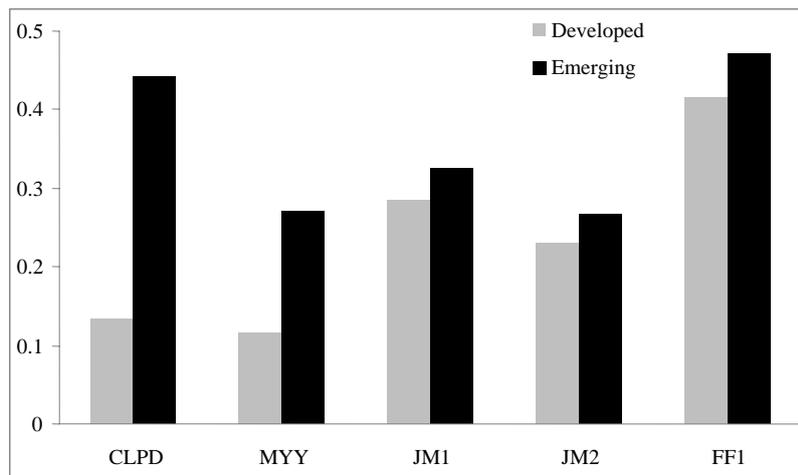**Figure 3: The Country-level Price Delay across Emerging Markets**

Figure 4: Comparison with Previous Country-level Efficiency Studies

Notes: CLPD is our country-level price delay measure; MYY refers to Morck *et al*. (2000); JM1 is the equal-weighted R^2 while JM2 the variance-weighted R^2 from Jin and Myers (2006); FF1 stands for the market model R^2 computed from Fernandes and Ferreira (2009).

3.4 Panel analysis

This section seeks to identify what factors are important for explaining the time series and cross-sectional variation in price delay measure. More specifically, we examine whether those significant firm-level determinants of price delay can explain the documented variation at the country level. Due to data availability, our analysis focuses on the aggregate counterparts for firm size, trading volume, short sales restrictions, and the degree of investibility. Firstly, the logarithm of market capitalization of listed companies is used to proxy for the size of the stock market. Secondly, our proxy for trading volume is the logarithm of one plus the turnover ratio. The panel data for market capitalization and turnover ratio are collected from *World Development Indicators*. Thirdly, we utilize the dataset on the legality and feasibility of market-wide short selling assembled by Daouk and Charoenrook (2005). The short sales dummy variable equals one if either short selling or put options trading is feasible in a given country and year, zero otherwise. Finally, we construct the country-level degree of investibility using the ratio of the number of firms in the Global Index (IFCG) and Investable Index (IFCI), extracted from the *Emerging Stock Markets Factbook* (1996-2002) and the *Global Stock Markets Factbook* (2003-2007). However, the data are only available for the period up to 2006.

Table 1 presents the fixed-effects panel regression results. In univariate regressions, market size and the degree of investibility are significant at the 1% level. Short sales feasibility and trading volume are significant at the 5% and 10% levels, respectively. More importantly, all the explanatory variables have the expected negative coefficients, consistent with firm-level evidence. In multivariate regression, all the variables are still negatively and significantly related to the country-level price delay. Our results hence imply that a slower response to global market-wide information is associated with smaller market size, lower level of trading volume, infeasibility of short selling, and higher degree of restrictions on foreign investors.

Table 1: Potential Determinants for Aggregate Country-Level Price Delay

	(1)	(2)	(3)	(4)	(5)
MCAP	-0.1345				-0.1113
	(0.0000)				(0.0000)
TV		-0.0391			-0.0365
		(0.0693)			(0.0761)
SSALE			-0.1207		-0.0839
			(0.0236)		(0.0808)
INVEST				-0.2876	-0.1729
				(0.0001)	(0.0156)
Country Dummies	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes
Number of observations	637	637	637	588	588
Number of countries	49	49	49	49	49
R-squared	0.6527	0.6270	0.6286	0.6393	0.6631

Notes: The dependent variable is the aggregate price delay measure constructed for each country in each year over the 1995-2007 period, capturing the delay with which aggregate stock market responds to global market-wide public information. MCAP is the logarithm of market capitalization to proxy for the size of the stock market. TV represents trading volume, proxied by the logarithm of one plus the turnover ratio. SSALE is the short sales dummy variable which equals one if either short selling or put options trading is feasible in a given country and year, zero otherwise. INVEST is the country-level degree of accessibility to foreign investors, with higher value indicates greater degree of stock market openness. Data for all the explanatory variables are available for the full sample period of 1995-2007, with the exception of INVEST which is only up to 2006.

Entries in parentheses are the two-tailed *p*-values. The standard errors for the OLS regressions are adjusted for heteroscedasticity and within-country correlation of the error terms.

4. CONCLUSION

Using the aggregate price delay measure, we find wide time series and cross-sectional variation in the speed of adjustment to global market information. Subsequent panel analysis identifies market size, trading volume, short sales restrictions and the degree of investibility as significant factors that could impede the swift incorporation of global market-wide news. These findings are consistent with previous empirical studies based on firm-level data, and call for further theoretical explanations (for competing hypotheses, see Lim, 2009). Our results also complement the work by DeFond *et al.* (2007) and Griffin *et al.* (2008) who explore cross-country differences in stock price reactions to one specific event, namely earnings announcements. For future studies, our proposed aggregate relative efficiency indicator can be used to examine the efficiency impact of securities regulations and the role of stock market in the real economy (see Lim and Brooks, 2009 and references cited therein).

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