CHAPTER TWO

STOCK PRICE SYNCHRONICITY LITERATURE

2.1 INTRODUCTION

This chapter provides the background and the literature of stock price synchronicity. Section 2.2 discusses the conceptual and the measurement issues related to stock price informativeness or stock price synchronicity. Section 2.3 discusses the cross-country mathematical development of stock price synchronicity. Section 2.4 presents a review of the related prior studies that have used stock price synchronicity as dependent variable. Finally section 2.5 presents brief summary of this chapter.

2.2 BACKGROUND ON STOCK PRICE SYNCHRONICITY

Prior literature (e.g., King 1966; Roll 1988; Morck et al., 2000; Piotroski and Roulstone, 2004) document that security prices reflect the complex interrelationship of information that is related to systematic risk of market and industry and unsystematic risk that is related to firm-specific risk. According to King (1966), "a critical assumption of this cross-sectional price behavior is based on the random-walk theory of price movement, which looks upon observed price changes as serially independent variable from a statistical random distribution". He also states that this position is distinguished from the "trendiests" who believe that dependence on past and present stock price observations can supply information in related to the direction and range of price movements in the future.

Without going deeply into the random-walk- trendiest debate or the theory of stock evaluation, it is appropriate to describe the ways in which price changes can be brought about in accordance with the two school of thoughts. According to King (1966), the theory behind the two positions "states that security price changes result from

transmission of incoming information through changes in anticipations that are used or loaded by a given security in a manner that is distinctive to that security". King continued his argument stating that some information affects other securities while some only idiosyncratic into that particular security. Hence, according to King (1966), the change in the price of a security j at the close of time t according to the random-walk theory can be observed as:

$$y_{jt} = \lambda_{j1} f_{1t} + \lambda_{j2} f_{2t} + \lambda_{j3} f_{3t} + \ldots + \lambda_{jq} f_{qt} \quad (1)$$

Where λ_{ji} is the loading coefficient of f_{it} corresponding to security j; the λ_{jt}'s are assumed to be fixed over time. Continuing with King mathematical flow, the lump of information at time t causes a change in anticipation that affect every security in the market to some degree, therefore, the change in anticipations is classified under impact class 1 and mapped into an element by the function f_1. The function takes on a particular value f_{1t} that will be multiplied by the coefficient λ_{j1} before it becomes a part of the particular price change y_{jt}. Similarly, impact of certain industry on y_{jt} can be loaded by $\lambda_{j2} f_{2t}$ and so on. Some particular change functions such as f_{i*t}, will have zero loadings for all securities in the market except for the class of anticipations which affect security j only.

King (1966) argues that the f_{it}'s that appears in equation (1) may not be mutually independent for a fixed value of t; however, there could be a relation between the change function t and $t+1$. If that holds, according to King (1966), then we can see the difference between the trendists and the random-walk positions. In other words, if each of the f_{it}'s is independent of f $f_i(t-1)$, $f_i(t-2)$, $f_i(t-3)$, then it follows that y_{jt} also independent of preceding values. On the other hand, according to his argument, if some of the f_{it}'s are dependent on the preceding values, and their coefficients account

for a considerable proportion of the y_{jt}, then we should expect y_{jt} to exhibit dependent behavior over time.

King (1966) concluded, dependence of successive f_{it}'s and their corresponding set of changes in anticipation could result from a gradual spread of awareness of lump of information throughout the market. That is, the lump sum of information causing a value of f_{it} may be highly correlated with, or even the same lump as that, which caused $f_i\ (_{t-1})$.

Therefore, according to the two positions namely "trendiests" and random walk, it is generally agreed, that the price of a security today is the present value of its future cash stream that is based on anticipations (King 1966). When these set of expectations change, the price can also change. King continues to argue that the stock market is subjected to a steady flow of information. This follow will have an effect on the set of anticipations that determines a price of a security some of which have a market-wide impact such as monetary news, where as others influence specific industry, and finally some related to specific security such as dividend payments.

As per King (1966) discussion, the stream of incoming information, consisting of both independent and dependent random pieces of information can be classified and clustered according to their scope of impact into random changes that determines share prices. He also argued that, although the random-walk assumption assumes full independence, random-walk theorist could claim that the portion of future piece of information that is revealed is based on correlation with one in the present. King (1966) continued to argue that, in perfect market, that dependence is instantaneously and disconnected thereby bringing about temporal independence of successive changes of

anticipation within an impact class keeping the random-walk assumption valid. The above arguments portray the role of corporate transparency and accounting information in security price changes within the context of the random-walk theory and the efficient market hypothesis.

Using monthly closing price changes of 316 common stocks continually listed on the New York stock exchange from 1927-1960 and restricted to those that have been on the exchange since 1927, King's finding, based on factor analysis methodology, supports the hypothesis that movement of a group of security price changes can be broken down into market and industry components. It also supports the hypothesis that security price changes covary with market and industry returns.

Extending King's findings, Roll (1988) stated that, although a conspicuous lack of predictive content about changes in asset prices is obvious within the current theory of efficient market, many financial economist believe that asset price movements could be explained with market data. Roll (1988) refers that to the prevailing paradigm of stock price changes that ascribes those movements to unpredictable movements in "systematic" or economic factors, unpredictable changes in the firm's market environment or industry factors and unpredictable firm-specific events.

To support this hypothesis, Roll (1988) investigates whether it is true that we security prices reflect the complex interrelationship of information that is related to systematic risk of market and industry and unsystematic risk that is related to firm-specific news. He used a representative set of data from the Center for Research in Security Prices (CRSP) and Interactive Data Corporation (IDC) files covering five years period

September 1982 through August 1987 period for monthly stock returns and 1982 through 1986 period for daily stock returns.

The findings of Roll (1988) document even further explanation of this co-movement phenomenon. Utilizing the monthly data set, R^2s were calculated for those returns as explained by the wide the market returns, industry returns, and the firm-specific returns based on the firm public news[9]. The regression results show no substantial difference of individual stock returns either on single market index (CAPM) or on multiple factor (APT). The average R^2 settled within the 30 percent area. Adding the industry factor increases the average adjusted R^2 to about 35 percent.

Roll (1988) obtained daily data pertaining to news events about firms in a number of publications and news services from the Dow-Jones retrieval system to investigate the effects of firm public information. Regressing the daily data to investigate the impact of unique news about the firm, unexpectedly, the variation in the dependent variable did not improve. However, R^2 dropped to around 20 percent and increased slightly to 20.5 percent after excluding information events two days before and one day after. Nevertheless, Roll (1988) noticed a dramatic decline in the sample kurtosis, which indicate according to Roll "the existence of private information or else unrelated to information content"[10].

[9] According to Roll (1988), public news refers to every single news reported about the firm in the financial press. Roll (1988) refers that to the prevailing paradigm of stock price changes that ascribes those movements to unpredictable movements in "systematic" or economic factors, unpredictable changes in the firm's market environment or industry factors and unpredictable firm-specific factors. He investigates these factors to predict the firm returns using the classic market model : $r_{it} = \alpha_i + \beta_{1,i} r_{m,jt} + \beta_{2,i} r_{ind,jt} + \varepsilon_{it,}$

[10] The principal feature of mixed distributions emphasizes the use of higher moments, particularly the fourth moment or the sample kurtosis. Kurtosis can reveal something about the probability of information and the difference between the information- related distributions and the non- information distributions. Sample kurtosis dropped from 17.935 including all daily observations to 7.312 when excluding two days before through one day after the news showing trade or more distribution of returns because of either private information or noise.

2.3 CROSS COUNTRY STOCK PRICE SYNCHRONICITY DEVELOPMENT

Building on the Roll's findings, Morck et al. (2000) introduced a stock price informativeness measure to quantify these synchronous movements rather in cross-country scope using 1995 biweekly stock returns for 40 countries. They notice a phenomenon that poorer countries have higher synchronous stock prices than rich countries.

Table 2.1 adopted from Morck et al. (2000) shows stock price synchronicity in some markets for the first 26 weeks in 1995. It can be observed that emerging markets have more stock prices moving together. Over 80 percent of stock prices in China, Malaysia and Poland move in the same direction. However, maximum co-movement in the same direction in developed markets such as United States, Denmark and Ireland is around 57 percent showing less synchronous movements. Figure 2.1 plots Chinese, Malaysian and Polish stock as emerging markets against US as Developed market. Data for Denmark and Ireland were omitted since they closely resemble the US returns.

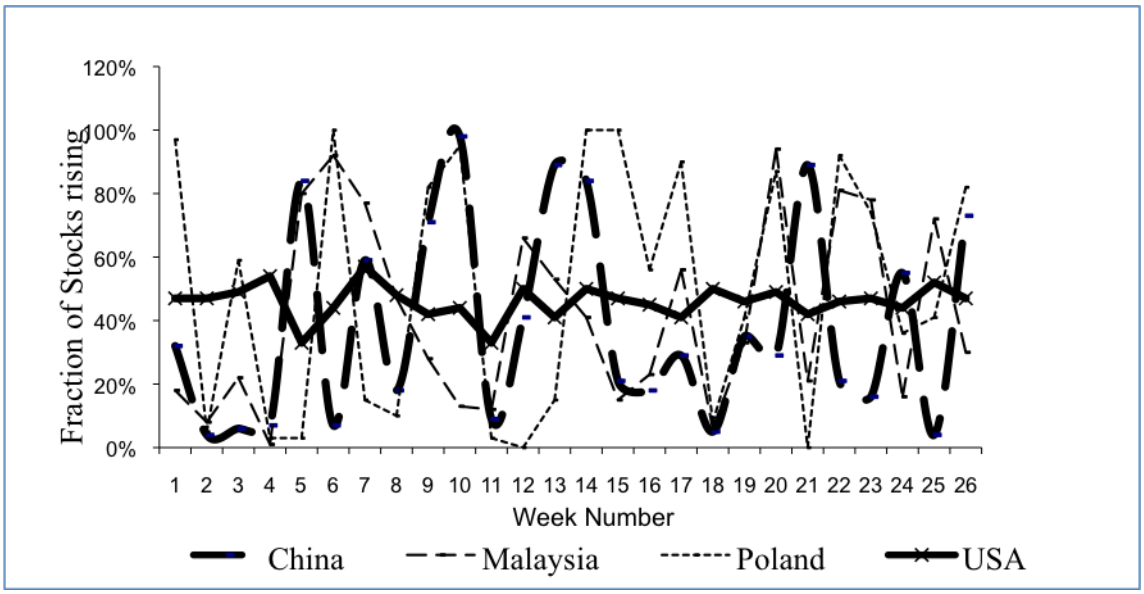
Morck et al. (2000) notice that the "law of large numbers", that states markets with many stocks should show less dispersion around the mean", could be rejected as markets like Denmark and Ireland with substantially less listing than Malaysia yet they show less synchronous movements resembling US market. This indicates that the observe phenomenon is not due to market size (Morck et al. 2000).

Table 2.1
Stock Price Co-movement in Selected Emerging and Developed Stock Markets[12]

	China			Malaysia			Poland			Denmark			Ireland			United States		
Week	%Up	%Down	%Same	%Up	%Down	%Same	%Up	%Down	%Same	%Up	%Down	%Same	%Up	%Down	%Same	%Up	%Down	%Same
	32	61	7	18	73	9	97	3	0	50	29	21	39	46	16	47	29	24
2	4	89	6	8	86	6	5	95	0	45	25	30	33	32	35	47	38	15
3	6	88	7	22	69	9	59	31	10	36	33	31	32	40	28	49	37	13
4	7	88	5	1	95	3	3	92	5	27	36	37	33	32	35	54	32	17
5	84	8	7	80	11	9	3	97	0	48	33	18	44	26	30	33	53	15
6	7	50	42	92	2	6	100	0	0	41	30	29	42	39	19	44	43	14
7	59	31	10	77	14	10	15	77	8	41	30	28	42	40	18	57	30	13
8	18	73	9	47	39	13	10	90	0	29	35	36	28	35	37	48	38	14
9	71	22	7	28	60	12	82	13	5	40	33	27	37	42	21	42	43	15
10	98	4	4	13	77	11	95	5	0	23	36	41	25	30	46	44	42	14
11	9	88	3	12	78	9	3	95	3	31	38	31	26	39	35	33	52	15
12	41	51	7	66	23	11	0	92	8	30	37	33	28	39	33	50	37	13
13	89	7	4	53	34	13	15	67	18	21	36	42	35	39	26	41	44	15
14	84	9	6	41	50	8	100	0	0	28	37	35	32	44	25	50	35	15
15	21	73	5	15	73	12	100	0	0	27	43	30	33	39	28	47	37	15
16	18	75	7	23	66	11	56	38	5	30	52	18	28	46	26	45	40	15
17	29	63	8	56	25	19	90	10	0	34	40	26	42	37	21	41	44	15
18	5	92	3	6	87	6	8	92	0	38	33	18	47	37	16	50	35	15
19	35	56	9	33	57	10	41	49	10	39	36	26	35	44	21	46	40	14
20	29	60	11	94	3	3	87	10	3	41	36	22	40	35	25	49	37	14
21	89	8	3	21	72	7	0	100	0	39	35	26	46	37	18	42	44	14
22	21	76	4	81	42	7	92	5	3	38	33	29	40	44	16	46	39	15
23	16	79	5	78	17	5	74	23	3	34	40	26	49	44	7	47	39	14
24	55	37	8	16	77	7	36	51	13	24	40	36	40	33	26	44	41	15
25	4	84	12	72	18	9	41	49	10	22	41	37	49	33	18	52	34	14
26	73	20	7	30	60	9	82	5	13	26	40	34	39	49	12	47	39	14
Sample		308 stocks			349 stocks			38 stocks			233 stocks			57 stocks			6,889 stocks"	

[12] Adapted from Morck et al. (2000).
The fraction of stocks whose prices go up, go down, or remain the same during each of the first 26 weeks of 1995. Price changes are from DataStream, and are adjusted for Dividends

Figure 2.1
Stock Price Synchronicity in US and Selected Emerging Markets



Source: Morck et al. (2000, p. 219)

Based on the above observations, they develop a measure for synchronicity as the percentage of stocks prices moving together in the same direction as equation (2) below:

$$f_{jt} = \frac{\max \left(n_{jt}^{\mathbf{up}}, n_{jt}^{down} \right)}{n_{jt}^{up} + n_{jt}^{down}}, \qquad (2)$$

Where n_{jt}^{up} represents the number of stocks in country j whose prices rise in week t, and n_{jt}^{down} is the number of stocks whose prices fall.

To test the difference between US and emerging markets by calculating $f_{us} - f_j$ for each country (j), the variance of the estimate can be calculated in formula (3).

$$\text{Variance} = \frac{f_{us}(1 - f_{us})}{n_{us}} + \frac{f_j(1 - f_j)}{n_j}, \qquad (3)$$

Equation (4) estimates the (rho) or the correlation between US and each emerging country. Assuming no correlation or small correlation between US and other emerging countries (f_{us} and f_j), the statistics:

$$(\text{rho}) = \frac{\left(f_{us} - f_j\right)}{\sqrt{f_{us}\left(1 - f_{us}\right)/n_{us} + f_j\left(1 - f_j\right)/n_j}}, \quad (4)$$

is normally distributed taken into consideration the large sample of n_{us} and n_j. Statistically, the hypothesis that the fraction of stocks moving together in the United States is the same as in other emerging countries is rejected[13]. Economically, Morck et al. (2000) find more synchronous movements in stock prices in emerging markets comparing to developed markets[14]. Therefore, they conclude that the difference between US and emerging countries is economically and statistically significant. This conclusion implies that we can develop a measure of synchronicity based on number of stocks moving up or down together. According to Morck et al. (2000), formula (5) shows the average annual measurer of synchronicity for a single country (j).

$$f_j = \frac{1}{T}\sum_t \frac{\max\left[n_{jt}^{UP}, n_{jt}^{down}\right]}{n_{jt}^{up} + n_{jt}^{down}} = \frac{1}{T}\sum_t f_{jt}, \quad (5)$$

Where n_{jt}^{up} is the number of stocks in country (j) whose prices rise in week t and n_{jt}^{down} is the number of stocks whose prices fall, and T is the number of periods used. f_j is the average value of f_{it}, as defined in equation (5). Periods can be up to 52 weeks if we are using weekly data. The values of f_i are between .05 and 1.0.

Since it is not suitable for the values of the synchronicity measure based on equation (5) to be within the intervals [0.5, 1], logistic transformation is applied to this variable as below:

[13] In China, the Null hypothesis that the fraction of stocks moving together in US market is the same as Chinese market is rejected in 43 weeks out of the 52 weeks, In Poland the hypothesis was rejected in 37 weeks and in Malaysia 45 weeks. However the hypothesis that the fraction of stocks moving together in US is the same in other developed markets was only rejected in 18 weeks in Denmark and New Zealand only 2 weeks for Ireland.

[14] Using market data of 1995 show that around 79% of stocks in average week move together in China, 77% in Malaysia and around 81% in Poland.

$$\Psi_j = log\left(\frac{f_j - 0.5}{1 - f_j}\right), \quad (6)$$

The normality of the data and the discussion surrounding Morck et al (2000) argument above tend to endorse the use of f_j as direct synchronicity measure. In additional to the above synchronicity measure shown in equation (5), an alternative measure is introduced, where market wide movements can be separated from firm-specific stock price based on French and Roll (1986) and Roll (1988). Both of the studies used the US data and calculated R^2 of the regression based on the Market Model as below:

$$r_{it} = \alpha_i + \beta_{1,i} r_{m,jt} + \beta_{2,i}[r_{us} + e_{jt}] + \varepsilon_{it}, \quad (7)$$

Where r_{it} is a return for a single stock in a single week, r_m a country market index for the same week and r_{us} is the U.S. market return since most open are open affected by foreign capital and (r_{us} + e_{jt}) translates US stock market to local market. Once more, since it is not suitable for the values of the synchronicity measure based on equation (7) to be within the intervals [0, 1}, logistic transformation is applied to this variable below:

$$\gamma_j = log\left(\frac{R^2 J}{1 - R^2 J}\right), \quad (8)$$

Table 2.2 adopted from Morck et al. (2000) ranks countries by stock return synchronicity measured by the fraction of stocks moving together in an average week in 1995 f_j and by stock return synchronicity measured by the average R^2 of firm level regression of bi-weekly stock on local and US markets indexes in 1995.

Table 2.2
Per Capita Gross Domestic Product and Stock Return Synchronicity Measures[16]

Country	Number of listed stocks	PC GDP 1995	Country	Number of listed stocks	PC GDP 1995	Country	(f_i)	Country	f_i	Country	R^2	Country	R^2
Japan	2276	33190	Taiwan	353	10698	United States	57.9	Spain	67	United States	0.021	Korea	0.172
Denmark	264	27174	Portugal	90	9045	Canada	58.3	Indonesia	67.1	Irlland	0.058	Pakistan	0.175
Norway	138	25336	Korea	461	7555	France	59.2	South Africa	67.2	Canada	0.062	Italy	0.183
Germany	1232	24343	Greece	248	1332	Germany	61.1	Thailand	67.4	U.K.	0.062	Czech	0.185
United States	7241	24343	Mexico	187	3944	Portugal	61.2	Hong Kong	67.8	Australia	0.064	India	0.189
Austria	139	23861	Chile	190	3361	Australia	61.4	Philippines	68.8	New Zealand	0.064	Singapore	0.191
Sweden	264	23861	Malaysia	362	3328	U.K.	63.1	Finland	68.9	Portugal	0.068	Greece	0.192
France	982	23156	Brazil	398	3134	Denmark	63.1	Czech	69.1	France	0.075	Spain	0.192
Belgium	283	21590	Czech	87	3072	New Zealand	64.6	India	69.5	Denmark	0.075	South Africa	0.198
Holland	100	20953	South Africa	93	2864	Brazil	64.7	Singapore	69.7	Austria	0.093	Columbia	0.209
Singapore	381	20131	Turkey	188	2618	Holland	64.7	Greece	69.7	Holland	0.103	Chile	0.209
Hong Kong	502	19930	Poland	45	2322	Belgium	65	Korea	70.3	Germany	0.114	Japan	0.234
Canada	815	19149	Thailand	368	2186	Ireland	65.7	Peru	70.5	Norway	0.119	Thailand	0.271
Finland	104	18770	Peru	81	1920	Pakistan	66.1	Mexico	71.2	Indonesia	0.14	Peru	0.288
Italy	312	18770	Columbia	48	1510	Sweden	66.1	Columbia	72.3	Sweden	0.142	Mexico	0.29
Australia	654	17327	Philippines	171	880	Austria	66.2	Turkey	74.4	Finland	0.142	Turkey	0.393
U.K.	1628	17154	Indonesia	218	735	Italy	66.6	Malaysia	75.4	Belgium	0.146	Taiwan	0.412
Ireland	70	14186	China	323	455	Norway	66.6	Taiwan	76.3	Hong Kong	0.15	Malaysia	0.429
New Zealand	137	13965	Pakistan	120	424	Japan	66.6	China	80	Brazil	0.161	China	0.453
Spain	144	13965	India	467	302	Chile	66.9	Poland	82.9	Philippines	0.164	Poland	0.569

[16] Adapted from Morck et al. (2000, p. 223)

Figure 2.2
Correlation between GDP and Stock Price Synchronicity Measures[17]

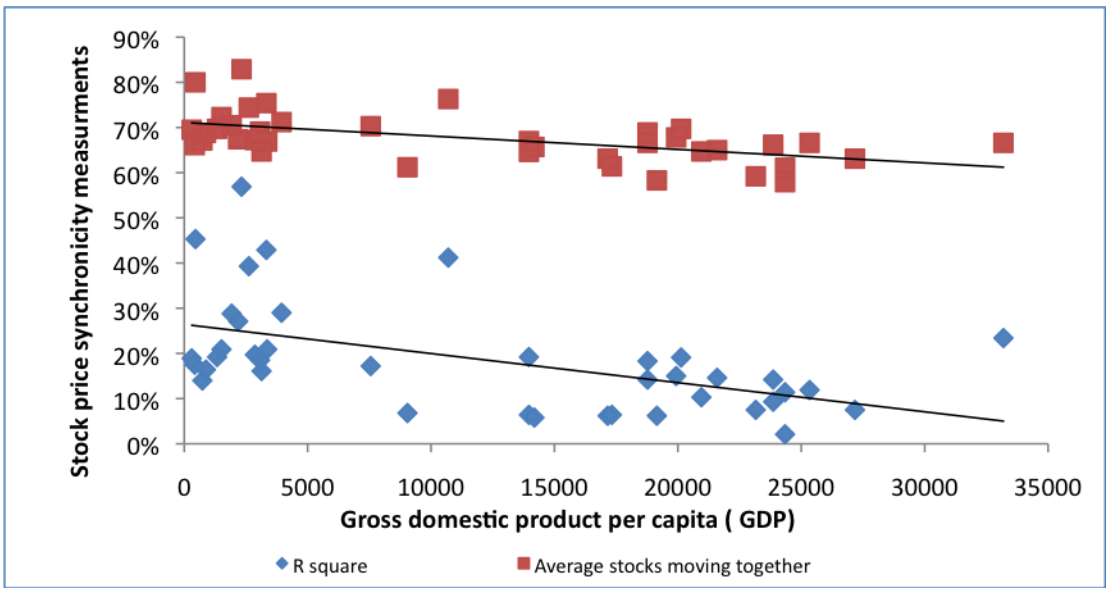


Figure 2.2 graphically shows the significant difference across countries in using the two measures of synchronicity f_j and the R^2. Both measures are plotted against GDP per capita showing significant negative relationship[18]. Morck et al. (2000) argue that GDP is a proxy for other economic development in a country. They also conclude that f_j and R^2 behave similarly. Therefore, both measures can me be a proxy for Stock price synchronicity.

Morck et al. (2000) continue their discussion and consider three possible explanations for this phenomenon. First, "low-income countries might have more correlated fundamentals" that make stock prices move together due to undiversified economies.

[17] Stock price synchronicity for each country using both measures: (1) Percentage of stocks moving together and (2) variation in stock return explained by market (R square) plotted against GDP per capita in US dollars. The two measures show negative correlation with GDP per capita.

[18] Around - 0.571 negative correlation significant at 0.1% is shown between GDP and f_j and about - 0.394 significant at 0.2% level between GDP and R^2.

Another possible explanation may be related to the "poor and uncertain protection of private property rights" in low-income countries that could make informed risk arbitrage less attractive. Such decrease in arbitrage activities will decrease the level of trading based on information and increases market-wide noise as per Delong (1989, 1990). Finally, countries that provide poorer protection from insiders could lead to interoperate income shift and make trade on firm-specific information less useful to risk arbitrage.

To investigate these propositions, Morck et al. (2000) construct a "good government index" established in the literature by La Porta (1998a) to measure the degree of protecting private property rights in a country. La Porta (1998a) introduce three indexes each ranging from zero to ten. These indexes measure government corruption, the risk of exportation and the risk of the government repudiating contracts.

The findings did not support the first hypothesis that high stock prices synchronicity in low-income economies is due to undiversified economies and more correlated fundamentals. However, with best control for fundamentals, GDP shows statistical significance in the model. Adding the "good government" proxy, which measures the government level of protecting private property protection in a country, renders GDP insignificant in explaining stock price synchronicity.

Therefore, Morck et al. (2000) conclude that the level of protecting private property in a country determines how much firm-specific information is incorporated in stock

prices[19]. In addition, Morck et al. (2000) controlled for firm-level accounting data using *CIFAR* 90 items disclosure index. However, the result was not significant.

Campell et al. (2000) notice a material decline in stock price synchronicity for US market during the 20th century. This findings support one of Morck et al. (2000) hypotheses that stock price synchronicity is not related to the size of the market or the economy.

Jin and Myers (2006) extended Morck et al. (2000) investigations by introducing a model that examine the effects of private property rights and corporate financial transparency on stock price synchronicity. and the amount of risk portion beared by insiders and outsiders. While Morck et al. (2000) interpretations suggest that higher level of private property protection in rich countries explains the association of higher GDP and R^2, Jin and Myers (2006) in contrast argue that imperfect protection for investors does not affect R^2 if a firm is completely transparent.

Enduring with Jin and Myers (2006) argument, if a degree of opaqueness exists, insiders would not disclose all firm cash flow and will tend to soak more firm- specific positive news and less of the negative firm-specific news. Insiders will continue this capturing process causing outsider investors to absorb economic and market news and less firm-specific news and consequently leading to higher R^2. If negative firm-specific news continue arriving for long span of time, insiders will continue to accumulate firm-specific risk until they decide to give up. Therefore, all bad news will go out at once which cause a high negative returns.

[19] Morck et al. (2000) report that in a weak private property protection, inform traders have less incentive to obtain more firm-specific information . Therefore, we expect to see high stock price synchronicity. However, in high private property protection we expect to see higher arbitraging activities by informed traders and therefore trading on firm-specific information.

The scenario is different with completely transparent firm. Assuming insiders can hold half of the firm-specific news due to poor property rights protection, investors can still see the whole cash flow of the firm. Therefore, investors capture only half of any value change due to firm-specific information and also half of any value change due to market risk leaving the proportion of firm-specific and market level and consequently stock price synchronicity or R^2 unaffected by insiders' capture. Jin and Myers (2006) continue to argue that in opaque firms, even with perfect private property protection, insiders can still hold unexpected returns that are not perceived by outside investors if the firm is opaque.

Jin and Myers (2006) investigate the effects of opaqueness on both R^2 and the crash likelihood. They pooled data from DataStream's total return (RI) for 33 countries from January 1990 to December 2001 and 10 additional countries for part of that period to calculate stock price synchronicity. Their model replicate Morck et al. (2000) model and introduced crash frequency factor as predictor for R^2. The authors document that both higher R^2 and higher negative returns crash likelihood are caused by lack of financial reporting transparency. In other words, the findings show that higher R^2 and crashes are higher in countries that are more opaque. Opaqueness was measured using an international disclosures index score, number of auditors, and analyst diversity.

Capitalizing on the private information interpretation as the main determinant of idiosyncratic volatility (or stock price synchronicity) implied on the above studies, Ferreira and Laux (2007) investigate the relationship between corporate governance and idiosyncratic risk. They propose that the absence or the fewer the anti-takeover provisions as a specific act of governance, the more incentives private information will be collected by arbitrage-oriented investors. Ferrerira and Laux (2007) assumptions in

collecting private information is consistent with better cost-benefit trade off on information suggested by Grossman and Stiglitiz (1980).

To select representative sample, they utilize several databases sources such as Investor Responsibility Research Center (IRRC), the Center for Research in Stock Prices (CRSP), Standard & Poor's Compustat across the period 1990-2001. Excluding financial firms and utilities, the average resulting number for the selected sample is 1,248 firms. The authors state that their study controls for large set of covariates suggested in the literature by Wei and Zhang (2006) and for firms' financial reporting transparency as per the results of Bushee and Noe (2000). The findings show a strong negative relationship between antitank-over provisions and firm specific information measured by idiosyncratic volatility.

Unlike Jin and Myers (2006) study that explored cross-country data, Ferreira and Laux (2007) used firm-level set of data. Their findings document significant moderating effects for corporate transparency on the relationship between corporate governance and idiosyncratic volatility. Controlling for accounting transparency by using two measures of accrual quality developed by Francis et al. (2005), they find that governance index variable demonstrates stronger association with idiosyncratic volatility with higher measure of transparency. They authors conclude that higher (lower) level of idiosyncratic volatility is associated with higher (lower) level of corporate transparency. Ferreira and Laux (2007) support the interpretation of idiosyncratic risk as the flow of firm private information into stock prices. The study provides evidence that more information flow to market via trading is associated with more financial corporate transparency.

Ross (1989) and Golstern and Milgrom (1985) interpret private information as the rate of information flow that is directly related to firm-specific variation due to the consequences of arbitrage free economies. French and Roll (1986) empirical evidence established that informed trade induces idiosyncratic volatility. Jin and Myers (2006) and Ferreira and Laux (2007) suggest that private information can be collected and best transformed in more transparent environment that includes less opaque accounting and better governance. Hutton et al. (2009) document recent evidence that higher R^2 is associated with more opaque firms.

Prior studies such as Morck et al. (2000) control for accounting information using accounting standard index reported in La Porta (1998a). Their findings indicate that accounting information is insignificant in explaining stock price synchronicity. They conclude that either the effect was unimportant or the measure is flawed. It can be argued that Morck et al. (2000) measure for accounting information is flawed. Morck et al. (2000) used "CIFAR 90 items" which is unsound measure for accounting information according to Miller (2004).

Jin and Myers (2006) use skewness of returns to measure crash likelihood and test that against opaqueness using three cross-country general measures. Although they report enough evidence supporting the hypothesis that transparency is associated with stock return synchronicity, the used measures neither were of firm-level disclosures nor was testing corporate transparency framework an issue in their investigation[20].

Ferreira and Laux (2007) control for transparency using accrual quality measure developed by Francis et al. (2005) which in return measure earning quality not corporate

[20] Jin and Myers (2006) use the Global Competitiveness report for 1999 and 2000. The measure is based on a survey about the level and effectiveness of financial disclosures in 27 countries. Methodology of the survey is the publishing organization choice.

financial reporting transparency per se. Similarly, Hutton et al. (2009) investigate opacity association with R^2 using an indicator for earning management to measure opacity.

Khanna et al. (2000) in cross-country variation in 47 countries, investigate whether active security analyst effect the corporate transparency. Their findings suggest that transparency is primarily influenced by countries legal system and information infrastructure. Khan et al. (2000) study deals with security-analyst activity in measuring transparency, which represents part of the proposed framework in the current study but not all. The current study use security analyst as a measure of transparency based on the number of analyst following.

Therefore, developing a framework for corporate transparency and testing its attributes against stock price synchronicity or its inverse is mostly to be worth investigating. A conceptual framework of transparency that can be tested empirically on stock price synchronicity may lead the process of filling the knowledge gap in the area of stock price synchronicity, private information and corporate transparency.

Bushman et al. (2004) conceptualize transparency as a framework to symbolize firm-specific information generating, gathering, validating, and disseminating. The various factors that collectively form this proposed system, including financial reporting magnitude as a central element of that system, should empirically be tested against measures of information flow established in the literature such as idiosyncratic volatility or stock return synchronicity. This study follows closely Bushman et al. (2004) to test empirically a framework of transparency on stock price synchronicity within the context of private information flow. The following section presents prior studies on stock price

synchronicity. It also discusses the competing interpretations of stock price synchronicity as information or noise based on prior empirical findings.

2.4 PRIOR STUDIES

The extant literature on stock price synchronicity can be separated into two streams. The main and continuous stream of research in this area defines stock price synchronicity as a measure of stock price informativeness. However, few prior studies on stock price synchronicity did not find enough evidence to support the informativeness interpretation of stock price synchronicity and conclude that it may be a measure of noise. The following is a review of the relevant literature on stock price synchronicity: Section 2.4.1 discusses the extant of the literature that considers stock price synchronicity as a measure of price informativeness. Section 2.4.2 presents different view and perceives stock price synchronicity as a market noise.

2.4.1 Stock price synchronicity as information

The existing literature on stock price synchronicity suggests that it is a measure of firm-specific information that is incorporated into stock prices. Prior studies on stock price synchronicity as firm-specific information are classified into country-level and cross-country level and the following studies focus on country-level scope.

Morck et al. (2000) observe a phenomenon that poorer countries have more stock price synchronous movements than in rich economies. They further consider Campell et al. (2000) findings that this phenomenon is not related to the size of the economy or the market. They also find these synchronous movements by economic fundamentals in low- income countries. Therefore, they consider the level of private property rights protection as another plausible explanation. To measure the level of private property rights protection in a country, they developed a "good government index" using three

indexes adopted from La Porta (1998a)[21]. Their findings suggest that low private property protection in a country explains the higher synchronous movement of stock prices or high R^2. Jin and Myers (2006) replicate Morck et al. (2000) study and find instead opaqueness explains the R^2[22].

Wurgler (2000) explores how financial markets improve the allocation of capital. Using a cross-country set of data for 65 countries and 28 industries for the period 1963 to 1995, the author finds that bigger market size is associated with better allocation of capital[23]. The findings also suggest that better efficient capital allocation is associated with (i) higher firm-specific information incorporated in stock prices, (ii) lower government ownership in the economy and (iii) better legal protection of minority investors. This evidence stress the importance of lower stock synchronicity in more efficient capital allocation and support Morck et al. (2000) findings.

Using a data set of 25 emerging markets over the period 1993 to 1995, Chan and Hameed (2006) investigate the effects of financial analysts following on stock price synchronicity. Their findings suggest positive relationship between financial analyst following and stock price synchronicity. Their interpretation is that, in emerging markets, the lack of publicly available firm-specific information and less stringent disclosure requirement may motivate analyst to produce firm- specific information that might be highly demanded by investors. However, less private property protection will discourage risk arbitragers to obtain more firm-specific information as suggested by Morck et al. (2000). Therefore, financial analyst pay off will be better if they

[21] Good government index" is the sum of three indexes from La Porta et al. (1998), each ranging from zero to ten. These indexes measure government corruption, the risk of expropriation of private property by the government, and the risk of the government repudiating contracts.

[22] Morck et al. (2000) sample 40 countries 22 of which are developed markets.

[23] Wurgler (2000) measures market size as the size of the domestic stock and credit markets relative to GDP

communicate market and industry information to the market. Their results are consistent with Piotroski and Roulstone (2004) who document that greater market-wide information for stocks covered by more analysts following.

Jin and Myers (2006) replicate Morck et al. (2000) but focused instead on opacity and show how private property protection and corporate transparency attribute risk to insiders and outsiders. Using DataStream's total return (RI) for 43 countries from January 1990 to December 2001, they investigate the effects of opaqueness on both R^2 and the crash likelihood. Their study findings show that higher R^2 and high likelihood of negative returns or crash are caused by opaqueness. Opaqueness is measured using an international disclosures index score, number of auditors, and analyst diversity.

Fernandes and Ferreira (2008) examine the effects of cross listing of non-US stocks in the United States markets on their price informativeness. A sample of 28,060 year firm from 47 counties across 23 years, 1980 - 2003 were utilized to construct measurement of stock price synchronicity. Around 3,000 firms were selected, consisting of all firms that have cross- listed in the past or have current cross listing. The finding of the study shows mix results. For developed markets, cross listing improves price informativeness. In contrary, emerging markets, cross listing show less price informativeness. The authors relate that to the added analyst following coverage of cross- listed firms from emerging markets. They argue that financial analyst will lead to the production of market and industry information. This argument is consistent with the evidence provided by prior studies on the role of financial analyst role in communicating market and industry risk (e.g., Piotroski and Roulstone , 2004; Chan and Hameed, 2006)

Fernandea and Ferreira (2009) investigate the relationship between a country's first-time enforcement of insider trading laws and stock price informativeness. Employing a data of 48 countries across 23 years, 1980–2003, the findings support the hypothesis that enforcement of insider trading laws improves price informativeness. However, developed markets show steady increase, but emerging markets show insignificant impact after enforcement. The authors conclude that poor legal institutions in emerging markets is preventing the impact of insider law enforcement that the enforcement does not bring about the goal of improving price informativeness in countries with poor legal institutions. They argue that, in emerging markets, insiders play an important role in impounding information into stock prices, and this role is largely eroded upon enforcement.

The above studies link country-level stock price synchronicity to better functioning stock market. Country-level studies calculate stock price synchronicity for each country, which is contrary to the studies on firm-level stock price synchronicity that calculate stock price synchronicity for each individual firm. Although both firm level and country level studies on stock price informativeness utilize R^2 to calculate stock price synchronicity, firm-level studies can bring better predictions. This is because the larger samples of the studies that allow for flexibility in econometric modeling. However, the generalization of the study findings will be limited to the firms of the specific country investigated. The following studies apply firm-level stock price synchronicity to measure firm-level stock price informativeness.

Durnev et al. (2003) investigate whether firm-specific price movements reflect the capitalization of private information into price or noise trading. Using the US data from 1983 to 1995, they find that firm specific stock price variability is positively correlated

with both of their measures of stock price informativeness: (i) the aggregated coefficients on the future earnings, and (ii) the marginal variation of current stock return explained by future earnings. Their results support the first conjecture of Roll (1988) that firm-specific variation reflects informed trading on private information.

Durnev et al. (2004) investigate the association between corporate capital investment and firm's stock price informativeness. They argue that the efficiency of corporate investment is affected the degree of price informativeness. Using a sample of over 4000 firms over the period 1990 to 1992, they document a positive relationship between economic efficiency and stock price informativeness [24]. This results suggest idiosyncratic volatility (or stock price synchronicity) reflects how the flow of firm-specific information is incorporated in stock prices.

Using a data set from the US market over the period 1984 to 2000, Piotroski and Roulstone (2004) examine the effects of institutional investors, financial analysts and insiders on stock price synchronicity. The study results documented (i) insiders' transactions signal timely firm information to the market and increase the level of firm-specific information incorporated in stock prices (ii) a negative association between institutional ownership and stock price synchronicity, but the relation is conditional on the level of holdings. Institutional trading reduces synchronicity, but this effect becomes less negative as the pre-trade ownership increases, and finally (iii) more financial analyst following leads to spreading more market and industry information and therefore increase synchronicity. The authors argue that insiders and institutional investors have relatively more firm private information and their trading behavior signal

[24] Durnev et al. (2004) measure the economic efficiency of corporate investment by the (deviation in Tobin's marginal q from its optimal level, the smaller the deviation, the greater the investment efficiency) and the magnitude of firm-specific variation in stock returns.

timely information to the market. In contrast, comparing to insiders and institutional investors, financial analyst have less competitive advantage in accessing inside information and therefore they are more motivated to communicate market and industry information.

Using a sample over 62000 firm-year 7268 of which is in the US market over the period 1981 to 2001, Chen et al. (2007) investigate whether managers react to the level of firm-specific information incorporated in stock prices when they make their investment decisions. They document a positive relationship between idiosyncratic return volatility (reverse measure of Stock price synchronicity). The study document a positive relationship between idiosyncratic return volatility and sensitivity of investment to stock prices. The study findings support the hypothesis that mangers use firm specific information incorporated in stock prices when they make their investment decisions.

Proceeding with the private information interpretation of idiosyncratic volatility, Ferreira and Laux (2007) examine the relationship of corporate governance and idiosyncratic risk. They propose that the absence or the fewer the anti-takeover provisions as a specific act of governance, the more incentives private information will be collected by arbitrage-oriented investors. The study sample consists of 1248 and controls for large set of covariates suggested in the literature (e.g., Wei and Zhang and Bushee and Noe, 2000). The findings show a strong negative relation between antitank-over provisions and firm specific information measured by idiosyncratic volatility. The findings also show that with the existence of better corporate transparency, this relationship is stronger. The study controls for corporate transparency by using two measures of accrual quality developed by Schipper et al. (2005). The governance index

adapted by the study shows strong association with idiosyncratic in the presence of more extensive corporate transparency measure.

Gul et al. (2009) examine the effects of firm level corporate governance on stock price synchronicity in emerging market country, China, across the period 1996 to 2003. Using a sample of 6,120 firm-year observations, they first find that "stock price synchronicity increases, but at a decreasing rate (concave relation), with the shareholding by the largest shareholder". Moreover, the synchronicity is lower when the largest shareholder is not government-related than when he or she is government related which supports the view that government-related, largest shareholders have little incentive to disclose value-relevant, firm-specific information to outsider shareholders than the no-government-related, largest shareholders. Second, stock price synchronicity decreases with the level of foreign shareholding. A comparison between B shares and H shares indicates that foreign shares that are listed in Hong Kong stock market are associated with even higher firm-specific information and lower stock price synchronicity than foreign shares that are listed in the domestic Shanghai or Shenzhen B share stock market. Third stock price synchronicity decreases with audit quality. Their results suggest that firm level corporate governance could improve the informational and functional efficiency of capital market in emerging markets where country level investor protection is weak.

Most of the literature on stock price synchronicity either in cross-country level or in country level is supporting the information interpretation of stock price synchronicity. Nonetheless, a competing stream of research, although limited and currently ceased, challenge the information interpretation of stock price synchronicity and take the noise

interpretation position. The following sub-section discusses prior studies of stock price synchronicity as a measure of noise.

2.4.2 Stock price synchronicity as a measure of noise

Rajgopal and Venkatachalam (2006) examine the relationship between quality of financial reporting and idiosyncratic return volatility (reverse measure of stock price synchronicity). In particular, they investigate whether higher idiosyncratic return volatility is associated with (i) financial reporting quality, and (ii) dispersion in analysts' earnings forecasts. The study findings show that lower reporting quality and higer disprecision in analyst forcasts are associated with higher idiosyncratic return volatility. The study results hold even when controlling for additional variables[25]. Although they focus on time-series trends in these two constructs, their results question the information interpretation of stock price synchronicity. However, they focus on return volatility, which is measured as the average monthly variance of raw or market adjusted returns, rather than directly use stock price synchronicity in their empirical tests.

Using data from the US market across the period 1964 to 2002, Yang and Zhang (2006) examine the relationship between stock price synchronicity and four accounting based regularities. Specifically, the authors examined the relationship between stock price synchronicity and (i) accrual anomaly, (ii) net operating assets anomaly, (iii) post announcement drift anomaly and (iv) V/P anomaly[26]. The argument if stock price synchronicity is a measure of firm- specific information incorporated in stock prices, then we should expect observe that the anomalous effects are weaker among low synchronicity firms low synchronicity firms. The study findings show that low synchronicity firms have strong accounting-based anomalies, which is not consistent

[25] The results hold even when controlling for for accounting for new listings, high-technology firms and firm-years with losses, mergers and acquisitions and financial distress.

[26] V/P is the ratio of I/B/E/S consensus forecasts to estimate firms' fundamental values (V) over stock price (P) as per Frankel and Lee 1998)

with the argument informativeness interpretation of stock price synchronicity. The authors concluded that stock price synchronicity indicate high level of uncertainty or noise.

Ashbaugh-Skaife et al. (2006) investigate whether stock price synchronicity is a measure of stock price informativeness. The authors examine the effects of stock price synchronicity proxied by R^2 on the pricing of the future earnings information and analysts' forecast errors. The study employed a cross-country data from six developed countries (Australia, France, Germany, Japan, the United Kingdom, and the United States) over the period 1990 to 2002. The argument is that if stock price synchronicity is a measure of stock informativeness, R^2 should explain some of the variations in future earnings information and analysts' forecast errors. The study findings fail to document significant relationship between stock price synchronicity and future earnings information and analysts' forecast errors. The study further investigates the variation in synchronicity due to firms cross listing in the US capital market. The argument is that listing in US market requires extensive firm disclosures which involve detailed the information about listed firms. Therefore, we should expect lower synchronicity surrounding firms' cross listing. The findings did not find lower stock price synchronicity after listing for firms from the six countries. Therefore, the study favors the noise interpretation for stock price synchronicity.

2.5 SUMMARY AND CONCLUSION

This Chapter reviews the related literature on stock price synchronicity. The extent literature supports the information interpretation of stock price synchronicity rather than market noise. Market model has been extended by the above studies to measure stock price synchronicity in cross-country scope. The current study attempts to extend the literature on the use of stock price synchronicity as a measure of informativeness of

stock prices. The lower the synchronicity the higher the stock price informativeness, *ceteris paribus.*

The following chapter discusses the related literature on corporate transparency in a broader scope. Specifically, it presents literature on financial reporting transparency, private information processing and communication and information dissemination.