

The Role and Policy Implications of Economic Variables in E-Commerce Finance

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Abstract

The development of e-commerce, facilitated by the rapid advances made in information and communications technology, as a new market system is important to the economic growth and continued competitiveness of the ASEAN countries.

E-commerce equity investment is a new phenomenon in the financial markets. This paper reviews the development of e-commerce as a market and its implications for the equity capital market as a primary source of funding for e-commerce business ventures in the Association of South East Asian Nations (ASEAN) region. The factors contributing to the developments in the e-commerce equity markets are identified, analysed and the issues and implications for valuation of e-commerce stocks are discussed and explained using a recent approach to econometric specification, including stationarity tests and cointegration modelling. This paper also provides an empirical analysis of some other important issues in the e-commerce financial market such as market efficiency, volatility and predictability. It draws on the Australian findings of various economic variables that influence Australian e-commerce stock returns. The empirical findings of the Australian study will be extrapolated and used for policy inferences in ASEAN countries.

1. Introduction

The knowledge economy promotes innovation and provides the foundation for

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accelerated economic growth in the 21st century and e-commerce is an important technological development that can help to restructure the industrial economy towards the new economy. The financial sector plays an important role in macroeconomic management but many studies on financial issues relate to the microeconomic level, where the study of markets under asymmetric information has provided insights into the significance of financial factors for corporate investment decision-making. There is relatively less research done on the role of financial intermediation at the macroeconomic level in the knowledge economy. Therefore, this paper contributes to the literature in this area by providing a systematic integration and investigation of the financial issues in the emerging knowledge economy through an empirical investigation of the e-commerce sector.

The paper is structured as follows: Section 2 provides a review of the development of the e-commerce sector, while Section 3 reviews the role of macroeconomic or real variables in the valuation process for equity and more specifically for e-commerce equity. Section 4 presents existing well-known theories of valuation of financial assets and the issues related to volatility and predictability. An improved model for valuation of e-commerce stock is developed in Section 5. An analysis of the methods for studying the Australian e-commerce market in terms of volatility and return is given in Section 6. Empirical evidence of the tests on the model developed in this paper, volatility, predictability and efficient market hypothesis is reported in Section 7. Sections 8 and 9 contain the policy implications and conclusions of this study.

2. The E-Commerce Sector and ASEAN Economies

According to Schreyer (2000), ICT investments contribute to economic growth and are inherently similar to other capital goods. A rapidly changing economy in which ICT plays an increasingly important role in restructuring economic activities resulting in strong non-inflationary growth, high stock market valuations, and low unemployment are evidence of economic progress. Australia has registered remarkable economic performance experiencing a rise in trend growth (GDP per capita) in recent years (OECD 2000) and the economic recovery in ASEAN countries increased significantly in 1999 exceeding earlier growth expectations (IMF 2000). The pervasive role of ICT spans across a wide range of sectors in the economy and is

believed to herald in the era of the New Economy of which the World-wide Web (WWW) is an intricate part. The WWW, which is inextricably entangled in the webs of law, custom and e-commerce, has grown exponentially over the past five years and is generally expected to continue this trend (Coppel 2000).

The valuation of e-commerce companies is influenced by the fact that firms are taking strategic positions in the post-industrial economy, which is the source of future economic growth.¹⁾ This view is reinforced by the globalisation of trade and financial systems where firms face intense international competition and are constantly striving to improve productivity and market-reach to remain profitable. This situation applies to ASEAN countries that have come to rely on the development in information and communication technology (ICT) to provide the impetus for accelerated and sustainable economic growth. The situation for ASEAN is more precarious having just emerged from the poignant Asian financial crisis with a considerably more fragile financial system.

2. 1 Financial Markets for E-Commerce Equity

The recent global market euphoria in e-commerce stocks has raised questions regarding the underlying value of market capitalisations that appear to defy all conventional financial evaluations and economic fundamentals.²⁾ The movements of stock prices have been closely connected to the rate of economic growth and standard valuation models can explain stock returns according to which stock prices are determined by market fundamentals. But the recent volatility of the e-commerce stock prices are more troublesome and the question has been asked whether these stock prices can still be explained by fundamentals, or whether speculative bubbles or "noise-trading" (Black 1986) govern these prices. A justification for the current valuation of e-commerce related stocks is that ICT is a fundamental factor transforming the economy (De Long 1996) and the stock market reflects this future growth of the economy because investors, optimistic about the new economy, factor this into their investment decisions.

1) Stefan Rover, Chief Executive Officer, Banking, BROKAT Infosystems AG, 1999.

2) Alan Greenspan's speech at the Economic Club of New York, January 2000.

3. Role of Real Macroeconomic Variables in Equity Valuation, Investment and Volatility

The analysis of long-term change in economic systems entails the study of the aggregate effect of individuals' actions and changes in activities that influence lifestyle such as consumption, production, distribution and procreation, as represented by e-commerce. The market is essentially a disaggregated system of economic control and coordination that allows rapid adjustment of new innovations or technical changes in the economic structure to facilitate growth in output and economic development and market prices provide an effective feedback of information from which investors and the users of capital (firms) can adjust their behaviour. The optimistic market valuation of e-commerce firms, even when their financial performance is still embattled, suggests investors clearly expect the increasing economic importance of the e-commerce sector in generating revenue for these firms. This condition is consistent with the high correlation between asset price fluctuations and business cycles in the industrialised world (IMF 2000). The Australian Government estimated the economic impact on the level of national output through increased use and development of the Internet to be an annual 2.7 per cent increase (OECD 2000). The valuation of e-commerce stocks based on current and likely future earnings performance poses a problem in that no past earnings or limited financial performance records are available for meaningful valuation and the process must therefore piece together information on forecasts of the overall economy and the conditions of the capital markets, to estimate or extrapolate a fair price. For many e-commerce firms, the emphasis is on long-term growth as opposed to current profitability. Traditional asset pricing methodologies, such as those of Sharpe (1964), Lintner (1965), Black (1972), Merton (1973), Ross (1976) and Breedan (1979) show that the expected return on a financial asset is a linear function of its betas or covariances with some systematic risk factors or market factors.

This paper adopts the theoretical approach to specifying factors and the purpose is to identify the causality relation of these variables to e-commerce stock returns. The selected macroeconomic state variables are identified for their pervasiveness in influencing stock returns generally and therefore e-commerce growth potential.

4. Issues Relevant to the E-Commerce Equity Market

The important issues in the e-commerce stock market relate to the principles of valuation of e-commerce stock, efficiency and volatility of the market and predictability of stock prices and returns. These issues are addressed below.

4.1 Valuation of E-Commerce Stock

The traditional theory of the firm stresses that business corporations provide the specialised institutional structure that comes into being to reduce transaction costs (Coase 1937). With the advent and proliferation of ICT in global economies since the early 1990s, the strategic use of ICT within the firm will no doubt revive interests in its role of promoting cost efficiency through the cyber market structure called the Internet. The theory of the firm expounds contractual relationships as a pervasive feature of economic life. New research into the tantalising effects of modern age ICT on the rules that govern exchange, vis-à-vis information exchange (Internet), would provide the catalyst to illuminate the impact of this phenomenon on the value of a firm.

The era of increasing returns is upon us. Where diminishing returns hold sway in the traditional part of the economy — the processing industries, increasing returns reign in the newer part — the knowledge-based industries (Arthur 1996). The absence of historical data of e-commerce firms made it imperative that surrogates are used for estimating a firm's potential earnings. The demographics of e-commerce are not subject to geographic constraint for the number of e-commerce users is only constrained by the people who have access to it and make active use of it. This has attracted the use of web-based metrics for valuation of e-commerce firms (Hagel and Armstrong 1997; Bontis and Mill 2000; Demer and Lev 2001; Trueman, Wong and Zhang 2000; Amir and Lev 1999). These "value drivers" are fundamentally firm-specific indicators used to estimate and extrapolate its growth potential. This method of factor portfolios based on e-commerce sector-specific characteristics is consistent with the theoretical approach for factor selection mentioned in this paper. While real activity variables provide the indicators and underpinnings for economic performance of the general market, the variables that would signify potential growth impetus for the e-commerce sector are more specific and overt. Fama (1970,

1990) conducted an extensive study of the relation between stock market returns and fundamental economic activities in the United States. Huang and Kracaw (1984) and Chen (1991) have modelled the relation between asset prices and real economic activities using factors such as productivity, growth rate of gross national product, production rates, yield spread, inflation, unemployment and other real activity indicators.

4. 2 General Valuation Principles

The simple "efficient market model" of stock prices maintains that the actual price is the expected present discounted value of future dividends where the share price is an unbiased estimate of its intrinsic value as estimated by well-informed and capable investors.

4. 3 Asset Pricing Models and E-Commerce Valuation

The mainstream concepts, issues and methods in financial economics are based on the theory of efficient market hypothesis (EMH). ICT, which underpins e-commerce, is interpreted as a fundamental factor transforming the real economy to high profit growth in the future (De Long 1996). In the context of EMH, this implies that the stock market reflects the future growth of the real economy due to developments in ICT and therefore fundamentally justifies the stock prices.

The discounted cash flow models for stock valuation where future cash flows are discounted at a constant rate poses two problems, the absence of earnings in the vast majority of e-commerce firms and the proposition that stock prices are too volatile to be rational forecasts of future dividends discounted at a constant rate (Shiller 1981). The higher volatility of e-commerce stock prices is also likely to cause the parameters needed to estimate expected returns to fluctuate and produce wide swings in the estimated expected returns.

The Capital Asset Pricing Model (CAPM) is an economic model that predicts a trade-off between systematic risk, known as beta (β), and expected return under specific conditions. It proves that the relationship between prices of assets in a general equilibrium, where the investors select assets to maximise the mean-variance utility, is linear. Although the CAPM is widely used there are still many criticisms (Roll 1977) against it. The evolving nature of the e-commerce sector creates a situation where information is dynamic with the constant introduction of

unanticipated operating conditions in the industry, creating information surprises that cause e-commerce stocks to move in a magnitude or direction not predicted by the single-factor CAPM. Empirical evidence suggests a multiple-factor model explains expected returns better (Chen 1983; Chen, Ross and Roll 1986).

4.3.1 Factor Models

Sharpe, Alexander and Bailey (1995) described factor models or index models as “return-generating” statistical models that assume that the return on a stock is sensitive to the movements of various factors or indices. The two main factor models are the one-factor market models and the multiple-factor models. Depending on the number of predicted variables, the techniques of simple or multiple regression analysis are used to define the return-generating process.

The market model is a statistical model linking *ex post* returns on a stock to those on the market in contrast to the CAPM Model. The multiple-factor model is a “return-generating process” statistical model that describes how the return on a stock is produced by identifying major economic variables that systematically move the prices of all stocks. Factor models potentially provide the benefit of reducing the variance of the abnormal return by explaining more of the variation in the normal return. This variance reduction is typically the greatest in cases where the sample firms have a common characteristic, as with e-commerce firms, when they are all members of one market sector or industry and are grouped into sectors under one market capitalisation group (Campbell, Lo and MacKinlay 1997).

4.5 Other Related Issues — Efficiency, Volatility and Predictability

The implications of the EMH in e-commerce stocks relate to the efficient allocation of capital in the sense that under the EMH market financing conditions and the firm’s cost of capital are optimal. Therefore the degree of market efficiency helps determine the viability and optimality of e-commerce-related projects and also the need for government intervention. The measure of volatility of the e-commerce stocks is crucial as a further test of market efficiency in the allocation of financial resources, for if the e-commerce prices do not reflect market fundamentals then resources will be misallocated and hence, volatility tests are joint tests for informational efficiency. The predictability of e-commerce stock returns depends on the statistical analysis of the random walk hypothesis of the stock prices. If e-

commerce stock prices were unpredictable, such a test would support the rational expectation element of the EMH that forecast errors should be zero on average and uncorrelated with any information available at the time the forecast was made. The EMH emphasises that it is impossible for investors to persistently make supernormal profits.

5. A Linear Multi-Beta Valuation Model for the E-Commerce Stock Market

Macroeconomic analysis generally focuses on changes in macroeconomic conditions as a result of changes in government policies, market structure, technology and culture. As these factors change, expectations about the performance of a particular firm, industry and economy will change and affect the investment weighting given to a particular sector. The advent of e-commerce has been pervasive and significant, affecting all market aspects including government policies, competition, lifestyle, costs and growth perception. There is commonality in the view that the variations in expected returns are rational variations in response to market conditions (Chen 1991; Schwert 1990; Fama and French 1989; Fama 1990).

The multi-beta models generalise the concept of risk under the traditional CAPM that market risk, risk that cannot be diversified away, underpins the pricing of assets.

E-commerce as a business medium is still in a relatively early stage of development, complex and not fully exploited and therefore requires a broad-based approach, such as the multi-beta model to capture its full implication (Oh and Islam 2001). The specific model developed in this study is presented in Section 7.2 below.

6. Empirical Study of the Australian E-Commerce Sector

6.1 Methodology and Econometric Methods

The broad methodology adopted in this paper is as follows:

- put the recent e-commerce stock price volatility and returns into perspective;
- identify and estimate factors that are most likely to pervade e-commerce stock value;
- develop an econometric multi-beta model for e-commerce stock returns and,

test the predictability of stock returns using the combined explanatory power of the factors; and

- make inferences from the perspective of the implications for corporate and public policy decision making.

The objective of using multiple regressions in this study is to identify the relationship between an exogenous variable (e-commerce stock returns) and multiple endogenous factors (e-commerce pervasive factors) and the selected factors are deemed to capture economy-wide systematic risks. The model assumes no hierarchical structure for the factors hence no orthogonalisation is done.

6.2 Data

The eighteen e-commerce firms in the sample are selected from the population of forty-five pure-play e-commerce companies listed on the Australian Stock Exchange (ASX) at the beginning of the study period. The proxy for market return is calculated from the closing S & P/ASX 200 index and stock prices are the closing prices of the e-commerce firms on the last trading day of the month in the period July 1999 to June 2000 from data obtained from the ASX. The macroeconomic variables used are monthly data for the corresponding period from the Australian Bureau of Statistics and the Reserve Bank of Australia.

7. Empirical Evidence and Econometric Study

7.1 E-Commerce Stock Valuation and Volatility

In this section, a comparison of the actual, historical market e-commerce returns with the expected returns estimated using the CAPM model is made to study e-commerce volatility, and the results provide a benchmark for highlighting the empirical behaviour of e-commerce stocks. The tendency of a stock to move up or down with the market is reflected in its beta coefficient, β .

The mispricing between the actual returns and CAPM based expected returns on a sector basis is presented in Table 1 as follows (numbers in brackets indicate the number of stocks in each sector):

The systematic and unsystematic risk profile, as measured by the market index, indicates that the e-commerce stocks were to a large degree subject to unsystematic

Table 1 Overview of Pricing

Sector	No. of Stock in Sector	Pricing
Casino & gaming	(1)	Overvalued
Computer & office services	(3)	Undervalued
Diversified media	(1)	Undervalued
Equipment & services	(2)	Mixed
Health & medical services	(1)	Overvalued
High technology	(1)	Undervalued
Misc. financial services	(1)	Undervalued
Miscellaneous services	(2)	Mixed
Other telecommunications	(2)	Undervalued
Retail/retail investment	(4)	Mixed

Source : Islam and Oh (2000).

risk (82%) rather than systematic risk (18%) in the study period (Oh et al. 2001). This means that there was less of a tendency for the e-commerce stock prices to move together with the general market variability and unsystematic or firm-specific risk explains 82% of their variance. This situation can also be illustrated by the higher return variability of the e-commerce stock portfolio (Oh et al. 2001); where monthly σ equals 49.82%, compared to the general market; monthly σ of 3.13%.

All the e-commerce sectors studied showed positive actual returns except for the High Technology sector (Table 2). Volatility measured against the market, represented by beta, is generally higher for most sectors. This indicates that the majority of e-commerce stock returns were more volatile than the market return in the study period. From the perspective of risk-return relationship, the risk and return trade-off appears not to hold in the sample stocks in the study period.

Though e-commerce firms have a number of advantages over traditional firms such as lower operating costs, the recent market consolidation³⁾ of e-commerce stocks indicates a reaction to market risks and conditions faced by this sector and investors are constantly studying to see how changing technology will end up transforming the market. This confirms the general systematic risk level of the e-commerce stocks and that they move predominantly in a volatility sphere of their own, and relatively independent of the market (Oh et al. 2001).

3) In April 2000 the Australian stock market index dip was predominantly a result of stocks in the e-commerce sector.

Table 2 Relative Market Volatility and Trade-off Between Risk* and Return

Sector	Beta	Return	SD
Health & Medical Services	19.86	0.39%	1105.33%
Miscellaneous Services	6.39	5.41%	47.04%
Retail/Retail Investment	5.22	4.20%	29.74%
Diversified Media	5.00	0.67%	28.99%
Computer & Office Services	4.93	0.07%	30.32%
Equipment & Services	4.25	26.97%	140.37%
Other Telecommunications	3.74	2.67%	21.38%
Miscellaneous Financial Services	0.57	0.44%	30.69%
Casino & Gaming	0.03	24.06%	56.33%
High Technology	- 0.26	- 1.26%	27.45%

*Ranked in order of beta.

Source: Islam and Oh (2000).

7.2 The Multifactor Regression Model — Results

The following sections present the results of the tests done in estimating the multi-beta models for e-commerce stock valuation.

7.2.1 Covariance and Correlation Coefficient Analyses

All the e-commerce stocks display predominant positive covariance with each other. This suggests the behaviour of e-commerce stock returns is largely consistent or similar in characteristics among the stocks in the portfolio. The process for factor selection is based on the average correlation coefficients of the individual stock returns by sector and those pervasiveness variables are included in the model. By computing a frequency over a cross-section of the e-commerce stocks, the intent is to eliminate idiosyncrasies of individual stocks so that a general behaviour between the returns and variables can be established and aid in factor selection by highlighting the more pervasive factors.

7.2.2 Multifactor Models

A generic factor model, named as the Australian E-Commerce Multifactor Model (AEMM), using the significant variables and on the basis of theoretical developments in finance (as summarised previously) is developed and estimated (see Section 7.2.4). The AEMM is a static model and it has the limitations that time is not incorporated here. This multifactor model differs from the traditional CAPM and the market model in that both are single-factor models. No serious econometric problems such as multicollinearity, heteroskedasticity and autocorrelation problems,

which are present in many empirical asset-pricing models, were evident in these results.

7.2.3 EMH Findings and Predictability

The results of the weak-form EMH hypothesis testing imply that for all sectors the information efficient markets hypothesis prevails at the 10% significance level (critical value = 1.812). This suggests that e-commerce stock prices reflect all historical information regarding the underlying firm and the market responds immediately to new information regarding the firm. This characteristic can be reconciled with the dynamic nature of Internet development that is constantly changing as the virtual market evolves to incorporate new technologies, ideas and business models. Any piece of past information would be rendered irrelevant or obsolete, whilst new information is rapidly factored into the stock price by investors.

The weak-form EMH tests using the autocorrelation of returns data suggest the validity of the EMH for the returns of the e-commerce stocks in this study. The low *R*-squared of these tests supports the EMH. This indicates the tests based on (*ex-post*) real returns cannot be used to predict excess returns. De Bondt and Thaler (1985) finds stocks with extreme price movements appear to have strong negative serial correlation of returns and are thus mean reverting. This would be contrary to the EMH in that it would be possible to make supernormal profits from predictability in stock prices. For the constructed e-commerce portfolio, there is no evidence of negative serial correlation except for some industry groups at the sector level. Longer time series data would be necessary to conduct a meaningful study of this volatility issue for the e-commerce stocks.

7.2.4 Stationarity Tests and Cointegration

A test of stationarity in a financial model is used to test for stability of the relationship of the explanatory variables on the dependent variable and enables a better understanding of the relationship when there is stationarity in the time series and the β does not change arbitrarily over time. If economic variables are significant and consistently priced in e-commerce stock returns, they should be cointegrated. This co-integration relation between e-commerce stock returns and the underlying factors is a necessary condition of the equilibrium model of stock market returns.

The three pervasive factors of the Nasdaq composite index (NAS), consumer confidence (CC) and US\$/A\$ foreign exchange (FE), selected from twenty-four independent variables using correlation analysis and factor-loading procedures (Oh et al. 2001), are tested for co-integration using regression involving the first-difference, Δy_t and Δx_t , in each of the following equations (1) to (3), on the dependent variable *e-stockret*, using the Dickey-Fuller test.

$$e\text{-stockret } (\Delta PR)_t = \hat{\alpha} + \hat{\beta} \Delta \text{NAS}_t; \quad (1)$$

$$e\text{-stockret } (\Delta PR)_t = \hat{\alpha} + \hat{\beta} \Delta \text{CC}_t; \quad (2)$$

$$e\text{-stockret } (\Delta PR)_t = \hat{\alpha} + \hat{\beta} \Delta \text{FE}_t; \quad (3)$$

The results are presented in Table 3 below.

From Table 3, the t -statistic of $(\hat{\rho}_{t-1})$ for the all the explanatory variables NAS, CC and FE are all below the asymptotic critical value of -3.04 at the 10% significance level. This is evidence that the $y_t - \beta x_t$ is an $I(0)$ process and that the variables are cointegrated for variables running a regression involving the first difference of their time series. Of the three pervasive factors, NAS and CC have a positive correlation and FE has a negative correlation with the e-commerce portfolio return. On the basis of the criterion of goodness of fit, the following equation of the first difference is selected for analysing e-commerce stock return and the three explanatory variables have the strongest influence on e-commerce portfolio return across all the stocks and sectors evaluated in this study. They are statistically significant at the significance level of 10% ($c = 1.943$):

Table 3 Cointegration Statistics of Series with First Differences

Cointegration Series	t -statistic $(\hat{\rho}_{t-1})$	p-value	
Equation 1 (ΔNAS)	- 5.3614	0.0003	Cointegration
Equation 2 (ΔCC)	- 3.7237	0.0040	Cointegration
Equation 3 (ΔFE)	- 3.7076	0.0041	Cointegration

*Asymptotic Critical Values ($c = -3.04$) from Davidson and MacKinnon (1993), at the 10% significance level and no time trend.

Source: Islam and Oh (2000)

$$e\text{-stockret } (\Delta\hat{P}R)_t = -0.1900 + 0.0013 \Delta\text{NAS}_t + 0.0692 \Delta\text{CC}_t - 0.3287 \Delta\text{FE}_t$$

$$\begin{matrix} (-1.2772) & (3.7657) & (1.9345) & (-2.1045) \end{matrix}$$

$$R^2 = .6421$$

where: $e\text{-stockret } (\Delta\hat{P}R)_t$ = the expected return e-commerce stock portfolio at time t;

ΔNAS_t = the value of the factor: NAS at time t;

ΔCC_t = the value of the factor: CC at time t;

ΔFE_t = the value of the factor: FE(US\$) at time t;

All three factors in the AEMM equation are statistically significant (t-statistics in parentheses) and this validates the present model and confirms the evidence of their pervasiveness on the portfolio return of the e-commerce stocks. In the midst of the Internet market euphoria, e-commerce stocks are perceived as growth stocks whose value is driven partly by the NASDAQ composite index, consumer confidence and strength of the Australian currency (AEMM). The AEMM only explains part of the e-commerce value ($R^2 = 64\%$) due to these systematic factors. Such systematic risk level is consistent with empirical study done by Drummen, Martin, Zimmermann and Heinz (1992) where systematic risk explains almost half of the variance of European stocks. The estimated model therefore provides a better measure of e-commerce portfolio return compared to the average 17% systematic risk level by the market model using the S & P/ASX 200 as the market index in this study.

8. Policy Implications.

In the post industrial revolution era, knowledge as well as increasing availability of material goods, services, and wealth have contributed to strong growth of national economies. However, the accelerated rate of economic growth has modified the traditional structure and institutional basis of the economy. This has been accompanied by by-products of fundamental consequences such as globalisation, the emergence of the knowledge economy, and regional convergences and divergences of economic growth of different countries (Islam, Billington and Oh 2001; Sheehan

and Tegart 1998). The important characteristics of a knowledge economy may be summarised as the following: the increasing knowledge intensity of the economy, the rise of the online economy, the rising value of knowledge and market failures, and integrated international markets and globalisation (Sheehan and Tegart 1998). The Internet, which spawns e-commerce, is a new market infrastructure in a nascent stage of development and with its potential to pervade all facets of the economy, is probably too important to be left entirely to market forces. The recent volatility in the e-commerce equity market reflects the uncertainty that characterises the real world. Since the future of the e-commerce sector is still relatively unknown, the effect of uncertainty surrounding the financing decisions of individual firms is compounded by having to confront with the need to make decisions about investment and financial assets.

The important prerequisites of a knowledge-based economy relate to people and infrastructure. People require high levels of both academic and technical education and infrastructure has to be contemporary to ensure knowledge-based economic systems operate effectively. Governments have always prided themselves in being able to accelerate economic development. They have done so by investing extensively for the purpose of building new economic infrastructure and providing facilities necessary for economic growth. There is nothing new about government participation in economic life to help new industries and the electronic commerce (e-commerce) sector is no exception. Assistance can take the form of tariff, incentives and subsidies to assist the industry to overcome financial difficulties in productive investments that facilitate and integrate economic activities, either on a long-term basis or to tie over short-term difficulties. The results of this study that the e-commerce stocks have a high unsystematic risk profile imply that the appropriate government actions for enhancing equity market efficiency in the e-commerce market as a means to minimise investment risk would be more definitive public regulations and/or more adept and literal information dissemination about the e-commerce market development. Romer (1992) and Soete (1997) find the need for government intervention to sustain investment in knowledge and Lehman (1996) suggest that US economic growth in the next century will be determined by the government creating incentives for private sector investment in R & D and fostering and promoting intellectual property.

In general, these findings imply that the NASDAQ composite index, consumer

confidence and foreign exchange rate between the Australian dollar and US dollar are significant factors in predicting changes in e-commerce stock return and it can be claimed that e-commerce stock returns variability is fundamentally linked to these variables. From the recent global experience on the volatility of the e-commerce equity market, there is a need for public policy to cultivate involvement in the e-commerce sector, taking into consideration these pervasive real economic factors, so that the sector operates efficiently in an economically and socially desirable manner. This is consistent with studies of financial intermediation in the economy by Gurley and Shaw (1955, 1960) and Fry (1988), and endogenous growth theory where it is implied that financial intermediation may weaken the relationship between money and economic activity and may make the economy more dependent on the complex interaction between debts and assets in the economy, and the adoption of public policy is justified for proper financial management for economic development. The accomplishment of social and economic objectives in relation to e-commerce development must therefore require government intervention. Brainard and Tobin (1963) postulated that monetary policy had important real effects as it affects return on real capital and it is also through such policy that government can influence the allocation of capital to the development of e-commerce. The focus of public policy should be directed at minimising the problems of moral hazard and adverse selection in the e-commerce equity market. These problems are more evident due to the nascent and evolving nature of e-commerce development creating a situation of asymmetric information. The implication, both in business and government, is that investments in education and technology need to be fostered for firms and countries to remain in the forefront of the knowledge-based economic challenge.

9. Conclusions

The following conclusion can be made from this study into the valuation of Australian e-commerce stocks on the basis of the empirical evidence generated here to provide a policy guide to ASEAN countries in the development of the e-commerce sector.

The excessive volatility of the e-commerce stock returns represented by the high level of unsystematic risk element implies a low correlation of e-commerce

returns to the market return in terms of their prices reflecting similar economic fundamentals. This is interpreted as a strong presence of event effects in e-commerce stock prices. From the covariance and correlation studies, the e-commerce stock do covary and reflect the fact that e-commerce firms tend to have similar properties causing them to uniformly react to market conditions influenced by systemic factors NAS, CC and FE. The fact that e-commerce firms are subject to a relatively high unsystematic risk suggests that e-commerce sector return may react more aggressively to idiosyncratic economic factors, including market uncertainty, speculative investment, distribution and composition of national income, effective demand, public policy and openness of domestic market to international finance and trade, than the traditional factors identified in other empirical studies. The systematic risk measured by the NAS, CC and FE factors using the estimated model explains more than half of the variance (64%) of the e-commerce portfolio return, PR. This indicates that 64% of Australian e-commerce stock variance is specified but individual stock may vary from this benchmark.

The proof of EMH shown by tests done does not rule out the possibility of positive feedback traders or noise traders in the markets for e-commerce stocks. Visual analysis of the return spread, betas and standard deviations for the e-commerce stocks appears to indicate excessive volatility, which is a characteristic of the e-commerce financial market as discussed in Section 2, than would be suggested by the change in fundamentals (or pervasive factors NAS, CC and FE) under the EMH. The static AEMM model developed here provides some empirical evidence in support of the informational efficient markets hypothesis. However, a dynamic model is necessary for a definitive finding. The Pareto efficiency of the Australian financial market is not shown in this study as the empirical evidence suggests the presence of a significant level of unsystematic risk in the market, which is generally caused by "secular effects", "small firm effects", speculation and market imperfections.

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