Incremental performance of an eChannel addition

Long-term and volatility consideration perspectives

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Abstract

Purpose – The purpose of this paper is to use the Black-Scholes-Merton option pricing model to evaluate the incremental performance of an eChannel addition.

Design/methodology/approach – Data were collected from 53 Taiwan financial services firms. In total, 33 of them introduced their online services, whereas the other 20 firms did not introduce their online services during the period under examination.

Findings – The research findings show that firm asset values increase following eChannel additions. Thus, eChannel additions enhance firm financial performance. A further analysis comparing the performance between firms with and without eChannel additions also shows that firms with eChannel additions have higher asset value growth rates, which further validates the capacity of eChannel additions to enhance financial performance.

Practical implications – Managers and shareholders in firms making eChannel additions are not required to be concerned regarding stock price volatility, and managers in firms without any eChannel investment could use eChannels to enhance their stock price and seize future opportunities. Using eChannel is a valid approach for firms to provide enhanced services to current customers, access new markets, and extend market coverage, thus enhancing overall financial performance. Investors could confide those firms implementing eChannel additions.

Originality/value – Studies investigating whether eChannel additions enhance firm financial performance are scant. No study has evaluated performance from a long-term perspective or from a volatility aspect (both are important considerations in eChannel performance evaluation). The research represents a pioneering work that empirically investigates these issues.

Keywords Internet channel, Black-Scholes-Merton option pricing model, eChannel, eChannel performance

Paper type Research paper

1. Introduction

Intensifying market competition and the emergence of the World Wide Web (WWW) are changing the channel system context (Ozuem *et al.*, 2008; Huang *et al.*, 2009; Chen *et al.*, 2012; Hsieh *et al.*, 2012). Using physical channels alone to access the market

is less popular, whereas merchants dealing in nearly all product categories are adding internet-based electronic channels of distribution (eChannels hereafter) to their existing channel systems as brick-and-click businesses (Hsiao *et al.*, 2012). For numerous firms, internet channels added to the modern channel system are critical, and the use of an eChannel addition continues to increase dramatically (Frost *et al.*, 2010; Liao *et al.*, 2011). The electronic commerce (e-commerce hereafter) literature has examined e-commerce to create new platforms for a competitive strategy (Celuch *et al.*, 2007; Chang and Wang, 2011) with different advantages associated with adding the internet to the existing channel structure. These advantages include creating a better communication environment, providing more information to meet customer expectations, and support for the continuous development of a firm (Earl, 2000; Harrison *et al.*, 2006; Canavan and Henchion, 2007; Simmons, 2008; Arroyo-Barrigüete *et al.*, 2010). Venkatesan *et al.* (2007) and Hsiao *et al.* (2012) also found multichannel users to be significantly more profitable than single-channel users because multichannel users are active shoppers, purchase larger quantities, and spend more money. Therefore, eChannels are complementary to, rather than independent from, the existing channel structure (Hsiao *et al.*, 2012).

The eChannels allow firms to provide customers with a range of value criteria, such as a convenient shopping environment, a broader and deeper product assortment, less waiting time, personalization, and interactivity (Cheng *et al.*, 2007; Flavián and Gurrea, 2007; Eng, 2008; Liu and Shrum, 2009; Hanafizadeh *et al.*, 2012). These values equip a firm with more competitive advantages, which information technology (IT) enables in a cost-effective manner (Barrutia *et al.*, 2009; Li *et al.*, 2012). The values help a firm reduce transaction costs and achieve a high level of customer value and loyalty (Silva and Alwi, 2008; Gainsbury *et al.*, 2013). Consequently, customer demands for products increase with the number of new customers, causing market share, and market coverage to grow (Geyskens *et al.*, 2002; Rajkumar and Kumar, 2004).

Despite these advantages, adding an eChannel can be harmful to a firm's operational performance. The eChannel implementation costs, conflicts with the original physical intermediaries, increased organizational complexity, and customer confusion are examples of the negative side of adding an eChannel (Geyskens *et al.*, 2002; Li *et al.*, 2004). Therefore, clarifying the usefulness of adding an eChannel to the current channel structure and predicting how the eChannel addition might affect a firm's overall financial performance are essential.

A review of the literature indicates that previous researchers have been concerned regarding channel cannibalization (Brynjolfsson and Smith, 2000; Kim *et al.*, 2009). Three studies related to performance in connection with an eChannel addition (Geyskens *et al.*, 2002; Cheng *et al.*, 2007; Tu, 2012) used the event study method, the economic value added (EVA), the market value added (MVA), and data envelopment analysis (DEA) approaches to evaluate a firm's overall performance for eChannel additions. However, these approaches fail to reflect adequately the long-term financial effects of eChannel additions in the volatile e-commerce environment. The interaction of volatility and return on prior investment evaluation studies plays a key role, and thus, volatility is a critical component in asset and options pricing models (Brealey and Myers, 2002; Dewan *et al.*, 2007; Dewan and Ren, 2011). Although volatility is widely acknowledged, it remains virtually absent in the research on IT investment performance (Dewan and Ren, 2011). We attempt to fill the literature gap.

To analyze financial performance during the four years following an eChannel addition, we apply the Black-Scholes-Merton option pricing model (the BS-M model

hereafter) as a volatility-considered performance evaluation tool with a long-term perspective in financial service industries. Other research areas also provide empirical evidence to the applicability of the BS-M model (Chen and Chen, 2005; Kristensen and Mele, 2011). We extend and validate the BS-M model in the current subject.

To evaluate eChannel addition effectiveness, we compare eChannel performance from two perspectives: internal environmental control (before and after the eChannel comparisons) and external environment control (eChannel and non-eChannel comparisons).

2. Literature review and hypothesis development

2.1 The eChannel addition performance literature

Literature on eChannel addition performance is rare, ranging from the Geyskens *et al.* (2002) study and the Cheng *et al.* (2007) study to the research by Tu (2012). Geyskens *et al.* (2002) adopted the event study method to evaluate internet-added channel performance by using daily stock prices of 22 firms within a 30-day period. Their research findings indicate that investors perceive gains following the announcement of an eChannel addition. In addition to the event study method, Cheng *et al.* (2007) introduced the EVA and MVA approaches to evaluate firm value in a 90-day period following an eChannel addition. Their research results also support the value of an eChannel addition to a firm's financial performance. Tu (2012) adopted the event study and DEA approaches to evaluate a firm's value in a three-year period (including pre-announcement, announcement, and post-announcement years) after an eChannel addition. His findings also show that eChannel addition has a significant effect on firm performance.

The methods in these studies (event study, EVA, and MVA) contain numerous shortcomings and leave room for improvement. Geyskens *et al.* (2002) admitted that their research findings using the event study method did not support the optimistic predictions of long-term profit and growth potential resulting from an eChannel investment. The short-term-oriented event study method raises the concern that short-term studies might not accurately reflect the true benefits of eChannel investment over time. This short-term-oriented shortcoming also applies to the use of the EVA approach (Glasser, 1996). The Cheng *et al.* (2007) study, using the EVA approach with a 90-day period following an eChannel announcement, only reflects the short-run performance of an eChannel addition. The inherent limitations of short-term measures are a serious drawback to eChannel evaluation because of high eChannel setup costs, such as heavy investment in tangible assets and organizational costs (Bartov *et al.*, 2002). Because consumers are more likely to observe system security and its interactive features than to use the new eChannel to purchase products in the initial stage (Han and Maclaurin, 2002), the beginning revenues of eChannel implementation are low, and the initial eChannel financial performance is poor. The effect of an eChannel strategy is therefore long term (Mäenpää, 2006), and short-term evaluation measures such as the event study method and the EVA approach are inappropriate.

For using the MVA approach, internet information is largely unregulated, can be incorrect, and lacks credibility (Antweiler and Frank, 2004; Kubiszewski *et al.*, 2011). Therefore, the e-commerce environment is risky and volatile (Lu *et al.*, 2013). The MVA, which applies to the asset side of the balance sheet or to certain, but not all assets and debts, may not expose the volatility effect by failing to reflect certain hedges, such as those that consider asset and debt maturities simultaneously or use future contracts (Shaffer, 1992). Consequently, the MVA approach in addressing eChannel evaluation cannot properly measure the market volatility effect, a serious consideration in

conducting internet commerce (Ofek and Richardson, 2002; Cao and Gruca, 2003). DEA is another long-term evaluation method that collects profit margin percentage, return on equity (ROE), and day receivables as output variables (Tu, 2012). However, this approach also fails to measure the market volatility effect.

These shortcomings call for using different financial approaches that offer a long-term perspective in addressing market volatility to compute performance following eChannel additions. One potential approach is options analysis.

2.2 The BS-M model
2.2.1 The BS-M model advantage for performance evaluation. A shock on stock prices mimics the long-term stochastic price trend (Lee, 1998), and therefore, views stock price as a long-term value (Gallagher and Taylor, 2002). An option is a financial instrument that gives the owner the right to buy and sell a commodity (such as a stock price) on a future date at a fixed price (Kellison, 1991). This right commences before the original contract is signed, and continues throughout the deal (Morrison, 2007), thus making an option a long-term derivative (Hill and Stevens, 2002). The BS-M model, a type of option analysis, combined with the use of stock prices as an input for company performance valuation, is thus a long-term-oriented approach (Wiles *et al.*, 2012). The BS-M formula also emphasizes the volatility concept and considers volatility a standard deviation of the return in its formula (Muurling and Lehnert, 2005; Dewan and Ren, 2011). By using stock prices for company asset value computation, a type of consumer measure, an option analysis can better objectively define company performance, and is more content-valid and reliable than performance evaluation studies that use company-reported financial figures (Chandler and Hanks, 1993). The BS-M model in conjunction with stock price input thus emerges as the best method to apply in examining performance following eChannel additions.

Black and Scholes (1973) and Merton (1974), known as the BS-M model, developed a closed-form solution to a single options price exercisable only on a simultaneous specified future date. According to the authors, the price of such an option is derivable by using a partially differential equation to characterize the stochastic process of stock returns (Botteron, 2001). In 1974, Merton further expanded the BS-M pioneering work to propose a model where firm equity is an option based on firm asset value.

The option analysis approach employs two alternate methods: the analytical formula (i.e. the BS-M model) and the numerical procedure. The BS-M model is the first to consider leveraged firm equity as an option in calculating firm value (Copeland and Weston, 2006), and is the most widely used model in evaluating option contracts (Cron and Hayes 2007). The model is also one of the most outstanding financial economic models (Sudarsanam *et al.*, 2006).

2.2.2 The BS-M model advantage to evaluate eChannel addition performance. The eChannel environment differs from the offline channel, and requires specific measurement tools to evaluate its performance. We adopt the BS-M model to explore the eChannel environment for the following reasons.

Long-term orientation. Frequently used financial measures include profit, revenues, return on investment (ROI), return on sales (ROS), and ROE (Kean *et al.*, 1998; Richard, 2000; Werner *et al.*, 2004). Traditional financial measures do not completely assess the long-term and forward-looking effect of adopting market orientation (Kara *et al.*, 2005). Thus, they are less appropriate indicators of internet channel value regarding a historical and short-term orientation without sufficient information related to firm future value (Birley and Westhead, 1994; Geyskens *et al.*, 2002; Anderson *et al.*, 2004).

By not using the firm book value of assets, the BS-M model estimates the market value of a stock price asset, which reflects investor expectations of a firm's perspective, thus containing forward-looking information (Vassalou and Xing, 2004; Chen *et al.*, 2009; Wiles *et al.*, 2012). The advantage of using options in a valuation is the ability to account for future strategic decisions. A company investing in an internet channel must invest certain costs in field exploration in the initial stage. Therefore, the financial report (accounting performance) is not good in the first period. The option performance of the economics measure is forward looking, giving insight into future opportunities because of the long-term investment of an internet channel addition.

Volatility consideration. Online trade over the internet is a more recent IT-related form of direct marketing, and is similarly perceived as higher risk by consumers (Lu *et al.*, 2013). Previous research has reported a volatile internet environment, particularly for financial services (Dewan *et al.*, 2007; Dewan and Ren, 2011). Such cases require an evaluation approach to consider the volatility effect. The traditional approach using the accounting model infers that firms with a similar financial structure have similar performance. The BS-M model implies that firms may have a similar financial structure, but not similar performance, if asset volatilities vary. Therefore, firm asset volatility involves critical information in firm performance (Vassalou and Xing, 2004; Dewan *et al.*, 2007; Dewan and Ren, 2011). Differing from accounting approaches that do not account for firm asset volatility to evaluate firm performance, we propose an alternative factual measure, the BS-M options model, considering stock price volatility as the model parameters.

Objective. In contrast to inaccurate financial performance figures reported by firms, option pricings measured by investor future expectations are more objective, and thus, useful. Consumers in the public market presented substantial evidence supporting the validity of their performance measures, and showed considerable reliability for reported performance measures (Brush and Wanderwerf, 1992; Chandler and Hanks, 1993). For an eChannel addition, precise measurement from the market viewpoint is anchored to objectively define performance criteria, and is content-valid and reliable (Chandler and Hanks, 1993).

2.3 Hypotheses
The addition of an eChannel poses opportunities to enhance performance. Supplementing the existing physical distribution with an eChannel enriches a firm's expected performance when revenue increases and costs decrease. We elaborate on each of these two perspectives.

The eChannel advantage from the revenue perspective. The development of new IT applications has led companies to a more sophisticated use of the channel system (Avery *et al.*, 2012). The IT industry in developed countries is advanced, and software and hardware facilities are complete. Internet popularity and the forthcoming intelligent phone have sharply increased internet trade, which has extended its trading time and physical store to a virtual space dimension (Lu *et al.*, 2013). The eChannel users can conduct transactions anywhere and at any time, and eChannel firms can access and satisfy customers through the interactive response mechanism with location and time flexibilities. Thus, the eChannel is an indispensable channel to reach the potential market quickly and easily (Tu, 2012; Hsiao *et al.*, 2012). The eChannel is an effective transaction operation method because of its faster transaction speed,

lower transaction handling fees, and information transparency, which influences customer convenience perception on eChannel service usage (Yoon and Steege, 2013) and increases sales (Geyskens *et al.*, 2002). Given market coverage extension, market expansion, marketing function shift, relationship deepening, customer retention, and loyalty improvement (Geyskens *et al.*, 2002; Boehm, 2008; Xia and Zhang, 2010; Avery *et al.*, 2012; Tu, 2012), firms can improve their performance following eChannelization.

eChannel advantage from the cost perspective. Although enterprises investing in the initial stage of the eChannel must invest in high fixed costs, the marginal cost is low. The main eChannel advantage is that it saves human resource costs because only eChannel firms provide a technical interface for customer interaction rather than with employees in a physical space (Lu *et al.*, 2013). Because of technology and infrastructure, the human resource cost is high in developed countries, accompanied by a high ratio of human resource costs within total costs (Chatterjee, 2012). A deeper eChannel level indicates greater human resource savings. The eChannel reduces transaction and production costs, and certain offline activities could transfer to the eChannel, reducing physical production costs (Geyskens *et al.*, 2002). The eChannel also provides the opportunity to manage direct marketing, removing unnecessary intermediary costs, and reducing company and customer transaction costs (Kabadayi, 2011; Wu *et al.*, 2013), a process that reflects great firm performance.

Thus, we propose the following hypotheses:

H1. eChannel additions increase long-run firm performance.

H2. Firm performance with eChannel additions is better than non-eChannel firm performance.

3. Method

3.1 Using the BS-M model to compute company asset value
The following discussion shows the reasoning for adopting the BS-M model. Suppose a firm has one zero coupon bond outstanding, and the bond matures at time T. Firm equity value E_T at time T is as follows:

$$E_T = \max(V_T - D, 0) \tag{1}$$

where E_T is the firm equity value (stock prices) at time T; V_T the firm asset value at time T; D the amount of debt interest and principal to be repaid at time T.

If $V_T < D$, the firm defaults on the debt at time T. The equity value is then 0. The lenders receive a payment equal to the asset value, and the shareholders receive nothing. If $V_T > D$, the firm should make the debt repayment at time T. The equity value at this period is $V_T - D$. The lenders receive the promised amount, and the shareholders receive the residual asset value. The equity is a call option on firm assets with a strike price D and maturity T. Black and Scholes (1973) showed that the equity value prevents an arbitrage opportunity (here option formula "C") as:

$$E_0 = C(\sigma, T, D, i, V_0) = V_0 \Phi(d_1) - De^{-it} \Phi(d_2) \tag{2}$$

where E_0 is the current firm equity value; V_0 the current firm asset value; $\Phi(\ )$ the value of the cumulative normal density function:

$$d_1 = \frac{\ln V_0/D(i + \sigma_V^2/2)T}{\sigma_V\sqrt{T}} \tag{3}$$

$$d_2 = \frac{\ln V_0/D(i - \sigma_V^2/2)T}{\sigma_V\sqrt{T}} \tag{4}$$

σ_v is the asset volatility; σ_E the equity volatility; i the risk-free rate of interest; T the option duration.

The risk-neutral probability $\Phi(-d_2)$ that the firm will default by time T is the probability that shareholders do not exercise their call options to buy firm assets for D at time T. Calculating the equity value requires V_0 and σ_v, neither of which are directly observable. However, for a publicly traded firm, E_0 is the market price of firm stock. Equation (2) provides one condition that V_0 and σ_v must satisfy. Estimating σ_E as the volatility of firm equity price is also possible. Itô's lemma provides the equation relating equity price to asset and equity volatility, the Delta of equity, and asset value that V_0 and σ_v must satisfy:

$$\sigma_E E_0 = \frac{\partial E}{\partial V}\sigma_V V_0 = \frac{\partial(V\Phi(d_1) - De^{-it}\Phi(d_2))}{\partial V}\sigma_V V_0 = \Phi(d_1)\sigma_V V_0 \tag{5}$$

$$\sigma_E = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(u_i - \overline{u})^2} \tag{6}$$

u_i is the stock returns; σ_E the typical estimate of u_i's standard deviation.

The underlying firm asset value is computable through the simultaneous equations of the BS-M model and Itô's lemma using equity market data, where frequently updated information is available (Bandyopadhyay, 2007). Equations (2) and (5) provide a pair of simultaneous equations to compute the asset value, V_0, and asset volatility, σ_v. Thus, estimating σ_E and E_0 is necessary to calculate V_0 and σ_v. Firm equity value, E_0, is obtainable empirically on the public market, and Equation (6) estimates stock return volatility, σ_E.

These equations are useful in computing the asset value, which is a powerful predictor of firm economic prosperity or distress (Leland, 1994; Bandyopadhyay, 2007).

3.2 Sample and data collection

We used data from the financial services sector in Taiwan. The consideration of variance across sectors mandated using a single industrial sector rather than multiple sectors. In addition to conducting traditional financial business through nationwide branches, Taiwanese financial service firms have increasingly faced globalization and new technology competition, and have begun to drive eChannels, considering the advantages of reduced personal financial transaction costs and time and geographical constraints to satisfy customer demands (Tu, 2012). The Taiwan financial services sector has a long history of providing automatic e-financial services (Shih and Fang, 2004), and offers ample information on eChannel practice, coupled with traditional

physical channel practice. The rapidly growing Taiwanese eChannel financial service firms process eChannel functions from corporate information to customer account access, positioning and monitoring online transactions. Within the dynamic environment, "strategic variations" has become a significant issue in the eChannel strategy (Xia and Zhang, 2010), and therefore, a multichannel strategy deserves further exploration.

Listings on the Taiwan Stock Exchange Corporation furnished the sampling frame of financial services firms. In total, 33 financial services firms (eChannel firms) introduced their online services over the period 1997-2005, and were thus qualified samples (Table I). We selected 20 additional financial service firms (non-eChannel firms) that did not introduce online services during the examination period as control samples for comparing firm performance with eChannel additions (see the data analysis method for more details).

We obtained the financial data of these 53 financial service firms from the TEJ database of the *Taiwan Economic Journal* (*TEJ*) Co., and used their stock prices for performance valuation. The TEJ database contains an assessment of annual audited

No.	Firm's name	Date to declare the access of internet orders
1	Fortune Securities Co Ltd	1997/07/01
2	Grand Cathay Securities Corp	1997/11/15
3	Yuanta Securities Co Ltd	1997/12/02
4	Core Pacific Securities Co Ltd	1997/12/02
5	Polaris Securities Co Ltd	1998/01/01
6	Master Link Securities Corp	1998/03/03
7	Capital Securities Corp	1998/03/06
8	Jih Sun Securities Co Ltd	1998/05/15
9	Huanan Securities Co Ltd	1998/06/01
10	Asia Securities Co Ltd	1998/06/20
11	Fubon Securities Co Ltd	1998/07/02
12	SinoPac Securities Corporation	1998/07/02
13	Taiwan Int'l Securities Corp	1998/07/15
14	Taiwan Securities Co Ltd	1998/09/21
15	Concord Securities Co Ltd	1998/12/21
16	KGI Securities Co Ltd	1999/01/05
17	The International Commercial Bank of China	1999/3/22
18	CTN Bank	1999/6/22
19	Ta Chong Bank Ltd	1999/09/20
20	Taiyu Securities Co Ltd	1999/10/20
21	First Commercial Bank	1999/11/04
22	Fuh-Hwa Securities Finance Co Ltd	1999/11/10
23	Union Bank Of Taiwan	1999/11/19
24	Shin Kong Life Insurance Co Ltd	2000/02/15
25	Hsinchu International Bank	2000/05/19
26	Waterland Securities Co Ltd	2000/07/25
27	E.Sun Bank	2000/11/20
28	United World Chinese Commercial Bank	2001/01/15
29	Huanan Commercial Bank	2001/6/11
30	The Farmers Bank of China	2002/03/11
31	Taiwan Business Bank	2002/08/23
32	Bank of Overseas Chinese	2003/07/21
33	Chang Hwa Bank	2005/11/9

Table I.
Announcement dates
of online services
(eChannel addition)

financials on Taiwanese firms, and is the only comprehensive database with updated financial information in Taiwan.

3.3 Data analysis method
Prior to asset value computation, we determined the length and number of time intervals.

Theory provides little guidance regarding the length and number of time intervals for comparing operation performance (Bartov and Bodnar, 1994), depending on the data collection. More data yield a clearer result. Thus, we adopted one quarter as the interval length because it is the shortest one available of publicly disclosed accounting information. The number of intervals before and after an eChannel announcement was five to eight quarters (greater than one accounting cycle) and 16 quarters (long-term consideration), respectively. The length of the period and the number of intervals in our research were consistent with prior studies (Bartov and Bodnar, 1994; Hoesli *et al.*, 2006). The calculation of equity volatility and the collection of related indices followed. Using BS-M model equations, we computed the asset value of each financial firm as a performance benchmark.

After computation, we adjusted the asset value by considering seasoned equity offerings (SEO hereafter), capital decrease, and cash dividends. We then compared the adjusted asset values before and after eChannel announcements. We compared the growth rates of the adjusted asset values before and after eChannel announcements, and then applied a sign test to compare performance before and after eChannel additions. We used a sign test to examine whether the overall percentage of the positive performance of qualified sample firms was significantly more than the negative performance after eChannel additions, and could thus prevent the performance of the few large firms in the qualified sample firms from overshadowing the small firms.

Using the before-and-after eChannel announcement approach in analyzing the effect of eChannel additions on firm performance reflects performance changes over time in economic factors, which are common to all firms in the financial services sector (cf. Smith, 1971) considering internal environmental control. This condition allows eliminating the differences from internal managerial factors, and thus, the effects of internal environment factors. To consider external environment control and provide a more reliable analysis result, we simultaneously compared the performance of eChannel and non-eChannel firms. Simultaneously facing the same external moderating factors such as politics, economics, society, and technology eliminates the effects of external environmental factors. We followed the lead of prior studies (Akhigbe and Madura, 2004; Bris *et al.*, 2004) to construct a sample of control firms (i.e. non-eChannel addition firms) during the examination period (i.e. between 1997 and 2005) by their paired-sample firms (i.e. eChannel addition firms). We focussed on the differences between firm performance with and without eChannel additions, and used a paired-sample *t*-test to examine significant differences in comparing the quarterly performance of the two groups.

4. Data analysis and results
Our research results (Figure 1) associated the mean asset values after eChannel announcements with positive growth rates, compared with those values before eChannel announcements. All of the effects based on sign tests were also significant, with the number of positive firms greater than the number of negative firms (Table II). Thus, the research results provided evidence that eChannel
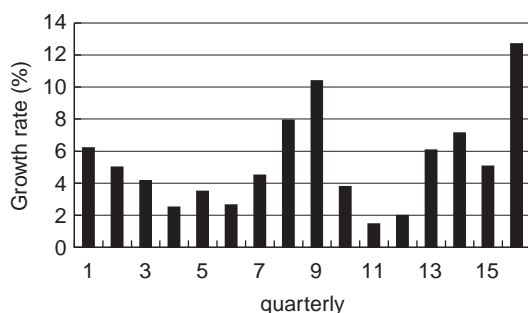
Note: The base is before eChannel addition

Figure 1.
Growth rate of firm
asset values after
eChannel addition

Time period (quarters)	Observes	Positive sign	Negative sign	p-value
1	33	22	11	0.0278*
2	66	44	22	0.0034***
3	98	64	34	0.0012***
4	129	80	49	0.0032***
5	160	101	59	0.0004***
6	190	118	72	0.0004***
7	220	140	80	<0.0001***
8	249	160	89	<0.0001***
9	276	178	98	<0.0001***
10	303	193	110	<0.0001***
11	328	206	122	<0.0001***
12	351	219	132	<0.0001***
13	373	231	142	<0.0001***
14	394	244	150	<0.0001***
15	413	254	159	<0.0001***
16	425	262	163	<0.0001***

Notes: The reported p-value is for the one-tailed sign test. *$p < 0.05$; ***$p < 0.001$

Table II.
Change in asset
performance of qualified
sample firms after
eChannel additions

additions increase asset values, and eChannel addition announcements increase long-run firm financial performance.

The results of a further analysis comparing firm performance with and without eChannel additions are shown in Figure 2 and Table III. Figure 2 shows greater growth rates of asset values in eChannel addition firms compared to non-eChannel addition firms in a simple time-series framework, except for the periods between 02/4Q and 03/4Q. The exceptional period began with a serious threat to internet integrity from disabling attacks in 2002. The most successful and well-known Distributed DoS attacks against 13 DNS root servers occurred on October 21, 2002 (Tsunoda *et al.*, 2008), an influence that lasted 1 year and ended in confidential server protection. The statistics in Table III further indicate the existence of significant differences in the growth rates of asset values between firms with and without eChannel additions. eChannel addition firms performed better than did firms without eChannels. The results provide further reliable evidence of the effect of eChannel additions on the financial gains of these eChannel addition firms.

Firm type	n	Mean	SD	t	p-value
eChannel addition firms	34	0.1	0.18	6.47	0.000***
Non-eChannel addition firms	34	−0.1	0.14		
Notes: Time period: 34 quarters. ***$p < 0.001$					

5. Conclusion

5.1 Discussion of result

Given widespread internet use, firms are rushing to add eChannels, but only a limited body of work has explored the financial contribution of eChannel additions to firms. The extant literature on short-term vision and volatility-solving research methods fails to fully reflect eChannel addition performance. We attempt to fill the literature gap using the BS-M model. Our research findings provide empirical evidence that eChannel additions significantly increase firm value in each financial quarter, compared with firm value before its eChannel addition. The research findings also indicate that, on average, significant positive assets exist in connection with the dates of eChannel addition announcements, effects that last for at least four years. These results provide evidence that eChannel additions positively influence firm financial performance and provide long-term financial advantages to firms.

5.2 Academic implications

Contrasting the current results with previous studies (Geyskens *et al.*, 2002; Cheng *et al.*, 2007; Tu, 2012), prior related research support of eChannel additions has a positive influence on firm financial performance. However, the event study method adopted by the three prior studies (Geyskens *et al.*, 2002; Cheng *et al.*, 2007; Tu, 2012), the EVA and MVA methods used by Cheng *et al.* (2007), and the DEA approach applied by Tu (2012) all evaluate short-period performance (5- to 15-day effect). The unique feature in our study is the long-term orientation with a volatility consideration that evaluates four-year performance after the eChannel addition announcement, which has academic implications for analyzing firms' multichannel strategies.

5.3 Managerial implications

Our research findings suggest that investors have confidence in firms that implement eChannel additions. The public associates eChannel additions with future long-term benefits for those firms. Managers and shareholders in firms without eChannel investments could use eChannels to enhance their stock price and seize future opportunities. Firm managers should adopt a broader viewpoint, and not be deterred by an initial investment of large sums of money because the investment will obtain long-term feedback. Using the internet for marketing channel purposes is a valid approach for firms to provide better services to current customers, access new markets, and extend market coverage, thus enhancing overall financial performance. Before implementing eChannel additions, firms could collect the experiences of successful eChannel firms, and follow them to shorten the learning curve. Firms that have implemented eChannel additions could deeply eChannelize to reduce labor and operational costs. The eChannel firms could also educate their customers to learn and familiarize with eChannel self-service functions to deepen customer relationships, extend service time and space, and reduce costs. Reduced operating costs provide greater opportunities for eChannel firms to rebate consumers. Thus, consumers can seize possible price negotiations.

5.4 Limitations and future research

Although our study represents an early inquiry into the current subject, its limitations leave room for further studies. The empirical test in the financial services sector in Taiwan leads to generalizability considerations. Future research could apply the BS-M model across sectors and geographical boundaries. Although the research findings validate the effectiveness of the BS-M model in predicting firm performance following an eChannel addition, the model may not work as well if mitigating factors such as cultural preferences preclude customers from internet use. We also discuss eChannel additions without considering firm size. Further research could gather more samples from various environments to assess the performance effect of eChannel additions based on firm size, particularly because of its important role in performance (Pinar and Girard, 2008). If future research fails to validate the BS-M model across geographical boundaries and does not account for the effect of firm size, we suggest that possible moderating effects exist that deserve further investigation. The nature of the BS-M model requires using external information to measure the quantitative aspects of eChannel additions. Future researchers could apply other approaches, such as the balanced scorecard (BSC; Kaplan and Norton, 1992), to measure overall eChannel addition performance. The BSC method incorporates financial measures and other measures such as customer focus and satisfaction, internal business processes, and learning and growth, to quantitatively and qualitatively measure overall organizational performance using a firm's external and internal information. Thus, the BSC method might be a better approach to thoroughly evaluate eChannel addition performance. Finally, factors influencing eChannel practices, such as government announcement of a reward policy, is another important issue. Future research could conduct a complete investigation of such factors and describe the phenomena.

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