Interdependence of Alternative Service Channels on Bank Performance

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1. Introduction

Facing continuously changing and highly competitive business environment, banks have invested heavily in information technology (IT) to enhance operating efficiency and sustain competitive advantage. Banks have deployed different IT to offer multiple service channels to serve customers and satisfy their needs. Strategically utilizing IT to optimize operating performance, banks have continued some functions with traditional branch-based channel, and enhanced their functionality by introducing alternative IT-based service channels, such as automated teller machines (ATMs) and internet banking. Relieving the pressure on branches enables banks to perform diverse financial transactions more efficiently and also attract high-end customers by providing more personalized services.

IT-based service channel may significantly lower costs of serving customers. Internet banking allows customers to perform many banking functions anytime and anywhere, while ATMs provide some services not possible by internet banking, such as withdrawing money around the clock. This suggests that a bank's channel mix strategy may influence a customer's decision of who to bank with and how to use alternative channels, but in turn also impact the bank's financial performance.

Much IS research in the banking industry has focused on examining the determinants of IT adoption from the customer perspective. There is very little empirical research that examines how multiple service channels (traditional service channels vs. IT-based service channels) impact bank performance, in particular the complementary relationship between channels. In this paper, we examine the impact of alternative service channels on bank performance simultaneously, from firm perspective. The examination of interdependence of alternative service channels further provide insights on how the utilization of channel mix strategy contributes to the improvement of a bank's short-term operating efficiency and long-term market value. This study contributes to the literature on the business value of IT by examining the impact of both traditional and IT-based service channels on firm performance while taking into account other competing firms' strategies in the market, and by investigating how these relationships are captured in different dimensions of performance in a competitive setting.

2. Hypotheses

The use of alternative service channels has changed the traditional way of understanding and undertaking banking activities (Portela and Thanassoulis 2007). For short-term operation, utilization of alternative service channels contributes to the improvement of operating efficiency. For long-term operation, efficient channel mix strategy enhances a bank's market competition ability. In the following paragraphs, we hypothesize the impact of multiple service channels on bank short-term and long-term performance, respectively.

Branch banking is the traditional service channel in the banking industry. The establishment of more branches improves access convenience for customers and contributes to retaining the loyalty of customers. However, the establishment of a branch also increases bank operating costs significantly. Higher reliance on branches can be expected to be associated with lower cost efficiency. With the rapid development of IT, banks now have multiple channels to deliver their services. Although IT may have reduced the importance of branches, branches are still the major component of a bank's service delivery system because more complex financial transactions and many customized services, such as personalized financial consulting, that enable banks to charge a premium price are still better delivered at branches. Utilizing IT to perform simpler and routine

transactions enables banks to reallocate their branch resources to focus on serving high-end customers who are more profitable to banks. Our hypotheses on the relationship between the level of branch intensity and firm performance are as follows.

H1a: Branch intensity is positively associated with higher bank efficiency

H1b: Branch intensity is positively associated with a higher market share in banks

ATMs, a technology employed now for a long time in the banking industry, can efficiently perform frequent, routine tasks that are traditionally processed though tellers and may improve cost efficiency. However, banks also incur significant costs for investing in ATMs, such as renting space for offsite ATMs, hiring security to guard ATMs, upgrading and maintaining of ATMs, and support staff to integrate ATMs with commercial banking. However, one of the main advantages of ATMs is that it expands banks' physical services and provides multifunctional products and services to efficiently satisfy diverse service needs of its most discerning customers (Saloner and Shepard 1995). That is, ATMs extend banks' brands beyond what is possible with the more expensive bank branch system. Therefore, we hypothesize:

H2a: The level of ATM intensity is is positively associated with bank efficiency

H2b: The level of ATM intensity is positively associated with a higher market share in banks

With the ascent of internet technology, several prior studies have examined the determinants of internet banking adoption from customer perspective. From a cost perspective, internet banking provides greater economies of scale to process transactions, compared to branches or ATMs since internet banking is mostly a fixed-cost technology. With less staff and fewer physical branch requirements, the average transaction cost through Internet banking is much lower than at a branch (Cheng et al. 2006; Yakhlef 2001). Internet banking also provides a more convenient way to deliver banking services and imposes few access, location or time constraints on customers (Calisir and Gumussory 2008). These characteristics of bank service may attract customers who value convenience and rapid services. As a result, we expect that internet banking positively impacts a bank's market share. However, the transactions currently processed through Internet banking are for low-end services for which banks cannot command premium prices. Unlike customized high-end advisory services where branch staff interact with customers intimately, Internet banking is found to be ineffective in influencing bank customers' buying decisions (Calisir and Gumussory 2008; Yakhlef 2001). The hypothesized relationship between internet banking and bank performance are as follows.

H3a: Internet banking adoption is negatively associated with bank efficiency

H3d: Internet banking adoption is positively associated with a higher market share

The adoption of IT-based channels enables banks to expand their market share in a more cost efficiency way and protect their market against their competitors that offer the same IT channel option (Kauffman and Kumar 2008; Hannan and McDowell 1990). Continued growth of branch network seems to be consistent with banks' beliefs that branch will continue to be an effective channel for generating revenues despite the costs and the development of alternative IT-based channels (Hirtle 2007). The reason behind the belief is that bank managers commonly believe that utilizing IT provides an opportunity to move non-value-added transactions to IT-based channels, leaving branches with more time to devote to value-added activities (Calisir and Gumussory 2008). In addition, customers' adoption of Internet banking is found to be associated with increased usage of branch services, suggesting that investments in branches and Internet banking are complements (Xue et al. 2009). We expect that the lower costs and higher convenience of IT-based channels create resource slack for customers and increases their demand for banking services. Similarly, we expect that, even between IT-based channels, the

increased usage of one IT channel such as ATMs will also increase the demand of the other IT channel such as Internet banking, if there exists unique channel characteristic that is not replaceable. We hypothesize the complementarity between alternative channels as follows.

H4a: The impact of branch intensity on bank performance will be higher for banks which invest a higher level of ATM intensity

H4b: The impact of branch intensity on bank performance will be higher for banks with longer experiences of Internet banking

H4c: The impact of ATM intensity on the bank performance will be higher for banks which invest a higher level of branch intensity

H4c: The impact of ATM intensity on the bank performance will be higher for with longer experiences of Internet banking

H4d: The impact of Internet banking adoption on the bank performance will be higher for banks which invest a higher level of branch intensity

H4e: The impact of Internet banking adoption on the bank performance will be higher for banks which invest a higher level of ATM intensity

3. Research Model

Our empirical model is shown below in Figure 1.

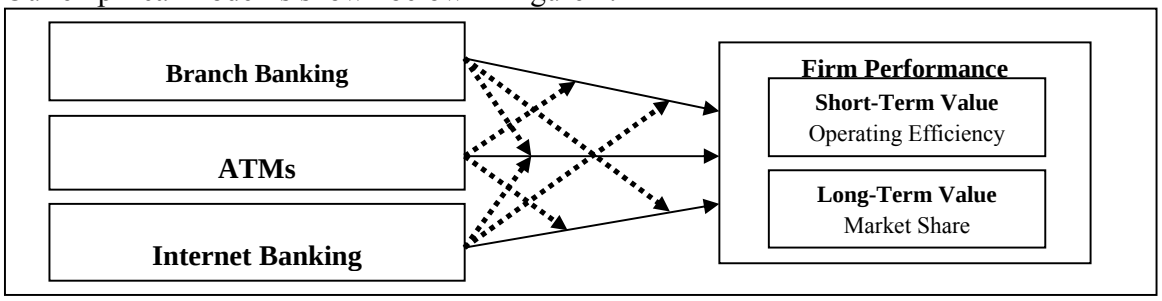

Figure 1. Research Model

We can express this mathematically in forms of the following equations:

$$PERFORMANC\ E_{jt} = \beta_0 + \beta_1 NBRANCH_{jt} + \beta_2 ATMINT_{jt} + \beta_3' ATMUSE_{jt} + \beta_4 EBANKYD_{jt} + \beta_5 NBRANCH * EBANKYR + \beta_6 NBRANCH * ATMINT + \beta_7 NBRANCH * ATMUSE + \beta_8 NBRANCH * EBANKYR + \beta_9 ATMINT * EBANKYR + \beta_{10} ATMUSE * EBANKYR + \beta_{11} INVASSET_{jt} + \beta_{12} NACCOUNT_{jt} + \beta_{13} DEPOSITDIV_{jt} + \beta_{14} LOANDIV_{jt} + \varepsilon_{jt}$$

For short-term performance measure, we employ Data Envelopment Analysis (DEA) to calculate bank efficiency by using value-added approach. The value-added approach identifies both assets and liabilities as outputs that contribute to banks' value added, and recognizes costs associated with the consumption of firm resources to support banks' operating activities as inputs (Berger and Humphrey 1992; Park and Weber 2006). As for long-term performance, we employ the Multiplicative Competitive Interaction (MCI) model to examine how alternative service channels impact the ability of a bank to competitively enhance its market share (Hanssens et al. 2001; Nakanishs and Cooper 1974). Three measures of market share are analyzed in this study: deposit market share (*DEPOSIT_MKT_SH*), loan market share (*LOAN_MKT_SH*), and number of customers (*CUSTOMER_MKT_SH*).

The principal explanatory variables include: branches (*NBRANCH*), ATMs (*ATMINT* and *ATMUSE*), and internet banking (*EBANKYR*). *NBRANCH*, measured as the number of branches relative to total assets, reflects branch service intensity. *ATMINT* measures ATM intensity as the number of ATMs per branch, and *ATMUSE* measures the level of ATM utilization as transactions per ATM. *EBANKYR* measures years after internet banking adoption because being further down the learning curve implies that a bank with longer history of internet banking is

more likely to proactively satisfy customer preference for convenient services and realize opportunities for cost reduction. We also consider two sets of control variables, economies of scale and economies of scope, that are commonly associated with bank efficiency. Economies of scale variables include bank size (*INVASSET*) and account size (*NACCOUNT*). As for economies of scope, we employ the commonly used Herfindahl index to calculate deposit diversity (*DEPOSITDIV*) and loan diversity (*LOANDIV*).

Table 1. Variables Definitions

Dependent Variable	
lnθ	= the logarithm of efficiency measure for bank i in year t [2 inputs (number of employees, net value of property, plant, and equipments), 4 outputs (total deposits, total loans, total investments, other operating revenue)]
DEPOSIT_MKT_SH	= total deposits of bank i at year t/Total deposits for all banks at year t
LOAN_MKT_SH	= total loans of bank i at year t/Total loans for all banks at year t
CUSTOMER_MKT_SH	= total customer accounts of bank i at year t/Total customer accounts for all banks at year t
Independent Variables	
NBRANCH	=(Number of branches/Total assets)*1,000
ATMINT	=(Number of ATMs/Number of branches)/1,000
ATMUSE	=(Number of ATM transactions/Number of ATMs)/1,000,000
EBANKYR	=Years after Internet banking adoption
INVASSET	=(1/Total assets)*1,000
NACCOUNT	=Number of customer accounts/Total assets
DEPOSITDIV	={1/[(Checking account deposits/Total deposits)^2+(Savings account deposits/Total deposits)^2+(CD/Total deposits)^2]}/1000
LOANDIV	={1/[(Short term secured loans/Total loans)^2+(Short term unsecured loans/Total loans)^2+(Medium term secured loans/Total loans)^2+(Medium term unsecured loans/Total loans)^2+(Long term secured loans/Total loans)^2+(Long term unsecured loans/Total loans)^2]}/1,000

We collect the sample data for this study from the banking industry in Taiwan. The rapidly growing number of banks in Taiwan has increased competition within this sector. Hyper-competition may drive banks that fail to sustain their competitive position out of the market. Due to the severe competition, Taiwanese banks actively invested in IT in order to be competitive. Examining the dynamic, highly competitive banking industry in Taiwan provides insights into how banks strategically utilize multiple service channels to compete. The data source is the Taiwan Economic Journal (TEJ) database which includes financial statements data and ATM investment data. We further collect internet banking adoption data by surveying IT departments of banks. We then match the observations for all variables employed in the study and delete those with missing values. Final sample size is 260 firm-year observations, from 1995 to 2007.

4. Preliminary Results and Conclusions

Following Banker and Natarajin (2008), we employ two-stage DEA procedures to examine how alternative service channels influence bank efficiency. Because pooled cross-sectional and time-series data is used to estimate the impact of contextual variables on bank productivity, potential serial correlation among data may result in the bias of the standard errors of the estimates. We address this problem by using a variant of the Prais-Winsten (1954) estimator

proposed by Park and Mitchell (1980) to make first-order autocorrelation adjustments to the variables. In addition, all the VIF values are less than 5, which rules out any collinearity problem.

In the second column of Table 2, we examine the impact of alternative service channels on short-term performance measured by operating efficiency. *NBRANCH* is significantly positive for bank efficiency, providing support for hypothesis *H1a*. Both *ATMINT* and *ATMUSE* have significant and positive impact on bank efficiency, suggesting the level of ATM investment contributes to higher efficiency score of bank. Accordingly, *H2a* is supported. The negative coefficient of *EBANKYR* is significantly related to bank efficiency, which provides support for *H3a*. This result is consistent with the expectation that, while Internet banking reduces costs due to simple, routine transactions, banks are unable to command premium prices for these non-value added activities, which in turn results in a negative impact on bank efficiency. The interaction terms between branch and IT-based channels are positive and significant. Higher levels of branch intensity are associated with higher levels of investment in IT-based channels, suggesting branch channel and IT-based channels are complements. Higher levels of investment in IT-based channels also increase customers' demand for branch resource. The positive and significant coefficients of interactions between ATM and Internet banking suggest that two IT-based channels are complements, providing supports for hypotheses *H4a, H4b, H4c, and H4d*.

Finally, we examine how each service channel impacts long-term firm performance. *NBRANCH* is positive and significant in three market share equations, which provides support for hypothesis *H1b*. Both *ATMINT* and *ATMUSE* are also positive and significant in all market share equations, supporting hypothesis *H2b*. Following, the positive and significant impact of *EBANKYR* on three measures of market share provides support for hypothesis *H3b*, suggesting that Internet banking channel is utilized to maintain current customers' satisfaction and also an important factor to attract new customers. The findings of interaction terms are quantitatively consistent with what we found for bank efficiency, suggesting complementary impacts among alternative channels contributes to the improvement of long-term market competition as well.

Table 2. Impact of Service Channels on Bank Performance

	lnθ		*DEPOSIT_MKT_SH*		*LOAN_MKT_SH*		*CUSTOMER_MKT_SH*	
Intercept	0.390** (2.00)	0.695*** (3.71)	0.111*** (3.44)	0.016*** (2.67)	0.038* (1.44)	0.019* (1.37)	1.239*** (4.62)	1.050** (1.82)
NBRANCH	4.741*** (11.49)	1.936*** (3.38)	0.214*** (2.38)	0.152 (1.25)	0.356*** (3.36)	0.251** (2.07)	0.170** (1.95)	0.066 (0.21)
ATMINT	0.213* (1.50)	0.045*** (2.99)	0.151** (1.72)	0.129 (0.27)	0.026* (1.46)	0.015 (0.87)	0.515*** (3.58)	0.367* (1.53)
ATMUSE	1.220** (1.93)	1.333 (0.41)	0.149*** (2.54)	0.125 (3.05)	0.077* (1.54)	0.010 (1.21)	0.359*** (4.20)	0.183* (1.58)
EBANKYR	-0.079** (-1.89)	-0.045*** (-2.53)	0.165*** (2.67)	0.114** (1.93)	0.154** (1.87)	0.070** (1.67)	0.308** (2.01)	0.277*** (2.73)
NBRANCH* EBANKYR		0.282*** (3.46)		0.064*** (3.04)		0.055*** (3.28)		0.416** (1.87)
NBRANCH* ATMINT		0.489*** (4.71)		0.038 (1.19)		0.013 (0.72)		0.266 (1.11)
NBRANCH *ATMUSE		0.132 (0.93)		0.030* (1.37)		0.090 (0.63)		0.063 (0.24)
ATMINT* EBANKYR		0.502*** (2.47)		0.022 (1.06)		0.056* (1.34)		0.466** (1.34)

ATMUSE* EBANKYR		0.546** (1.62)		0.039* (1.39)		0.016 (0.19)		0.274*** (2.49)
INVASSET	0.450*** (3.62)	0.237*** (3.00)						
NACCOUNT	1.795** (1.92)	2.911 (0.44)						
DEPOSITDIV	0.723** (1.79)	0.560** (2.09)	0.447** (2.13)	0.324* (1.50)	0.104 (0.58)	0.093 (0.56)	0.302 (0.99)	0.093 (0.56)
LOANDIV	0.080** (2.02)	0.024 (1.13)	-0.081 (-0.50)	-0.049 (-0.26)	-0.106 (0.76)	0.040 (0.24)	0.104 (0.45)	0.039 (0.24)
Adjusted R^2	0.4282	0.4296	0.2077	0.2267	0.1370	0.1686	0.1561	0.1836

In conclusion, our study examines the impact of alternative service channels on bank short-term and long-term performance, respectively. The impact of IT-based service channels on firm performance is contingent on the IT. ATM investment is revenue-driven enabling banks to command premium prices for services such as ATM interchange. In contrast, internet banking adoption is negatively associated with short-term operating efficiency. In addition, we show that both traditional branch service and IT-based services are positively associated with market shares. The significant and positive interdependence of alternative service channels on bank performance suggest that efficient channel mix strategy not only enables banks to compete sufficiently in short term but also enhance banks' long-term market competition ability.

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