COMPETITIVE ADVANTAGE IN E-COMMERCE FIRMS: PROFITABILITY, CUSTOMER RETENTION AND SWITCHING COSTS IN ONLINE BANKING

By:

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Approved by:

Terry Ryan, Chair

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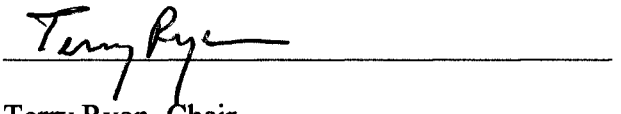

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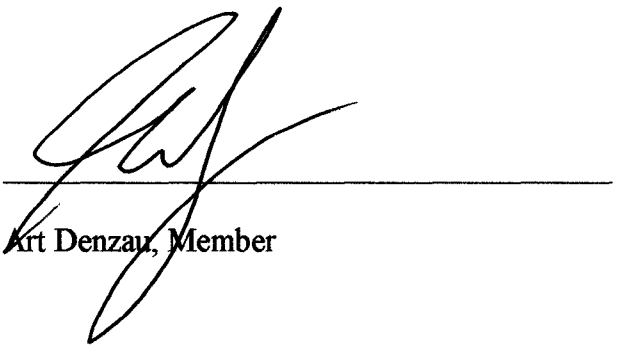

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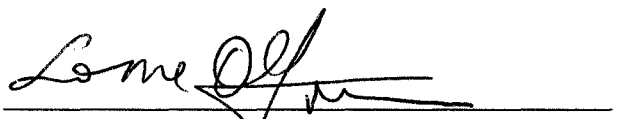

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COMPETITIVE ADVANTAGE IN E-COMMERCE FIRMS: PROFITABILITY, CUSTOMER RETENTION AND SWITCHING COSTS IN ONLINE BANKING

ABSTRACT

Electronic commerce (e-commerce) provides consumers with the benefits of any time, any where transactions, with lower costs. By reducing these costs, however, e-commerce firms may also be reducing their customer retention since customers will have fewer "switching costs" to incur in changing their supplier (Porter 2001).

Switching costs contribute to competitive advantage by increasing the bargaining power of suppliers, increasing barriers to entry, decreasing the threat of substitutes and reducing the bargaining power of buyers. They increase competition for new customers and reduce competition for existing customers. Higher switching costs lead to increases in customer retention, profitability and competitive advantage (Ghemawat 2002).

Despite the prevalence of switching costs in the strategy and IS literature, few studies have empirically measured these costs and their effect on customer retention. This study will analyze transaction data to explicitly measure this component of switching costs. Results from this study indicate that customers using bill pay services of banks have higher numbers of transactions (leading to higher switching costs) and higher customer retention than their online or offline banking counterparts. This can lead to a sustainable competitive advantage for the firm.

At the firm level, profitability is a necessary but not sufficient component of sustainable competitive advantage. This study finds that banks that operate primarily online are more profitable while also providing higher interest rates to customers. This is in contrast to their competitors who operate primarily offline or somewhere between the two on the continuum ("hybrid"). This is also contrary to models in the IT economics literature that suggested that "hybrid" banks should be most profitable.

This study contributes to development of IT economics and e-commerce theory by testing existing theory with empirical data. Deviations from existing models allow for improvement and refinement of theory. For the empirical researcher, this study uses statistical methods (e.g., probit models, Markov chain method) commonly applied in other disciplines and brings them into the IT economics domain.

DEDICATION

To Kevin:

If I got this far, it's because you were with me, providing intellectual and emotional support. I am never truer to myself than when I am with you.

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I would also like to thank the service provider who provided the data set for my customer data analysis and the FDIC, which provided firm-level data for analysis.

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

CHAPTER 1: INTRODUCTION

This study will examine consumer behavior, product mix and their effect on competitive advantage in e-commerce firms, with particular focus on banking firms. The decision of the firm to place itself on a particular point on the continuum between offline (traditional branch) and online banking reflects a specific chosen generic strategy (Porter 1990) of cost leadership, focus, or differentiation.

This choice of generic strategy by the firm results in specific behaviors by the customer that can lead to competitive advantage for that firm. If a firm generates sufficiently high "switching costs", customers are disincentivized from leaving. (These costs may not immediately be evident at initiation.) Marketing and economics literature refers to this as "lock-in" (Farrell and Klemperer 2006). Firms that can lead their customers into doing business in ways that increase lock-in should see substantially lower rates of switching (attrition) among their customers.

Along these lines, this study will provide an increase in understanding of the effects of generic strategy on customer lock-in. In the second chapter, rates of attrition will be measured for online, offline and hybrid banking customers of two large financial institutions. Each customer's total transactions, tenure[1] with the bank, tenure with online banking, and tenure with bill pay will be analyzed for predicting customer attrition[2].

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[1] Tenure is defined as the length of time in months since initiation of the relationship or service.

[2] Customer attrition is defined as having no transactions for six months.

Different customer attrition rates will be compared as evidence of a priori different customer switching costs.

In the third chapter, using the same data set and definitions, a Markov chain analysis of attrited and retained customers will examine whether the strategy and IS literature predictions hold. Characteristics of the customers (income, age, type of accounts, etc.) will be analyzed. This analysis will describe the parameters, probability of switching and probability of staying, according to a stochastic process. If the probability of staying is higher for online banking and bill pay customers, this suggests the firm has switching costs higher than any potential benefit from switching, which may yield competitive advantage.

In the fourth chapter, banks will be partitioned according to their place on the continuum between offline and online banking. Hybrid banks will be defined as being between the two extremes. Information Science (IS) literature suggests that in equilibrium, online-only banks will have to pay higher interest rates to attract depositors (Viswanathan 2005). Offline (branch only) banks need not pay as high an interest rate to attract customers and hybrid banks (those with both traditional branches and a significant online presence) will price themselves between their online and offline counterparts. This study will examine the interest rates paid by FDIC-insured offline, online, and hybrid banks. Using the model defined in the literature, profitability will be estimated for each type of bank. Traditional measures of profitability will also be calculated and compared to the model results. The model predicts that hybrid banks will have a comparative advantage over their offline and online counterparts due to their operational effectiveness. If this is the case, banks must migrate from either side of the continuum to

the middle to attain competitive advantage, even if their customers have high switching costs.

1.1. Prior Research

Some studies have empirically examined switching costs for customers of banks and found them to be high, particularly for customers with loan accounts (Kim, Kliger et al. 2003)[3]. Moreover, even if switching costs are not high, a firm can actually improve its strategic position by increasing them (Chen and Forman 2006). This is true even for a commodity product with open standards (switches and routers, in their case). In the case of open standards, switching costs can be increased by improving vertical compatibility.

Vertical integration in the market for switches and routers is analogous to providing a higher-level interface (such as Quicken or a third party software) to the software of a financial services provider (which could be a bank, brokerage, or bill pay firm). In fact, an open standard (OFX) for this purpose was developed in 1997 (Bauer and Colgan 2001). A 1999 survey of financial institutions adopting this data standard found that they had higher price competition (i.e., by having lower fees for services) than their counterparts who had not adopted the standard. The OFX adopters would have had lower switching costs than their non-OFX counterparts. These results agree with literature finding additional price competition when there are reduced switching costs (Shi, Chiang et al. 2006), reflecting an increased risk of customers switching firms.

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[3] 4.1%, about a third of the market interest rate, was due to switching costs

Propensity to switch may be measured using tenure and service quality dimensions (such as reliability and responsiveness) developed in the IS literature (Chakravarty, Feinberg et al. 2004). Use of electronic transactions (Kennickell and Kwast 1997) has also been found to increase with asset base, income, and education, and to decrease with age. This may mean that the highest revenue customers are also the lowest cost, making them the most profitable (Hitt and Frei 2002). (Electronic transactions can be substantially cheaper than alternative methods. The average online transaction cost $.04, compared to $.15 for ATM transactions and $.80 for branch transactions (Graeber 2003). Online customers also had lower switching rates than their traditional banking counterparts. This is consistent with other studies finding that customers that utilized more types of services have lower attrition rates (Roust and Witman 2006).

The results of these studies are summarized in Table 1.

Table 1: Summary of Prior Research

Research Cited	Independent Variable	Dependent Variable	Relationship
(Kim, Kliger et al. 2003)	Loan accounts	Switching costs	↑ Loan accounts → ↑ Switching costs
(Bauer and Colgan 2001)	Open standards	Price competition	↑ Open standards → ↑ Price competition
(Shi, Chiang et al. 2006)	Switching costs	Price competition	↑ Price competition → ↓ Switching costs
(Chakravarty, Feinberg et al. 2004)	Tenure, Age, Education	Propensity to switch	↑ Duration → ↓ Propensity to switch ↑ Age → ↓ Propensity to switch ↑ education → ↓ Propensity to switch
(Sciglimpaglia and Ely 2006)	Age, Income, Education, Number of transactions	Use of bill pay, Loan application, Perception of importance in banking services	↑ Age → ↑ Use of bill pay ↑ Income → ↑ Use of bill pay ↑ Education → ↑ Use of bill pay ↑ Age → ↑ Loan application ↑ Income → ↑ Loan application ↑ Education → ↑ Loan application ↑ Number of transactions on the internet → ↑ Perception of importance of internet banking services
(Kennickell and Kwast 1997)	Age, Education, Income	Use of electronic transactions with financial institution	↑ Age → ↓ Use of electronic transactions with financial institution ↑ Income → ↑ Use of electronic transactions with financial institution ↑ Education → ↑ Use of electronic transactions with financial institution
(Hitt and Frei 2002)	Type of Customer ("PC Banking") or not	Profitability, Number of Different Accounts, Total Balances, Customer Retention	↑ Use of PC Banking →↑ Profitability ↑ Use of PC Banking →↑ Number of different accounts ↑ Use of PC Banking →↑ Total balances ↑ Use of PC Banking →↑ Customer retention

Switching banks can be modeled using Markov chain processes, where customer attrition and retention are represented as independent states having values 1 and 0, respectively (Duxbury 2007). A Markov chain allows for estimation of the transition probability of changing from one state to another. The transition probabilities then provide information on long-term market share for the firm. According to these results, the larger the switching costs, the larger the market share of the firm and natural monopoly may be the result (Farrell and Klemperer 2006).

1.2. Research Questions

1.2.1. Questions Addressed

The second chapter in this study will address questions related to offline banking, online banking, and bill pay customers of two banks. The questions that will be examined include: 1) Are offline, online banking, or bill pay customers different in their tenure with the bank, balances, income distribution, or number of transactions? 2) Are online banking or bill pay customers more (or less) likely to switch banks than their offline counterparts? 3) What is the change in the rate of attrition for each additional month of tenure with online banking or bill pay? 4) How well does the number of transactions (which may increase the effect of switching costs) explain the propensity to switch banks? 5) For new customers, does the number of transactions change as tenure increases (initial transactions may be considered a startup cost, another type of switching cost)?

The third chapter will utilize a Markov chain analysis to estimate the relative probabilities of switching banks for offline, online, and bill pay customers. Questions

examined in this paper include: 1) What are the demographic characteristics of each of these groups of customers (offline, online, bill pay)? 2) Are these groups different in their balances, income distribution, or types of accounts (e.g. demand accounts, loan accounts, etc)? 3) What are the transition probabilities (probabilities of switching and staying) for each type of customer? The implications of these transition probabilities will also be discussed.

The fourth chapter will examine data from the FDIC to address questions relating to costs and profitability of online, hybrid, and offline banks. The research questions addressed in this paper include: 1) Do online banks provide more interest to depositors than their offline and hybrid counterparts? 2) Utilizing the economic models of profitability (Viswanathan 2005), in equilibrium, hybrid banks are predicted to be more profitable than online or offline banks. Does this model hold for FDIC-insured hybrid, online, and offline banks? 3) How do these profitability results from the model compare to traditional measures of profitability (e.g., return on assets) for these banks? What are the strategic implications of these profitability findings?

1.2.2. Importance of Topic

Strategy and IS theory agree that, unless e-commerce firms can differentiate themselves, price-based competition will result in prices being driven down until profits are eliminated (Porter 2001). This is also known as Bertrand competition (Grimm, Lee et al. 2006). E-commerce firms that deal in commodity goods are particularly susceptible to price-based competition. As money may be considered the ultimate commodity, banks may be a good example of an e-commerce firm dealing in a commodity good. This

suggests that online banking should be an ideal application of these theories. This research focuses on the banking environment, but still fails to find evidence of exclusively price-based competition, raising a fundamental question of whether Bertrand competition is an adequate model of competitive equilibrium.

This theory of competitive equilibrium supposes that customers can switch freely between e-commerce firms and that there are no switching costs. By testing these theories with data from online banking firms, it is possible to determine whether e-commerce firms experience switching costs and whether strategic advantage based on this is possible for them. If customers of online banks do experience switching costs, there should be a first-mover competitive advantage for online banking firms. Additionally, the effect of switching costs should be to increase customer retention with increased use of online channels, such as bill pay. As these channels are of lower cost to the banking firm, they should result in higher profitability for the firm.

The profitability implications also relate to another issue of return on technology investment. If online banking firms experience higher profitability, then they are likely to yield a positive return on investment. The literature examining the "productivity paradox" (Brynjolfsson and Hitt 1998) suggests that if the return on IT investment is positive, it has positive implications for the productivity of the firm as a whole, and if applied by all firms, for the overall economy. Improvements in productivity improve the living standard for all of a nation's citizens (Porter 1990). To quote Porter, "the only meaningful concept of competitiveness at the national level is productivity."

Yet despite the importance of this topic, few researchers have addressed the issue of switching costs, switching rates, profitability, and strategic advantage in e-commerce

firms. This is perhaps due to the interdisciplinary nature of this body of work, as it crosses the boundaries of economics, marketing, strategy, and information science. This study will address the question of whether strategic advantage exists for e-commerce firms, studying online and offline financial institutions and their customers. The first two chapters will look at differences in customer behavior and how that may affect competitive advantage. The final chapter will analyze the institutions themselves to determine how providing online services, offline services, or both affects profitability. Profitability leads to operational effectiveness, which is a necessary (but not sufficient) component of sustainable competitive advantage. These studies analyze the topic of strategic advantage in e-commerce firms from multiple units of analysis.

1.2.3. Theoretical Background

Given the multiple disciplines this study covers, it is not surprising that the theory underlying it is also derived from many fields. First, strategy and economics encompasses the Theory of Competitive Advantage, both in Porter's Five Forces Framework (Ghemawat 2002) and in Barney's Resource Based View (Barney 1991).

The former theory describes the attractiveness of the industry to a firm within it. The five forces are 1) the bargaining power of suppliers, 2) the bargaining power of buyers, 3) barriers to entry, 4) the threat of substitutes, and 5) industry rivalry. The Five Forces model applies because switching costs are part of each of the five forces. Switching costs increase the bargaining power of suppliers, increase the barriers to entry, decrease the threat of substitutes and reduce the bargaining power of buyers. In terms of industry rivalry, switching costs increases the industry competition for new customers and reduces

competition for existing customers. The Five Forces Model suggests that an industry is more attractive to firms within it when switching costs are higher.

Firms may be following generic strategies such as cost leadership, focus, and differentiation (Porter 1985). In the cost leadership strategy, a firm strives to be the lowest-cost firm within the industry (e.g., Walmart). Firms following a focus or differentiation strategy direct their attention to a particular segment of the market, while cost leaders concentrate on the market as a whole. Banking firms may be adopting any of these generic strategies in their choice of what services to offer. For example, by encouraging their customers to utilize less expensive electronic channels, banks may all be competing using a cost leadership generic strategy.

Barney's Resource Based View (RBV) of strategy suggests that competitive advantage can only be sustained if a firm's strategy is not perfectly replicable. For a strategy to not be perfectly replicable, the product involved cannot be perfectly homogeneous. This is a necessary but not sufficient condition for a firm to have a first-mover competitive advantage. The service offered by banking providers is heterogeneous, which prevents it from being perfectly replicable, suggesting there may exist a competitive advantage, even without switching costs.

Theory also suggests that network externalities may also contribute to the banking firm's choice of what services to offer (Prasad and Harker 2000). Positive network externalities may be described as benefits that accrue to the customer as well as the firm from increasing the number of customers (Kauffman and Wang 2002). For online bill pay services, some examples of positive network externalities include the ability to transfer funds from one customer to another instantly. The more people who use online

bill pay, the higher the benefits accrued. Other positive network effects include the ability to perform electronic record keeping or transfer funds between different accounts. These externalities may induce the customer to stay with their bank, and theory suggests that consumers accrue most of the benefits of increasing network externalities (Viswanathan 2005).

In the presence of switching costs, however, economic models suggest that poaching customers may be another source of profit for banks (Gehrig and Stenbacka 2004; Gehrig and Stenbacka 2007; Vesala 2007). This suggests that some firms are competing for operational effectiveness while others are increasing their size to offset fixed costs or are vying for cost leadership, and others are utilizing focus or differentiation generic strategies, narrowing their target market in an attempt to increase switching costs (Southard and Siau 2004).

Switching costs may be classified into six different types (Klemperer 1987): equipment costs, transaction costs for switching suppliers, learning costs, quality uncertainty, contractual devices, and psychological costs. Learning costs, psychological costs, and transaction costs are likely to be the most applicable types of switching costs for customers of e-commerce firms addressed in this paper.

Finally, information science expands upon the Five Forces Model and the Productivity Paradox. If IT is not used for strategic differentiation of the firm (Carr 2003), firms will not achieve strategic advantage. For example, if banking firms use a common software platform (provided by a third party), there may be a reduction in the threat of complimentary products, but also a loss of competitive advantage. As a result, firms may not be able to earn a positive return on their investment in IT, and both

profitability and productivity of the firm would decline. In this case, a reduction in switching costs should also be observed (i.e., lower learning cost), and a resulting increase in customer attrition that can be measured.

This theory base is applied to empirical analysis in the three research chapters.

CHAPTER 2: SWITCHING COSTS IN E-BANKING

ABSTRACT

E-banking services are a natural progression for e-commerce because of the lack of physical delivery. In order for this nascent field to achieve its potential, however, it must be profitable. If customers of e-banking firms can freely switch firms, then competition should reduce profit towards 0. The more difficult it is to switch, the higher customer retention should be, and profitability should increase as a result. With an increase in the number of transactions, internet banking (IB) and bill pay (BP) customers can be expected to have higher retention and more profitability than offline (OF) customers. We say these customers have higher "switching costs" and as a result, the e-banking industry can be viewed as having a first-mover competitive advantage. We consider transactions as a measure of switching costs, examine customer retention rates for IB, OF and BP customers, and compare demographic and account information data for the different types.

2.1. Introduction

Electronic banking (e-banking) offers an interesting value proposition for financial firms. A smaller branch network, coupled with direction of traffic through internet channels such as online banking and bill pay services may result in a lower cost structure (Graeber 2003; Sciglimpaglia and Ely 2006). Yet firms may not be able to turn that lower cost structure, if it exists, into profitability. If firms cannot retain the e-banking customers, profitability will decline as the firm continually seeks out new customers.

The firm also will not be able to achieve a sustainable competitive advantage without customer retention.

A sustainable competitive advantage is also not possible if firms are competing solely on the price dimension (Porter 2001). In the consumer banking arena, the competition would be in terms of rates of interest. In the absence of any costs for changing banks ("switching costs"), the customer would continually switch in search of a higher rate of interest. Profits would decline to 0 and interest rates would be driven to the marginal cost of funds for the industry, a scenario known as Bertrand competition (Grimm, Lee et al. 2006). As a result, no firm in the industry would be able to achieve a competitive advantage. Empirical studies have agreed with this theory, finding additional price competition when switching costs are reduced (Bauer and Colgan 2001; Shi, Chiang et al. 2006).

This "doomsday" scenario has not been the result with e-banking, however. Bertrand competition requires that products be perfectly homogeneous, which banking accounts are not. Product heterogeneity is a necessary, but not sufficient, component for a first-mover competitive advantage (Barney 1991). It may be possible for e-banking to have a first-mover competitive advantage if it is able to capture accounts quickly.

Additionally, e-banking customers cannot switch without incurring at least some costs. Even in brick-and-mortar banks, some differences in interest rates were not sufficient to induce customers to change banks (Kiser 2002, p.8), indicating switching costs are at least perceived to be high. Measures of switching costs have been found to be high for banking customers in general (Kim, Kliger et al. 2003), and may be even higher for online banking and bill pay customers (Roust and Witman 2006). As a result, e-

banking firms may gain additional customer retention due to customer use of online banking and bill pay. Customer retention can then lead to profitability and competitive advantage for these firms. The existing literature has not thoroughly examined this relationship. While there is a rich body of literature focusing on customer satisfaction in online firms and even studies of online banks (Vatanasombut 2001), very little work has been done to explicitly compare customer retention for users of online banking and bill pay to their offline counterparts. This paper will fill a void in the literature by addressing this question and also describe the strategic impact of customer retention in the industry.

In the next section, we will describe and summarize the existing literature of e-banking. The strategy literature as it pertains to e-banking will also be addressed. Next, we will test several customer retention hypotheses through a longitudinal analysis of online banking, offline and bill pay customers at two financial institutions. Variables such as tenure with the financial institution, income, balances and number of transactions will be examined to show that they alone do not account for customer retention. Switching costs in terms of the number of transactions for these customers will also be explored.

2.2. Existing Literature

Strategy and marketing literature describes switching costs, dividing it into six different types: equipment costs, transaction costs for switching suppliers, learning costs, quality uncertainty, contractual devices and psychological costs (Klemperer 1995). For e-banking, learning costs, psychological costs and transaction costs are likely to be of the highest concern.

Studies modeling customer retention in e-banking have found satisfaction and trust to be antecedents of customer retention, although age and income have also been determined to moderate customer retention (Floh and Treiblmaier 2006). Income and assets have also found to increase propensity to use e-banking (Kennickell and Kwast 1997; Sciglimpaglia and Ely 2006). Age, however, had variable results, with some studies finding age relating to increasing use of bill pay (Sciglimpaglia and Ely 2006) and others finding it decreasing use of internet banking (Kennickell and Kwast 1997). A summary of prior research is shown in Table 2.

Table 2: Summary of Prior Research

Research Cited	Independent Variable	Dependent Variable	Relationship
(Kim, Kliger et al. 2003)	Loan accounts	Switching Costs	↑ loan accounts → ↑ switching costs
(Bauer and Colgan 2001)	Open standards	Price competition	↑ Open standards → ↑ price competition
(Shi, Chiang et al. 2006)	Switching costs	Price competition	↑ price competition → ↓ switching costs
(Chakravarty, Feinberg et al. 2004)	Tenure, Age, Education	Propensity to switch	↑ Tenure → ↑ Retention propensity ↑ Age → ↑ Retention propensity ↑ Education → ↑ Retention propensity
(Sciglimpaglia and Ely 2006)	Age, Income, Education, Number of transactions	Use of bill pay, Loan application, Perception of importance in banking services	↑ Age → ↑ Use of bill pay ↑ Income → ↑ Use of bill pay ↑ Education → ↑ Use of bill pay ↑ Age → ↑ Loan application ↑ Income → ↑ Loan application ↑ Education → ↑ Loan application ↑ Number of transactions on the internet → ↑ Perception of importance in banking services
(Kennickell and Kwast 1997)	Age, Education, Income	Use of electronic transactions with financial institution	↑ Age → ↓ Use of electronic transactions with financial institution ↑ Income → ↑ Use of electronic transactions with financial institution ↑ Education → ↑ Use of electronic transactions with financial institution
(Hitt and Frei 2002)	Type of Customer ("PC Banking") or not	Profitability, Number of different accounts, Total balances, Customer retention	↑ Use of PC Banking →↑ Profitability ↑ Use of PC Banking →↑ Number of different accounts ↑ Use of PC Banking →↑ Total balances ↑ Use of PC Banking →↑ Customer retention
(Campbell 2003)	Adoption and use of online banking, customer retention	Transactions by different channels, revenue to the bank, balances	↑ use of online banking →↑ Transactions ↑ use of online banking →↑ Customer retention ↑ use of online banking →↑ Cost to serve for the bank ↑ use of online banking →↓ Decreased revenue

			to the bank
(Floh and Treiblmaier 2006)	Customer retention	Trust, Web site quality, Satisfaction, Demographics	↑ Trust → Demographics → ↑ Customer retention ↑ Web site quality → Demographics → ↑ Customer retention
(Chen and Hitt 2002)	Switching costs, Customer retention,	Brokerage, Systems usage (transactions), Service design, Rates	↑ Usage → ↑ Customer retention ↑ Rates has no effect on customer retention Brokerage affects customer retention
(Witman, Roust et al. 2006)	Customer retention, Profitability	Transactions, Cost-to-serve, Type of customer (OF, IB, BP), Total balances	IB customers have more transactions than OF BP customers have more transactions than IB IB customers have higher cost-to-serve than OF BP customers have higher cost-to-serve than IB ↑ Transactions → Customer retention IB and BP are more profitable due to higher balances and greater retention
(Vatanasombut 2001)	Customer retention	Trust, Relationship "termination cost", Type of customer (OF or IB)	↑ Relationship "termination cost" → Customer retention OF or IB customer type does not affect customer retention ↑ Trust →↑ Customer retention
(Moore and Katkov 2001)	Profitability	Customer retention Cost to serve	↑ Use of IB → ↑ Customer retention → ↑ Profitability ↑ Use of IB → ↓ Cost to serve → ↑ Profitability
(Graeber 2003)	Customer retention, profitability	Transactions, Cost-to-serve	↑ Use of IB → ↑ Customer retention → ↑ Profitability ↑ Use of IB → ↓ Cost to serve → ↑ profitability
(Kiser 2002)	Customer retention	Interest rates Switching costs	Interest rates usually not sufficient to cause bank switch (p.8) Switching costs high for brick-and-mortar customers

Relationship criteria have also been found to explain customer retention in brick-and-mortar banks (Chakravarty, Feinberg et al. 2004). Another study of brick-and-mortar banks found that relationships have contributed to 35% of marginal revenue (Kim, Kliger et al. 2003). In the same study, 23% of the marginal revenue to the bank was due to switching costs, indicating that switching costs can have an impact on profitability.

Switching costs examined in online brokerages found that actual costs incurred by the customers may not explain customer retention, or lack thereof (Chen and Hitt 2002). This study also found that dummy variables representing the brokerages were highly significant. This suggests that idiosyncratic features of the brokerages explained a great deal of variation in customer retention.

With respect to online banking and bill pay, utilization of lower cost channels provides an additional potential source of profitability (Moore and Katkov 2001). Electronic transactions can be substantially cheaper than alternative methods. The average online transaction can cost $.04, compared to $.15 for ATM transactions and $.80 for branch transactions (Graeber 2003). Additional profitability may also accrue due to increased retention of customers. Yet it is not entirely clear whether customers of these services actually have higher retention, making this a useful field of inquiry (Giesen 2004).

Where there is increased retention, studies still disagree as to whether or not these customers are actually more profitable than their offline counterparts. Increased profitability was found to be due to increased retention (Graeber 2003; Roust and Witman 2006) and utilization of lower cost channels (Hitt and Frei 2002). Other studies have found that online banking and bill pay customers do utilize lower cost channels, but

do so more frequently, making them more costly as a result (Campbell 2003; Roust and Witman 2006). In addition, the bill pay service is estimated to cost banks an additional $3.14 per month per customer, which is another potential source of additional costs (Witman, Roust et al. 2006).

Increased profitability in banking has also been found to be due to increases in "relationship depth" (Graeber 2003). This is consistent with existing theory suggesting that even if the firm offers a free service, both it and the consumer may benefit because it may direct customers to their other more costly services (e.g., free mail service allowing purchase of more disk space) as well as yield other sources of income (e.g., ad revenue) (Thatcher and Pingry 2004). In terms of banking, internet banking and bill pay customers are more likely to have higher balances and more types of accounts. In one instance, bill pay customers were found to have a 27% growth in profitability over their offline counterparts just from higher balances and more types of accounts (Graeber 2003). Customer retention also contributed to a growth in profitability, and these two effects individually and combined contribute to competitive advantage for the firm.

Since customer retention may be an important source of competitive advantage for the banking firm, this paper will examine retention of offline (OF), internet banking (IB) and internet banking with bill pay (BP) customers at two similar financial institutions. These groups are classified by their use of services in February 2005 and retention is measured by continued transactions with the banks as of June 2005. The next section explains the research questions that will be examined by this study.

2.3. Research Methodology and Hypotheses

2.3.1. Research Questions

From the existing literature and a review of the table above, it is evident that questions of increased retention and profitability from online banking and bill pay are far from resolved. Given the strategic implications for the banking industry, this study hopes to shed some light on many of these issues through the following research questions:

Q1) Are offline, online (aka "internet"), or bill pay customers different in their tenure with the bank, balances, income distribution, or number of transactions?

Before examining internet banking and bill pay customers, we must make sure that any conclusions we draw are due to these factors alone. This is because differences in income demographics and tenure were found to have their own impacts on use of bill pay and retention (see Sciglimpaglia & Ely, 2006, Chakravarty, Feinberg, and Rhee 2004 in Table 2).

Q2) Are online banking or bill pay customers more (or less) likely to switch banks than their offline counterparts?

This question will resolve differences in the literature as to whether internet banking and bill pay customers have higher (Graeber 2003; Roust and Witman 2006) or lower (Hitt and Frei 2002; Giesen 2004; Vatanasombut, 2001) customer retention than their offline counterparts.

Q3) What is the change in the rate of attrition with online banking or bill pay?

This question will address the fundamental question suggested by strategy literature of whether internet banking and bill pay customers have lower customer retention rates than their offline counterparts (Porter 2001).

Q4) How well does the number of transactions explain the propensity to switch banks?

Transactions may be considered a component of switching costs, as any setup-related transactions will have to be repeated with a new financial institution once the customer has attrited. Additionally, transactions would reduce the propensity to switch, because of the amount of work required to reestablish these transactions with a new financial institution. For example, new payees and bill payments may have to be set up and online transactions reestablished.

Q5) For new customers, does the number of transactions change from one period to another?

This question addresses the issue of startup costs. If customers have startup costs in the form of initial transactions that must be repeated, customer retention will be higher due to the higher switching costs. Firms may experience a first-mover competitive advantage if startup costs are high enough.

2.3.2. Hypotheses

From these questions, we form the following hypotheses.

H1: Offline, online (aka "internet"), and bill pay customers are on average equal in their tenure with the bank, balances, income distribution, or number of transactions.

H2: Online banking and bill pay customers are less likely to switch banks than their offline counterparts

H3: Customer retention for online banking and bill pay customers will be higher than for offline customers

H4: An increase in the number of transactions increases customer retention.

H5: New customers will have more transactions than their counterparts.

2.3.3. Methodology

To reduce the heterogeneity in our sample, we have selected two similar financial institutions, described in Table 3.

Table 3: Description of financial institutions

Financial Institution (FI) number	**Description**
FI 1	A large East Coast financial institution, focusing on consumers, with over 220,000 customers and over $2.1 billion in assets
FI 2	A large East Coast financial institution, focusing on consumers, with over 250,000 customers and over $2.5 billion in assets

To examine our hypotheses, data were collected from the marketing databases of two financial institutions. A census sample was used to allow maximum flexibility, including the ability to conduct multiple random samples and evaluate the results within each. Each institution provided records related to all of their clients (> 470,000 customer records in total) and included client demographic information, account information, and transaction information. Selected variables provided are summarized in Table 4.

Snapshots of these variables were taken in February and June 2005 to provide a longitudinal analysis of the data.

To ensure the security and privacy of the client data, all data were provided via secure media and were encrypted in transit. Encryption keys were known only to individuals who could decrypt the data in a secure data center. All aggregation activity was conducted inside the secure data center. Data were also obtained from various vendors used by the financial institutions, including the Internet Banking, Bill Payment, and online statement vendors. These data were correlated (based on the key identification number used by the financial institution) to the data provided by the financial institution.

Records for each client from each of the various data sources were then aggregated to provide a single record for each client. This record included the client's demographic information, usage and tenure in using electronic services, aggregated account balances by type of account, and transaction counts. Where appropriate, data for both the initial and final censuses were captured and aggregated (e.g., accounts, balances, transaction counts). Other data, such as demographics, were not captured at the second point in time due to the relatively slow rate of change of these variables, and because the institutions had not updated this information between the two census points.

For privacy, data were anonymized to ensure that no personal information could be lost or released. All clients were assigned a monotonically increasing serial number, and all data for a particular client were linked to this primary key for anonymity. Additional calculations were performed on the anonymized data. These calculations included categorizing various usage tenures and activity levels, combining time and demand deposit account balances into a single variable, and categorizing clients based on the

types of channels used to access their financial institution. A summary of these variables is shown in Table 4 below.

*Table 4: Description of Variables Used in Data Analysis**

Field Name	**Value Info**
FI_NUMBER	Unique identifier for the financial institution
CUST_SERIAL	Unique customer number per FI
TENURE	Number of months the customer has been with the FI (to February 2005)
IB_BINARY	True of False; True if customer is classified as online banking, False if offline only
BP_BINARY	True of False; True if customer is classified as bill pay, False if online banking or offline.
CUSTOMER_INCOME_CODE	Income is classified from 0 to 9, ranging from lower income to higher.
ATTRITED_SINCE_FEB	True/False; True if no transactions between February and June 2005
NEW_SINCE_FEB	True if the customer was newly added to the records since February, 2005; False otherwise.
TOTAL TRANS	Average number of transactions of all types by this customer, per month (until February 2005)
TOTAL TRANS2	Average number of transactions of all types by this customer, per month (until June 2005)
TOTAL BALS	Total account balances for the customers (includes loans, time and deposit accounts as of February 2005)

2.4. Data Analysis and Results

In order to test H1, whether OF, IB and BP customers had roughly equal tenure, total balances, incomes and number of transactions, t-tests were performed between OF and IB and between BP and not BP (all BP customers are IB customers, but customers without BP can be either IB or OF). A two-sample t-test of equality of means for OF vs. IB customers found that the difference in mean tenure was approximately 17.5 months. That is, IB customers had, on average, 17.5 months more tenure than OF, with a standard error of .258. As the t-statistic had a value of -67.6, this result is statistically significant. Similar results held for BP vs. non-BP customers, with BP customers having mean tenure of 24.9 months greater than non-BP. Again, the value for the t-statistic (t=-65.7) shows this to be a statistically significant result, and H1 is rejected for tenure.

For total balances, a t-test of IB and OF customers found that IB customers had balances that were on average $8250 higher than their OF counterparts. This result is statistically significant (t=-54.0). Results for BP and non BP were also statistically significant (t=-110). BP customers had mean total balances that were $25400 higher than their non BP counterparts. So H1 is rejected for total balances and supports the findings of (Kennickell and Kwast 1997; Sciglimpaglia and Ely 2006).

For income, a t-test of IB and OF customers found that the difference between mean income brackets was approximately .406, with a standard error of .007. With only 10 ordinal income brackets, this was a statistically significant result (t=-59.3). For BP and non BP, the difference in means was -.379, with a standard error of .009 and a t=42.4. This interesting result suggests that mean income for bill pay customers is lower than their internet banking counterpart. Although it would be better to perform a chi-square

test of this ordinal data, with 10 categories and the extremely high number of observations, a t-statistic is suggestive of the same result for this income partitioning.

Finally, a t-test of total transactions for IB and OF customers found that internet banking customers had on average 5.80 more transactions (t=-170). A t-test of BP vs. non BP customers found that BP customers had on average 15.3 more transactions (t=-300). This result supports the findings of (Campbell 2003; Graeber 2003; Witman, Roust et al. 2006).

So H1 is rejected for all the variables – total transactions, total balances, tenure, and income were all higher for IB than for OF and for BP rather than non BP customers. To determine whether these variables had effects independent of IB and BP membership, a multiple regression analysis (probit) including all these variables was performed and is reported below in the section examining H3.

To test H2 and determine whether IB and BP customers have lower retention than their OF counterparts, summary statistics were analyzed. For offline customers, the mean customer retention was 98.2%, with a standard deviation of .135. For IB customers, customer retention was 99.0% with a standard deviation of .100. BP customers had customer retention of 99.5%, with a standard deviation of .073. As a result, we find support for H2 and can say that IB and BP customers have lower customer attrition and higher customer retention (with some 470000 records, a difference of means t-test will be highly statistically significant).

For the change in the rate of attrition for IB and BP customers, we utilized a differential probit (dprobit) regression analysis, which examines the change in a dichotomous dependent variable. In this case, the variable in question is attrition, which

is either 1 (customer switched banks) or 0 (customer was retained). H3 hypothesizes lower attrition rates (which we saw in our summary statistics above) for IB and BP customers over their counterparts and a dprobit analysis can provide a way to estimate that reduction.

The dprobit analysis for IB customers shows an increase in retention of 0.970% for internet banking customers over offline. Translated, this means that the customer retention would increase from 98.2% to 99.2%. This is a reduction of half of all attrition! A dprobit for BP customers finds similar results: increase in retention of 0.972% over offline, which would increase customer retention from 98.2% to 99.2%. These results are also consistent with the summary statistics examined with H2. So H3 is supported – retention rates are higher for IB and BP customers. The result for IB is robust to the inclusion of total balances, transactions, income group, and tenure, with IB still increasing retention by 0.45% and all variables except tenure having a statistically significant effect. The same is true for BP, with a coefficient of 0.24%.

Interestingly, additional dprobit analysis of tenure found that tenure had little impact on retention (coefficient of 10^{-6}). Effectively, this means for each one decade increase in tenure, retention will increase by a relatively tiny 0.1%. Increases in income, total transactions and total balances were found to correspond to increases in retention of 0.10%, 0.07%, and 10^{-7} respectively, but these are not a large impact (on the order of 1% increase in retention for a one standard deviation increase in the variable). So H4 is supported, because the increase in total transactions results in an increase in customer retention.

Given this direct relationship between transactions and customer retention, if customers have more transactions when they first join the bank ("startup costs"), then they will have higher customer retention. By regressing total number of transactions at our second data collection point (June 2005) as the dependent variable and the February 2005 data point and new customer binaries as the independent variables, we can examine the number of startup transactions. According to this analysis, with an R^2 of .809, new customers have 2.58 more transactions. This supports H5 and new customers experience more transactions, which have already been found to contribute to customer retention. The hypotheses and these results are summarized in Table 5 below.

Table 5: Summary of Hypotheses and Results

Hypothesis	**Supported or Rejected?**
H1: Offline, online, and bill pay customers are similar in their tenure with the bank, balances, income distribution, or number of transactions.	Rejected
H2: Online banking and bill pay customers are less likely to switch banks than their offline counterparts	Supported
H3: The rate of attrition for online banking and bill pay customers will be lower than for offline customers	Supported
H4: An increase in the number of transactions increases customer retention.	Supported
H5: New customers will have more transactions than their counterparts.	Supported

2.5. Discussion and Conclusions

It is evident from this data that online banking and bill pay services can provide a valuable source of additional profitability for the e-banking firm, both in terms of additional customer retention and additional product sales. This can lead to a competitive advantage for the firm. Additionally, given our retention information, if the e-banking firm is an early entrant into online banking and bill pay, this can potentially lead to a first-mover competitive advantage.

This study has also shown that the transactions customers make influence their propensity to switch financial institutions and so switching costs exist in terms of the

number of transactions customers make. Both the transactions for initiating a relationship with a firm and total transactions provide the switching costs that have a direct relationship to customer retention. This study supports the existing research findings that high switching costs lead to customer retention, and thus competitive advantage.

While our conclusions regarding switching costs, customer retention and competitive advantage will fill a void in the research, it is worthwhile to note that the first hypothesis could not be supported. We were not able to separate out income and tenure effects from the online banking and bill pay customers. Our findings were consistent with prior literature (Hitt and Frei 2002) that bill pay and online banking customers were higher income, had more tenure and more transactions (Campbell 2003; Graeber 2003). This provides a potential source for future research in modeling the contribution of income and tenure to retention and thus, competitive advantage.

2.6. References

Barney, J. (1991). "Firm Resources and Sustained Competitive Advantage." Journal of Management 17(1): 99.

Bauer, C. and J. Colgan (2001). "Planning for electronic commerce strategy: an explanatory study from the financial services sector." Logistics Information Management 14(1/2): 24 - 32.

Campbell, D. (2003). The Cost Structure and Customer Profitability Implications of Electronic Distribution Channels: Evidence from Online Banking.

Chakravarty, S., R. Feinberg, et al. (2004). "Relationships and individuals' bank switching behavior." Journal of Economic Psychology 25(4): 507.

Chen, P.-Y. and L. M. Hitt (2002). "Measuring switching costs and the determinants of customers retention in Internet-enabled businesses: A study of the online brokerage industry." Information Systems Research 13(3): 255.

Floh, A. and H. Treiblmaier (2006). "WHAT KEEPS THE E-BANKING CUSTOMER LOYAL? A MULTIGROUP ANALYSIS OF THE MODERATING ROLE OF CONSUMER CHARACTERISTICS ON E-LOYALTY IN THE FINANCIAL SERVICE INDUSTRY." Journal of Electronic Commerce Research 7(2): 97.

Giesen, L. (2004). ""Not so sticky?"" Banking Strategies LXXX(1).

Graeber, C. (2003). Want to Get More Online Bill Payers? The TechStrategy Report. Cambridge, MA, Forrester Research: 13.

Grimm, C., H. Lee, et al., Eds. (2006). Strategy as Action: Competitive Dynamics and Competitive Advantage. Strategic Management Series. Oxford, Oxford University Press.

Hitt, L. M. and F. X. Frei (2002). "Do better customers utilize electronic distribution channels? The case of PC banking." Management Science 48(6): 732.

Kennickell, A. B. and M. L. Kwast (1997). Who Uses Electronic Banking? Results from the 1995 Survey of Consumer Finances. Western Economic Association, Seattle, Washington.

Kim, M., D. Kliger, et al. (2003). "Estimating switching costs: the case of banking." Journal of Financial Intermediation 12(1): 25-56.

Kiser, E. K. (2002). "Household Switching Behavior at Depository Institutions: Evidence from Survey Data." Federal Reserve Board: Finance and Economics Discussion Series 2002(44): 1-30.

Klemperer, P. (1995). "Competition when Consumers have Switching Costs: An Overview with Applications to Industrial Organization, Macroeconomics, and International Trade." The Review of Economic Studies 62(4): 515-539.

Moore, A.-M. and N. Katkov. (2001). "Customer Retention and Cost Savings Drive Online Banking ROI." Retrieved Feb 16, 2008, 2008, from http://www.celent.com/PressReleases/20011017/ROI.htm.

Porter, M. E. (2001). "Strategy and the Internet." Harvard Business Review 79(3): 63-78.

Roust, T. and P. Witman (2006). Strategic Implications of Online and Bill Pay Use in Banking: A Transactional Analysis. Global Information Technology Management Association (GITMA), Orlando, FL, Global Information Technology Management Association (GITMA).

Sciglimpaglia, D. and D. Ely (2006). "Customer account relationships and e-retail banking usage." Journal of Financial Services Marketing 10(4): 109-122.

Shi, M., J. Chiang, et al. (2006). "Price Competition with Reduced Consumer Switching Costs: The Case of "Wireless Number Portability" in the Cellular Phone Industry." Management Science 52(1): 27.

Thatcher, M. E. and D. E. Pingry (2004). "An Economic Model of Product Quality and IT Value." Information Systems Research 15(3): 268.

Vatanasombut, B. (2001). Factors affecting retention of customers who are users of computerized applications on the Internet: The case of online banking Information

Systems and Technology. Claremont, CA, Claremont Graduate University. PhD: 115.

Witman, P., T. Roust, et al. (2006). Profitability as a result of bill pay: tracking and mapping end user behavior. Digital Insight National Client Conference. Orlando , FL.

CHAPTER 3: A MARKOV CHAIN ANALYSIS OF CUSTOMER RETENTION AND ATTRITION IN ONLINE BANKING

ABSTRACT

Although online banks may experience reduced costs compared to their brick-and-mortar counterparts, these costs may not result in increased profits if customers are more able to change banks. It is therefore important to examine determinants of customer retention and profitability in these firms. This paper examines four different groups: noncustomers, offline, internet banking and bill pay customers. Demographic and transaction data were analyzed for these four groups. Bill pay customers were found to have the highest income with largest balances and numbers of accounts, making them the most profitable group for the bank. Through a Markov chain analysis, the probability of customers transitioning from one group to another was examined. Bill pay customers were found to have the highest customer retention, followed by internet banking. Once bill pay customers were dissatisfied, they were most likely to transition to the internet banking state, and vice versa. Dissatisfied offline customers were most likely to leave the bank entirely.

3.1. Introduction

Internet banking and bill pay services provide benefits to consumers (in the form of quicker, easier, more automated transactions) as well as to the firms which provide it (in the form of lower costs) (Giesen 2004). However, these benefits may be asymmetric if consumers can easily switch firms. Any cost savings the firms accrue may have to be

paid out as additional benefits to retain customers (Carr 2003). In such an environment, firms will be competed down to marginal cost and no firm will be able to yield a sustainable competitive advantage.

If it is the case that consumers switching reduces competitive advantage, then it is essential to examine internet banking and bill pay customers versus their offline counterparts to determine whether firms are more or less likely to retain these customers. While previous papers have examined explicit customer retention statistics for these customers, this paper will examine summary statistics for these groups as a means of comparison and utilize a Markov chain framework to model group retention behavior.

3.2. Literature Review

A Markov chain can be thought of as a process where each value at a particular period of time (known as a "state") depends on the value at the previous time (Ross 1997). A random walk, shown in Figure 1, is a special case of a Markov chain. The movement of the variable from one state to another is described by transition probabilities, shown as p_i,j,t in the figure, where i is the initial state, j is the next state and t is the time period.

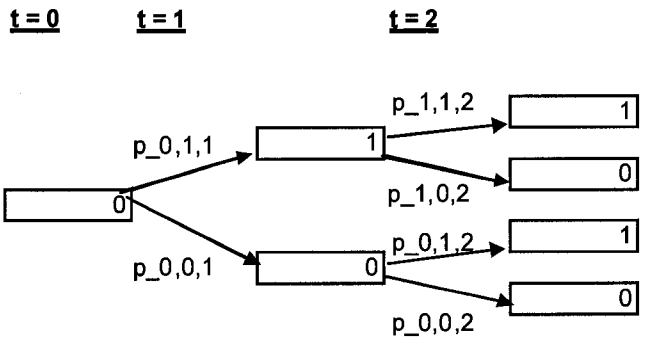

Figure 1: Random Walk Process for Binary Outcomes

Markov chains have been used in various fields to describe everything from the political party affiliation changes over time (Henry 1971) to the behavior of consumers in responding to marketing promotions (Pfeifer 2000). They are especially useful in describing customer retention scenarios since states can be set as either retained (0) or attrited (1). The Markov chain can be estimated using a random walk, representing the change in the customer's state (either 0 or 1) over time. The transition probabilities can then be examined as a means of describing customer retention, since they describe how likely a customer is to leave the firm.

Other variables can also be examined for internet banking, bill pay and offline customers as determinants of a customer's "stickiness" (Giesen 2004) or willingness to remain with a particular firm. Internet banking customers have been found to be more profitable, with more types of accounts and customer retention than their offline counterparts (Hitt and Frei 2002). Older customers with more education and longer tenure have been found to have higher usage of bill pay (Sciglimpaglia and Ely 2006). [Note: other studies (Kennickell and Kwast 1997) have found age has an inverse, not a

positive, relationship to propensity to use bill pay]. These same variables have been found to reduce customers' propensity to switch banks (Chakravarty, Feinberg et al. 2004). The results of these studies are summarized in Table 6.

Balances and types of accounts have also been found to affect customers' propensity to switch banks. In particular, loan balances were found to affect customer retention the most (Roust and Witman 2006; Witman, Roust et al. 2006; Witman and Roust 2008). For these reasons, this study will examine balances and number of accounts for internet banking, bill pay and offline customers as well as age and income of these groups.

Table 6: Summary of Prior Research

Research Cited	Independent Variable	Dependent Variable	Relationship
(Kim, Kliger et al. 2003)	Loan Accounts	Switching Costs	↑ Loan Accounts → ↑ Switching Costs
(Chakravarty, Feinberg et al. 2004)	Tenure, Age, Education	Propensity to Switch	↑ Tenure → ↓ Propensity to Switch ↑ Age → ↓ Propensity to Switch ↑ Education → ↓ Propensity to Switch
(Sciglimpaglia and Ely 2006)	Age, Income, Education, Number of transactions	Use of bill pay, Loan application, Perception of importance in banking services	↑ Age → ↑ Use of bill pay ↑ Income → ↑ Use of bill pay ↑ Education → ↑ Use of bill pay ↑ Age → ↑ Loan application ↑ Income → ↑ Loan application ↑ Education → ↑ Loan application ↑ Number of transactions on the internet → ↑ Perception of importance of internet banking services
(Kennickell and Kwast 1997)	Age, Education, Income	Use of electronic transactions with financial institution	↑ Age → ↓ Use of electronic transactions with financial institution ↑ Income → ↑ Use of electronic transactions with financial institution ↑ Education → ↑ Use of electronic transactions with financial institution
(Hitt and Frei 2002)	Type of Customer ("PC Banking") or not	Profitability, Number of different accounts, Total balances, Customer retention	↑ Use of PC Banking →↑ Profitability ↑ Use of PC Banking →↑ Number of different accounts ↑ Use of PC Banking →↑ Total balances ↑ Use of PC Banking →↑ Customer retention
(Witman, Roust et al. 2006)	Type of customer (OF, IB, BP),	Transactions, Cost-to-serve, Total balances, Customer retention, Profitability,	IB customers have more transactions than OF BP customers have more transactions than IB IB customers have higher cost-to-serve than OF BP customers have higher cost-to-serve than IB ↑ Transactions → ↑ Customer retention IB and BP are more profitable

(Witman and Roust 2008)	Account transactions	Relationship depth (number of accounts * balances)	↑ Online usage → ↑ Relationship depth ↑ Transactions → ↑ Relationship depth
(Roust and Witman 2006)	Tenure, IB tenure, BP tenure, Number of transactions	Customer retention	↑ Number of transactions → ↑ Switching costs → ↑ Customer retention ↑ IB Tenure → ↑ Customer Retention ↑ BP Tenure → ↑ Customer Retention

3.3. Research Methodology

To examine the research questions, data were collected from the marketing databases of two similar financial institutions. A description of each is shown in Table 7.

Table 7: Description of financial institutions

Financial Institution (FI) number	**Description**
FI 1	A large East Coast financial institution, focusing on consumers, with over 220,000 customers and $2.1 billion in assets
FI 2	A large East Coast financial institution, focusing on consumers, with over 250,000 customers and $2.5 billion in assets

A census sample was taken from the marketing databases to allow maximum flexibility, including the ability to conduct multiple random samples and to evaluate the results within each sample. Customers in the database were classified as offline, online, or bill pay as shown in Table 8 (tenure defined as of Feb 2005).

Table 8: Classifying Offline (OF), Online Banking (IB), or Bill Pay (BP) Customers

Tenure with Online Banking (IB) (months)	**Tenure with Bill Pay (BP) (months)**	**Customer Type (IB, BP, OF)**
0	0	OF
> 0	0	IB
> 0	> 0	BP

Each institution provided records related to all of their clients and included client demographic, account, and transaction information. Snapshots of these variables were taken in February and June 2005 to provide a longitudinal analysis of the data. Analysis of the variables in Table 9 was performed for each of the different customer groups (OF, IB, BP) as specified.

Table 9: Description of Variables Used in Data Analysis

Field Name	Value Info
CUSTOMER_BIRTH_YEAR	Year the customer was born
CUSTOMER_INCOME_CODE	Code representing household income (0-9); 0 =blank, 1 = 0-15000, 2 = 15001-19000, 3 = 19001-30000, 4 = 30001-40000, 5 = 40001-50000, 6 = 50001-74000, 7=74001-99999, 8=100000-124000, 9=>124001
TIME_ACCTS	Count of all Time Deposit (e.g., savings, CDs, money market accounts) type accounts
TIME_BALS	Sum of all Time Deposit balances
DEP_ACCTS	Count of all non-Time Deposit (e.g., checking) type accounts
DEP_BALS	Sum of all non-Time Deposit balances
LOAN_ACCTS	Count of all Loan type accounts
LOAN_BALS	Sum of all Loan account type balances

The research questions addressed in this chapter are shown below. The methods used to address these questions are shown below each question.

Q1) What are the characteristics of each group of customers (offline, online, bill pay)? Are the groups different in their balances, income distribution, or types of accounts (e.g., demand accounts, loan accounts, etc.)?

Prior research (Sciglimpaglia & Ely, 2006, Kennickell & Kwast, 1997, Roust and Witman, 2006) has found that bill pay customers had higher income and (sometimes) age, as well as larger balances and numbers of accounts. By examining summary statistics, statistical significance can be determined. Customer_birth_year, customer_income_code, time_accts, time_bals, dep_accts, dep_bals, loan_accts, and loan_bals will be examined for bill pay (BP), offline (OF) and internet banking (IB) customers. This will help resolve some of the inconsistencies in the literature regarding these variables.

Q2) What are the transition probabilities (probabilities of switching and staying) for each type of customer?

The estimated transition probabilities for an irreducible, aperiodic Markov chain can be found based on the observed transition probabilities (Ross 1997) as follows.

If state i = state j (customer is retained), $p_{ij} = c_i$, else if state i != state j (customer is attrited, customer just joined the bank, or customer changed the services they use),

$p_{ij} = (1 - c_i) * A_j / \sum_{k=1}^{i} A_k$, where

p_{ij} = estimated transition probability from state i to j

c_i = retention probability

A_i = attractiveness parameter of state i

c_i and A_i are allowed to vary (such that the two banks still sum to 1 but are nonnegative) to determine the steady state probabilities. Henry (1971) describes a similar model structure, where the attractiveness parameters are reduced to a conditional probability of switching to a state (given attrition).

3.4. Data Analysis and Results

Analysis for the more than 450000 records in the data set was performed using STATA, including calculation of summary statistics and statistical testing. Calculation of transition probabilities for the Markov chain was performed in Excel.

Results for Research Question 1: What are the characteristics of each group of customers (offline, online, bill pay)? Are the groups different in their balances, income distribution, or types of accounts (e.g., demand accounts, loan accounts, etc.)?

The summary statistics for the offline customer group are shown in Table 10, internet banking is shown in Table 11, and bill pay is shown in Table 12.

Table 10: Summary Statistics for Offline Customer Group

channel_group = OF	**Obs**	**Mean**	**StdDev**	**Min**	**Max**
Customer_income_code	200551	5.5	2.1	0	9
Customer_birth_year	209278	1964.1	21	1900	2005
Time_accts	209278	0.2	1.3	0	113
Time_bals	222533	3031	21813	0	2290376
Deposit_accts	209278	1.4	0.9	0	20
Deposit_bals	222533	3725	22878	0	6280123
Loan_accts	209278	0.5	0.8	0	11
Loan_bals	222533	6821	30302	0	4750000

Table 11: Summary Statistics for Internet Banking Customer Group

channel_group = IB	Obs	Mean	StdDev	Min	Max
Customer_income_code	169161	5.9	2.0	0	9
Customer_birth_year	176278	1968	13.7	1902	2005
Time_accts	176278	0.2	0.9	0	57
Time_bals	180688	3347	21441	0	1702537
Deposit_accts	176278	2.0	1.1	0	61
Deposit_bals	180688	5351	23755	0	4132433
Loan_accts	176278	1.0	1.0	0	12
Loan_bals	180688	11603	43441	0	4206586

Table 12: Summary Statistics for Bill Pay Customer Group

Channel_group = BP	Obs	Mean	StdDev	Min	Max
Customer_income_code	62377	6.1	1.9	0	9
Customer_birth_year	64158	1964.8	11.9	1908	2004
Time_accts	64158	0.4	1.3	0	69
Time_bals	66813	5271	28759	0	4564902
Deposit_accts	64158	2.7	1.4	0	88
Deposit_bals	66813	10973	32373	0	4502055
Loan_accts	64158	1.4	1.2	0	49
Loan_bals	66813	24630	58805	0	1985957

Comparing the means in these tables, the results indicate that bill pay customers are older than internet banking (1964.8 for bill pay vs. 1968 for internet banking) but younger than offline customers (1964.8 for bill pay vs. 1964.1 for offline). This explains the difference that was observed in literature, which did not differentiate between bill pay and internet banking customers in determining the relationship between age and retention for online and offline banking customers.

In the summary statistics, bill pay customers also had:

- higher income (6.1 for bill pay vs. 5.9 for internet banking vs. 5.1 for offline, or roughly $50,000 vs. roughly $40,000),
- higher balances in savings accounts ($5271 for bill pay vs. $3347 for internet banking and $3031 for offline)
- higher balances in deposit accounts ($10973 for bill pay vs. $5351 for internet banking and $3725 for offline) and
- higher balances in loan accounts ($24630 for bill pay vs. $11603 for internet banking vs. $6821 for offline).

All these variables are associated with increases in customer retention in the literature. Having higher mean balances also means that those customers are more profitable to the bank, which is a necessary but not sufficient component for competitive advantage.

While examining means between groups is instructive, it also raises the question of whether any differences in these means are statistically significant. The answer is an unqualified yes. Pairwise t-tests of means were performed for all these variables and all were statistically significant with an alpha of .01. With three exceptions, all t-statistics

were larger than 10 or -10, so were very highly significant. (The exceptions were customer_birth_year between bill pay (BP) and offline (OF) and time_accts and time_bals between internet banking (IB) and offline (OF)). This suggests that the internet banking, bill pay and offline groups are different in their demographic data, which supports to segregation of customers into these groups. The t-statistics for these tests are shown in Table 13.

Table 13: T-Statistics for Equality of Means Between Different Groups

t-statistic for test of equality of means for two groups	**OF vs. IB**	**IB vs. BP**	**OF vs. BP**
Customer_income_code	59.0	17.2	58.6
Customer_birth_year	61.4	-47.8	7.3
Time_accts	-3.7	33.7	25.4
Time_bals	4.6	18.0	21.5
Dep_accts	189.3	137.3	302.6
Dep_bals	22.1	47.1	64.7
Loan_accts	171.6	96.8	232.4
Loan_bals	41.1	59.8	104.1

Results for Research Question 2: What are the transition probabilities (probabilities of switching and staying) for each type of customer?

The Markovian model of customer attrition can be used as in Henry (1971) or Ross (1997), starting with by describing customers as "offline" (OF), "internet banking" (IB),

"bill pay" (BP) or "noncustomer" customers. The noncustomer group in February will include people who are new customers in June (and people who are never customers). The noncustomer group in June will include people who were customers in February but have since attrited (and also some people who are never customers). The matrix of each group is shown in Table 14.

Table 14: Membership in Groups for Feb and June 2005

		June				
		Offline	**Internet Banking**	**Bill Pay**	**Non-customer**	**Total**
Feb	**Offline**	206601	10137	1157	4638	222533
	Internet Banking	1107	172428	5320	1833	180688
	Bill Pay	58	826	65573	356	66813
	Non-Customer	17557	7844	1319	102256000	102282720
	Total	225323	191235	73369	102262827	102752754

According to the 2004 Survey of Consumer Finances by the Federal Reserve (Bucks, Kennickell et al. 2006), 91.3% (of 112,000,000 households = 102,256,000) of families have a transaction account. These values are used to specify the number of people who are always noncustomers in the membership group matrix in Table 14.

The membership group matrix enables us to calculate the transition probabilities for moving from one group to another. This transition matrix represents the customers switching from one group to another between February and June 2005. For example, the transition probability from offline to noncustomer is estimated by taking the number of offline customers in Feb who were noncustomers in June (4638) and dividing it by the number of offline customers in Feb who changed to another group (4638+1157+10137). This gives us the transition probability of offline to noncustomer = .291. The transition probabilities of all the groups are shown in Table 15.

Table 15: Transition Matrix from One Group to Another

		June				
		Offline	**Internet Banking**	**Bill Pay**	**Non-Customer**	**Total**
Feb	**Offline**	0	0.6363	0.0726	0.2911	1
	Internet Banking	0.1340	0	0.6441	0.2219	1
	Bill Pay	0.0468	0.6661	0	0.2871	1
	Non-Customer	0.6571	0.2936	0.0494	0	1

These transition probabilities are conditional probabilities showing (given that a customer has decided to change their state), the probability that they switch to the specified new state. This matrix shows that, given an offline customer who is going to change, they are most likely to transition to the internet banking group (with 64% probability). The nonconditional transition probabilities from group to group (and

retention within a group) are shown in Figure 2. Similarly, the internet banking group is likeliest to transition to bill pay and vice versa. This may be due to a poor experience with bill pay or dissatisfaction with the costs of bill pay relative to the benefits received. Noncustomers are likely to start their tenure with the bank as offline customers before adopting internet banking, and then bill pay. These transition probabilities agree with the conceptual hypothesis that customers join the bank, then start using internet banking, then transition to bill pay. The high transfer rate out of bill pay and back to internet banking is interesting. Given that a bill pay customer decides to switch groups (a low probability – 1.9%), there is a 67% chance they will switch to internet banking. At the same time, there is a 29% chance they will become a noncustomer (attrited).

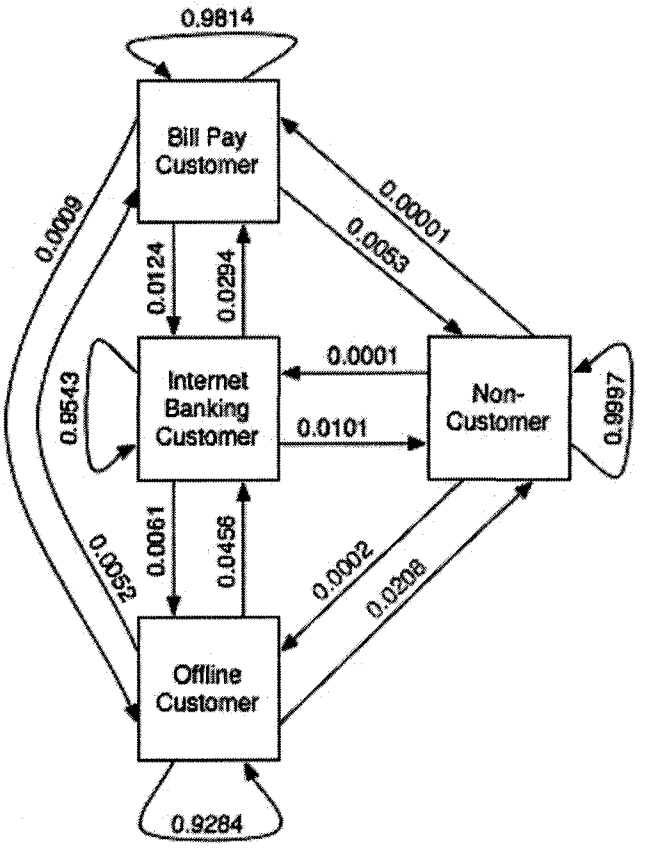

Figure 2: Transition and Retention Among Customer Groups

Additionally, once a bill pay customer does decide to switch, they have higher probability of becoming noncustomers (i.e., leaving the bank) than internet banking customers who decide to switch (as described below, however, the non-conditional probability of becoming a noncustomer is lowest for bill pay customers). These topics may be worthy of additional research to determine why the bill pay group has a lower retention rate than internet banking. It may be that if a bill pay customer is dissatisfied enough to switch groups, they are merely on their way to becoming noncustomers (possibly with some intermediate groups in between).

Following Ross (1997) and Henry (1971), the customer's decision is modeled in two steps: should they make a change, and then what should they change to. The first part of the decision splits customers into satisfied ones (who will be retained in their current group) and dissatisfied ones (who will make a change, as described above). The retention rate of customers for each group is shown in Table 16.

Table 16: Retention Probabilities (staying in the same group)

	Retention Probability
Offline	0.9284
Internet Banking	0.9543
Bill Pay	0.9814
Non-Customer	0.9997

The retention probabilities matrix indicates the probability that a customer remains in their existing group. Offline customers have the lowest retention probability, and thus are most likely to make a change. These probabilities of change are different from the probability of attrition, because the customers can remain with their bank while changing customer groups within the bank. For example, offline customers can start using internet banking or internet banking customers can begin using bill pay. (Note that the estimated number of noncustomers affects only the retention probability of noncustomers. If the true population of possible customers was 10 million rather than 102 million, the retention probability would be around .997 (instead of .9997). This noncustomer retention number serves to confirm that it is difficult to obtain new customers.)

Table 15 and Table 16 can be combined to calculate the probability that a customer chooses to leave the bank and become a noncustomer. These attrition probabilities are shown in Table 17, which shows more clearly that the probability of changing banks is highest for members of the offline customer group.

Table 17: Attrition Probabilities for Internet Banking, Bill Pay and Offline Customers

	Attrition Probability
Offline	0.0208
Internet Banking	0.0101
Bill Pay	0.0053

3.5. Discussion and Conclusions

These results indicate bill pay and internet banking customers are more profitable than their offline counterparts, with higher balances and numbers of accounts, in addition to their increased customer retention. Based on earlier literature, increases in those areas increases the switching costs, so customers will be more likely to remain with the firm. A first-mover competitive advantage may result from firms which are able to grab more of the bill pay and internet banking customer groups early.

Analysis of the Markov chain also shows some interesting properties. Based on the transition probabilities, offline customers are the most likely to want to change groups and bill pay customers are the least likely. Once these groups decide to make a transition, though, the results are similar: 66% choose to become internet banking customers and 29% leave the bank entirely.

Combining these two results, it is apparent that if a banking firm can keep their bill pay customers satisfied (e.g., by providing the service free of charge or by providing a satisfactory online experience), then this creates a first-mover competitive advantage for firms with early entry into the market. In fact, by examining the bill pay customers who transition to internet banking, the firm may receive a useful source of information regarding why the bill pay service is not satisfactory.

3.6. References

Bucks, B., A. B. Kennickell, et al. (2006). Recent Changes in U.S. Family Finances: Evidence from the 2001 and 2004 Survey of Consumer Finances. Federal Reserve Bulletin. 92: A1-A38.

Carr, N. (2003). "Does IT Matter? Nicholas Carr responds." Harvard Business Review 81(7): 112-112.

Chakravarty, S., R. Feinberg, et al. (2004). "Relationships and individuals' bank switching behavior." Journal of Economic Psychology 25(4): 507.

Giesen, L. (2004). ""Not so sticky?"" Banking Strategies LXXX(1).

Henry, N. (1971). "The Retention Model: A Markov Chain with Variable Transition Probabilities." Journal of the American Statistical Association 66(334): 264-267.

Hitt, L. M. and F. X. Frei (2002). "Do better customers utilize electronic distribution channels? The case of PC banking." Management Science 48(6): 732.

Kennickell, A. B. and M. L. Kwast (1997). Who Uses Electronic Banking? Results from the 1995 Survey of Consumer Finances. Western Economic Association, Seattle, Washington.

Kim, M., D. Kliger, et al. (2003). "Estimating switching costs: the case of banking." Journal of Financial Intermediation 12(1): 25-56.

Pfeifer, P. E., Carraway, Robert L. (2000). "Modeling Customer Relationships as Markov Chains." Journal of Interactive Marketing 14(2): 43-55.

Ross, S. M. (1997). Simulation, Academic Press.

Roust, T. and P. Witman (2006). Strategic Implications of Online and Bill Pay Use in Banking: A Transactional Analysis. Global Information Technology Management Association (GITMA), Orlando, FL, Global Information Technology Management Association (GITMA).

Sciglimpaglia, D. and D. Ely (2006). "Customer account relationships and e-retail banking usage." Journal of Financial Services Marketing 10(4): 109-122.

Witman, P. and T. Roust (2008). "Balances and Accounts of Online Banking Users: A Study of Two US Financial Institutions." International Journal of Electronic Finance(4).

Witman, P., T. Roust, et al. (2006). Profitability as a result of bill pay: tracking and mapping end user behavior. Digital Insight National Client Conference. Orlando , FL.

CHAPTER 4: PRICE DIFFERENTIATION IN ONLINE, HYBRID, AND OFFLINE BANKS

ABSTRACT

E-banking services are a natural progression for e-commerce because of the lack of need for physical delivery. Existing banks may wish to add online banking services to their product offerings, but must incur costs to do so. New banks may wish to instead start out with online banking to reduce costs. Banks can then be said to operate on primarily online, offline and hybrid channels. Whether these channels are more profitable because of their lower costs is an open question. The profitability depends on how much interest (the "price") the banks must pay their depositors for their use of one channel over another. The pricing and profitability of the online, hybrid, and offline channels for banking are examined in this paper.

4.1. Introduction

Electronic commerce provides many benefits to consumers in terms of lower explicit and implicit costs for goods and services. From the e-commerce firm's perspective, however, these benefits may be at the firm's expense (Carr 2003). The firms may be forced to provide more services, with higher costs, while simultaneously being unable to recoup those costs from customers. According to strategy literature, firms competing only on price will achieve only a normal profit as prices will be competed down in the online domain (Grimm, Lee et al. 2006). As a result, these firms will be unable to achieve a sustainable competitive advantage (Porter 2001).

Making this analysis even more difficult is the fact that most firms lie somewhere on an "online-offline" continuum between exclusively online firms having no physical presence and firms with only a physical but no online presence. For every Amazon.com (pure-play internet firm), there are several small neighborhood bookshops using aggregators such as Half.com or even Amazon Marketplace to sell their wares. Classifying one as "online" and the other "offline" can be problematic. How should Powell's Books, with several downtown Portland locations, yet with a large online presence as well, be classified?

Firms operating between the endpoints of the "online-offline" continuum can also experience channel conflict as consumers become aware of price differentiation in the different channels. If consumers are aware of the price offered by the online bookstore when they go into a physical location, they may expect pricing to be identical. This can cause greater customer attrition (price mismatch creates deadweight loss and dissatisfaction which creates attrition) as well as increased costs of operating the different channels for the firm (educating consumers about the different channels). Studies of pricing of homogeneous goods (e.g., books, CDs) in online, hybrid and offline channels have found decreased pricing in online channels (Brynjolfsson and Smith 2000) relative to offline channels.

Thus far, however, few studies have systematically examined profitability and pricing across the continuum of online through offline firms. This is remarkable, considering that profitability is a necessary (but not sufficient) component for a firm's sustainable competitive advantage. Without profitability, the firm will eventually cease operations as it runs out of funding sources. This paper will fill a void in current e-commerce research

by providing essential empirical analysis of pricing and profitability and has important implications for strategy, marketing and economics literature as well.

In the next section, the existing pricing and profitability literature will be examined and summarized for e-commerce firms in general as well as for banking firms specifically. The strategy literature as it pertains to e-banking will also be addressed. Next, by examining statistics available at the firm level cross-sectionally, models of the profitability and pricing of different online, traditional and hybrid banks will be tested. These findings will be compared to traditional accounting measures of profitability for the firm. Finally, the strategic implications of the model predictions, empirical results and accounting measures of profitability will be described.

4.2. Literature Review

From the theoretical perspective, the "online-offline" choice of the firm is analogous to a choice of a specific generic strategy (Porter 1990). Generic strategies include cost leadership, differentiation or focus strategies. The cost leadership generic strategy is characterized by an undifferentiated product and large economies of scale (Wright 1987), with a great deal of price competition (e.g., online banks offering only savings accounts at high interest rates and no checkwriting privileges). Differentiation is the opposite extreme - characterized by unique products customized to each user, with competition on multiple dimensions, not just price (e.g., private banking with its emphasis on personalized service). Focus is similar to differentiation, but with a more general product that appeals to a specific target segment (e.g., TCF Bank, which keeps branches open 7 days a week).

A purely online firm can be thought of utilizing a cost leadership strategy (lowest cost in that industry), because there are large economies of scale. Even for customized products, such as computers, competition is primarily on the price dimension. At the same time, online firms can be marketed to appeal to specific target segments – a focus strategy. An offline firm usually selects a differentiation generic strategy (high perceived value, as opposed to low perceived costs). A hybrid firm could be thought of as selecting either a differentiation or focus strategy – it may provide highly customized products or services through various channels (differentiation) or it may choose to provide those services only to a specific target segment.

Choice of generic strategy also affects a firm's attitudes towards customer retention. A cost leadership firm under Bertrand competition (homogenous goods, consumers know all prices and price is the only competing variable) may be less concerned with customer retention, as only the cost leader will be profitable after prices are competed down to marginal cost (Brynjolfsson and Smith 2000). A differentiation firm would be much more concerned with customer retention. If a firm also has customer retention, it is said to have customer "lock-in" (Farrell and Klemperer 2006). As a result of additional customer retention, the firm can then achieve additional profitability under its generic strategy.

Firms choosing a cost leadership or focus strategy are more likely to compete on the basis of price (Wright 1987). When there are open standards, such as those establishing how online banking customers will interact with their accounts, the switching costs that customers incur by changing firms are reduced. As a result, intense price competition occurs (Bauer and Colgan 2001). This can lead to lower profitability as prices are

competed down to marginal costs (decreasing revenue) and firms also incur customer acquisition costs.

Profitability and pricing models exist for firms across the "online-offline" continuum (Bauer and Colgan 2001; Viswanathan 2005). The models predict that traditional firms should offer the highest prices and be moderately profitable, and hybrid firms would be most profitable. In the case where the hybrid firm is restricted in its ability to price discriminate (it must offer the same price in both the traditional and online channels), the hybrid firm will always price between purely online and traditional firms. These models suggest that online firms will offer the lowest prices and be least profitable.

In fact, some studies comparing online, offline and hybrid firms for even purely homogeneous goods (e.g., books, CDs) have found this to be the case, with prices 9-16% lower for online books and CDs (Brynjolfsson and Smith 2000). Hybrid firms (e.g., Barnes & Noble / bn.com) were found to have higher prices than their online counterparts but lower prices than some of their offline brethren. Higher price dispersion was also found to be true for online firms, with the suggestion that this may be due to customer asymmetry of information. Customers lack complete information about all prices available in the market, so they may select only a few vendors for price comparisons. As a result, online firms may initially charge a low price to get on a customer's radar, then charge a higher price later. Hybrid firms may also be using their physical presence to increase brand awareness, with the ability to charge higher prices for their homogeneous product as the result.

For a heterogeneous product[4] such as banking, little research exists on the pricing and profitability for online, hybrid and offline firms. Firms can vary from online banks with no actual physical branches[5] and traditional offline banks (with numerous branches), with hybrid firms appearing somewhere between the two extrema. These banks may choose to differentiate themselves by the interest rates (their "price") they pay as well as by their place on the "online – offline" continuum. Mathematically, assuming equilibrium conditions, if we partition the continuum into 3 disjoint sets (online, offline and hybrid), the prices and the corresponding profitability of the firms can be modeled [Viswanathan, 2005]. Additionally, empirical data exists for banks, allowing explicit calculation of pricing and direct effects on profitability for online, hybrid and traditional banks. This calculation will be performed in the next section.

As this model suggests, pricing can have direct effects on profitability. In fact, some studies have calculated the monetary benefits that accrue to the banking firm from adopting the online channel, net of the attendant costs of serving that channel. These benefits are derived from three sources: 1) reducing the costs of serving customers, 2)

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[4] Banking is heterogeneous in that different banks may provide different services to the same account type (e.g., checking with no ATM fees, checking with $3 ATM fees, etc.)

[5] While banks may incorporate in a specific state, it is often not necessary to have physical branches there, e.g., EmigrantDirect, Prosper and Zopa. Source: http://marketingroi.wordpress.com/2007/10/28/bank-branches-big-expensive-security-blankets/

additional customer deepening (more accounts and higher balances with the firm) and 3) additional customer retention (resulting in lower customer acquisition costs). Some of these explicit monetary benefits are summarized in Table 18.

Table 18: Net Monetary Benefits of Online Channel Adoption to Banking Firms

Study	**Net Monetary Benefit ($ per customer per year)**	**Benefit derives from:**
(Moore and Katkov 2001)	$221	Bill payment, online payment, loan revenue, account aggregation
(Witman, Roust et al. 2006)	$905	Additional customer retention, additional balances, cost savings
(Graeber 2003)	$96	Additional relationship deepening, cost savings, additional customer retention

Other studies have examined the indirect effects of pricing (Shi, Chiang et al. 2006) on reducing customer retention, which in turn reduces profitability. This second-order effect, however, is far from certain. Studies of online brokerages (Chen and Hitt 2002; Shi, Chiang et al. 2006) and traditional banks (Kiser 2002) found that pricing had no effect on customer retention. Instead, increased customer utilization of the online and hybrid channels has been found to have direct positive effects on profitability and indirect positive effects through increases in customer retention ((Hitt and Frei 2002), (Campbell

2003), (Witman, Roust et al. 2006), (Graeber 2003), (Witman and Roust 2008), (Roust and Witman 2006)). These studies are summarized in Table 19.

Table 19: Summary of Prior Research

Research Cited	Independent Variable	Dependent Variable	Relationship
(Bauer and Colgan 2001)	Open standards	Price competition	↑ open standards → ↑ Price competition
(Shi, Chiang et al. 2006)	Price competition	Switching costs	↑ Price competition → ↓ Switching costs
(Hitt and Frei 2002)	Type of customer ("PC Banking") or not	Profitability, Number of different accounts, Total balances, Customer retention	↑ Use of PC Banking →↑ Profitability ↑ Use of PC Banking →↑ Number of different accounts ↑ Use of PC Banking →↑ Total balances ↑ Use of PC Banking →↑ Customer retention
(Campbell 2003)	Adoption and use of online banking,	Transactions, revenue to the bank, balances, customer retention	↑ Use of online banking →↑ Transactions ↑ Use of online banking →↑ Customer retention ↑ Use of online banking →↑ Cost to serve for the bank ↑ Use of online banking →↓ Decreased revenue to the bank
(Chen and Hitt 2002)	Switching costs, Customer retention,	Brokerage, systems usage (transactions), service design, rates	↑ Usage → ↑ Customer retention ↑ Rates has no effect on customer retention Brokerage affects customer retention
(Witman, Roust et al. 2006)	Type of customer (OF, IB, BP),	Transactions, cost-to-serve, total balances, Customer retention, profitability,	IB customers have more transactions than OF BP customers have more transactions than IB IB customers have higher cost-to-serve than OF BP customers have higher cost-to-serve than IB ↑ Transactions → Customer retention IB and BP are more profitable due to higher balances and greater retention
(Vatanasombut	Type of	Customer retention	↑ Relationship "termination cost" →

2001)	customer (OF or IB), Trust, relationship "termination cost"		customer retention OF or IB customer type does not affect customer retention ↑ Trust → Customer retention
(Moore and Katkov 2001)	Customer retention, Cost to serve	Profitability	↑ Use of IB → ↑ Customer retention → ↑ Profitability ↑ Use of IB → ↓ Cost to serve → ↑ Profitability
(Graeber 2003)	Customer retention, profitability	Transactions, cost-to-serve	↑ Use of IB → ↑ Customer retention → ↑ Profitability ↑ Use of IB → ↓ Cost to serve → ↑ Profitability
(Kiser 2002)	Interest rates	Customer retention, Switching costs	Interest rates usually not sufficient to cause bank switch (p.8) Switching costs high for brick-and-mortar customers
(Lin, Bailey et al. 2007)	Adoption of internet banking channel	Return on equity (profitability), Efficiency	↑ Adoption of IB → ↑ Return on equity ↑ Adoption of IB → ↑ Efficiency
(Witman and Roust 2008)	Account transactions	Relationship depth (number of accounts * balances)	↑ Online usage → ↑ Relationship depth ↑ Transactions → ↑ Relationship depth
(Roust and Witman 2006)	Tenure, IB tenure, BP Tenure, Number of transactions	Customer Retention	↑ Number of transactions → ↑ Switching costs → ↑ Customer retention ↑ IB Tenure → ↑ Customer retention ↑ BP Tenure → ↑ Customer retention

4.3. Research Methodology

Mathematical models can be used to estimate pricing and profitability for hybrid, offline, and online banks. Since interest rates are the "price" the consumer receives for use of deposits to make loans, interest paid on deposits can be used to test model estimates. As part of regulatory requirements, FDIC-insured banks must provide

quarterly information about their balance sheet (e.g., assets and liabilities) and their income statement (revenue, expenses and sources). The FDIC, in turn, makes this information available to the general public through its "Statistics on Depository Institutions" website (http://www2.fdic.gov/sdi/index.asp).

From this website, amounts of interest-bearing deposits, interest paid, and the number of domestic offices was collected for 8,600 FDIC insured banks for June, 2006[6]. Restricting the data set to FDIC-insured banks provides support that the interest differential is not due to additional bank default risk. To separate out offline banks with only a few branches from online banks, additional information was collected for each bank from the Federal Financial Institutions Examination Council Central Data Repository (CDR) website (https://cdr.ffiec.gov/public/). This data included a self-reported variable as to whether customers can perform transactions on the bank website – a feat only hybrid and online banks can claim. These variables are summarized in Table 20. Once this data was collected, the number of domestic offices (offdom) and ability of customer to perform transactions online (webtrans) variables were used to partition banks into offline, online or hybrid categories, as shown in Table 21.

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[6] While more recent information was available, this date in particular was selected to provide additional analysis of the same data set as Lin, M., J. Bailey, et al. (2007). Banking Efficiency from Internet Adoption. Workshop in Information Systems Economics (WISE) 2007. Montreal, Quebec, Canada.

Table 20: Variables taken from FDIC Data Sets

Variable name	**Database**	**Variable definition**
Interest-bearing deposits (depidom)	SDI	The sum of all domestic office deposits, including demand deposits, money market deposits, other savings deposits and time deposits.
Total interest expense (edepdom)	SDI	Total interest expense on deposits held in domestic offices.
Number of Domestic Offices (offdom)	SDI	The number of domestic offices (including headquarters) operated by active institutions in the U.S., territories and possessions.
Website Transaction (webtrans)	CDR	"Do any of the bank's Internet Web sites have transactional capability, i.e., allow the bank's customers to execute transactions on their accounts through the Web site?" Yes/No

Table 21: Definition of online, hybrid, offline channels[7]

Primary Channel	**Variable definition**
Offline	Webtrans = "No"
Hybrid	Webtrans = "Yes" and offdom >2
Online	Webtrans = "Yes" and offdom <= 2

Using the accounting data from the FDIC database and variables shown in the tables above, the following research questions are examined. The methods used to address these questions are shown below each question.

Q1-A) Do online banks provide higher interest to depositors than their offline and hybrid counterparts?

Theory (Porter 2001; Carr 2003) and models (Viswanathan 2005) predict that the answer will be yes, but this has not been examined for these banking types before. The actual interest paid, interest bearing balances, and the number of branches is given in the SDI data set. The relationship between interest rate (equal to interest expense divided by interest bearing deposits) and number of domestic offices will be examined. A linear regression with interest rate as the dependent variable and number of branches as the independent variable will be used to examine the relationship.

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[7] The breakpoint for hybrid and offline banks (2) was selected to keep a reasonable distribution between offline (2378), online (2118) and hybrid (4194). Results were robust to choosing this threshold to be either 1,2, or 3.

Q1-B) Do model results and empirical results find that online banks pay higher interest than offline and hybrid banks?

Applying the applicable model, the interest rates paid by online, hybrid and offline banks are given by the following formulas (Viswanathan 2005).

Interest rate paid by online banks: $p_A = (1/4) * (2\ p_H * t_A)$

Interest rate paid by offline banks: $p_B = (1/4) * (2\ k * p_H * t_A)$

Interest rate paid by hybrid banks:

$p_h = [n_A * t_B * (2 * p_A * t_A) + k * n_B * t_A (2 * p_B + t_B)] / [4 * (k^2 * n_B * t_A + n_A * t_B)]$

where

- a, b, h Firms in the online, traditional, and hybrid channels, respectively .
- n_i, Size of market served by channel i,
- t_i, Cost/unit distance of channel misfit in channel i (a measure of the disutility of the channel to the consumer),
- $t_A = 4 * p_A - 2 * p_H$
- $t_B = 4 * p_B - (2 * k * p_H)$
- p_i, Price set by firm i,
- k, hybrid firm's discount (markup) in offline channel relative to the online channel (1 if no price differentiation).

Q2) Utilizing the mathematical models of profitability (Viswanathan 2005), in equilibrium, hybrid banks are predicted to be more profitable than their offline or offline counterparts. Does this prediction hold for FDIC-insured hybrid, online, and offline banks?

Applying the applicable model, the total profit of the online, hybrid and offline banks is given by the following formulas, using the same notation as above (Viswanathan 2005).

Profit for online banks:

$$\pi_A = n_A * t_A * [2 n_A * t_B + k * n_B * (k * t_A + t_B)]^2 / 16[k^2 * n_B * t_A + n_A * t_B]^2$$

Profit for traditional banks:

$$\pi_B = n_B * t_B * [2 k^2 * n_B * t_A + n_A * (k * t_A + t_B)]^2 / 16[k^2 * n_B * t_A + n_A * t_B]^2$$

Profit for hybrid banks:

$$\pi_H = t_A * t_B * (n_A + k * n_B)^2 / 4[k^2 * n_B * t_A + n_A * t_B]$$

Q3) How do the profitability results from the model compare to traditional measures of profitability (ROA) for these banks?

Although the above model estimates total profit, traditional accounting measures such as return on assets should also be used for comparison. Return on assets is measured by a firm's net income over its assets, both of which are available in the FDIC SDI dataset. The model estimated total profit is stated in terms of dollars.

4.4. Data Analysis and Results

Results for Research Question #1: A) Do online banks provide higher interest to depositors than their offline and hybrid counterparts?

The results for the regression with interest rate as the dependent variable and number of domestic offices (offdom) as the independent variable are shown in Table 22. With an R^2 of < .0008 and coefficient of 10^{-6} on number of branches, every 200 additional branches would add a mere .1% in interest rate. These results do not suggest that interest

rates can be predicted by number of branches alone, even though the regression and offdom are statistically significant with p = .013.

Table 22: Summary Statistics for interest rate as predicted by number of domestic offices (offdom)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.026705
R Square	0.000713
Adjusted R Square	0.000599
Standard Error	0.019988
Observations	8724

ANOVA

	Df	**SS**	**MS**	**F**	**Significance F**
Regression	1	0.002487	0.002487	6.224748	0.012616
Residual	8722	3.484478	0.0004		
Total	8723	3.486965			

	Coefficients	**Standard Error**	**T Stat**	**P-value**	**Lower 95%**
Intercept	0.017375	0.000215	80.72075	0	0.016953
Offdom	5.39E-06	2.16E-06	2.494945	0.012616	1.15E-06

To test whether web transactions themselves add explanatory power for interest rate, a dummy variable was added. The results, as shown in Table 23, indicate that this does

not improve the analysis much – R^2 remains about the same (< .0008) and the regression and independent variables are no longer statistically significant with p = .01.

Table 23: Summary Statistics for interest rate as predicted by number of domestic offices (offdom) and webtrans

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.028068
R Square	0.000788
Adjusted R Square	0.000559
Standard Error	0.019988
Observations	8724

ANOVA

	Df	**SS**	**MS**	**F**	**Significance F**
Regression	2	0.002747	0.001374	3.438045	0.032171
Residual	8721	3.484218	0.0004		
Total	8723	3.486965			

	Coefficients	**Standard Error**	**t Stat**	**P-value**	**Lower 95%**
Intercept	0.017098	0.000406	42.13703	0	0.016302
Website allows transactions	0.000386	0.000478	0.807212	0.419566	-0.00055
Offdom	5.3E-06	2.16E-06	2.449491	0.014325	1.06E-06

Analyzing the additional effect of the prior two independent variables using an interaction term between website access and number of domestic offices shows that, in

fact, the effect of number of domestic offices is virtually eliminated when including the interaction between website and number of domestic offices. The summary statistics are shown in Table 24. Again, the R^2 remains about the same (< .0008). These results indicate that interest rates start at 1.75% for online and hybrid banks and increase .1% for every 200 branches. Interest for offline banks starts at 1.69% and increases .1% for every 11 branches. Neither of these differences is significant nor is the regression as a whole.

Table 24: Summary Statistics for interest rate as predicted by number of domestic offices (offdom), interaction term and webtrans

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.029267
R Square	0.000857
Adjusted R Square	0.000513
Standard Error	0.019988
Observations	8724

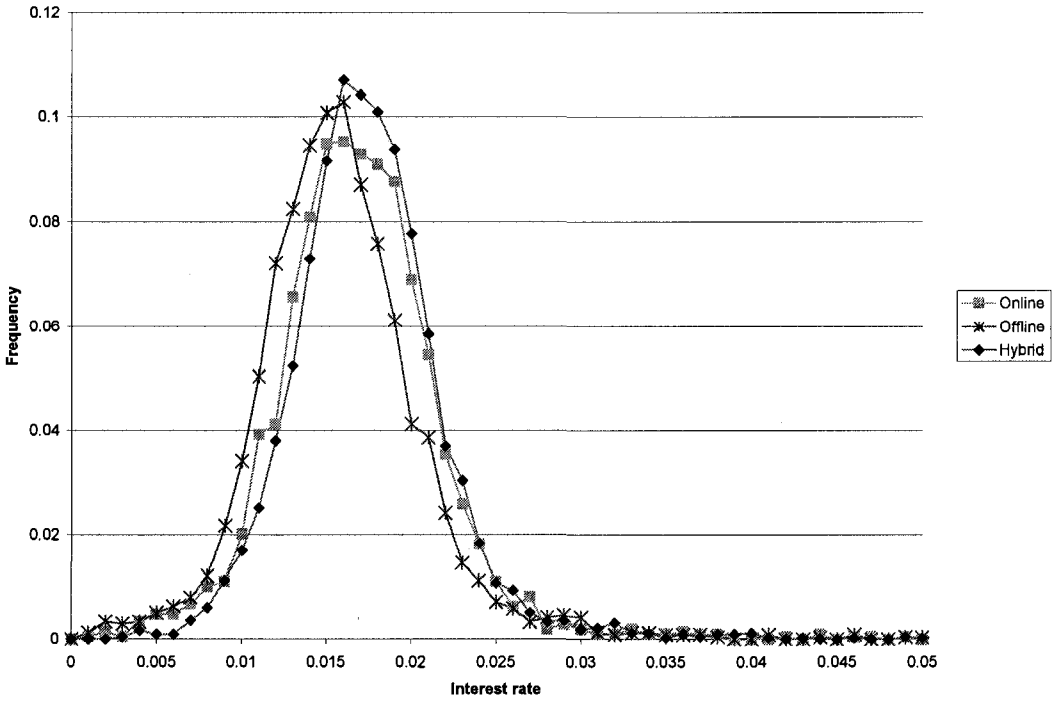
ANOVA

	df	SS	MS	F	Significance F
Regression	3	0.002987	0.000996	2.491815	0.058265
Residual	8720	3.483978	0.0004		
Total	8723	3.486965			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%
Intercept	0.016888	0.000488	34.6137	4.1E-246	0.015931
website yes / no	0.000596	0.00055	1.084278	0.278272	-0.00048
Offdom	9.1E-05	0.000111	0.822057	0.411067	-0.00013
Interaction term	-8.6E-05	0.000111	-0.77438	0.438725	-0.0003

Testing that different interest rates exist for the three channels: Given these results, a test was performed to ensure that the interest rates were statistically significantly different between the online and offline channels. Figure 3 shows there is not much difference in the distribution of interest rates in online, offline and hybrid banks (x axis is interest, y axis is frequency). (The 18 banks paying no interest were excluded from this histogram, as well as the following t-test analysis.)

Figure 3: Distribution of Interest Rates for Online and Offline Banks



Using interest paid as a metric, t-tests of unequal variance were performed to confirm the partitioning of primary channels among the financial institutions. The results are shown in Table 25.

Table 25: Probability that Online / Offline / Hybrid Banks Pay the Same Interest

	p value of t-test
online v. offline	5.6E-07
online v. hybrid	5.6E-05
hybrid v. offline	4.9E-21

Such low p-values suggest a very high probability (>99.994%) that the three groups pay significantly different interest rates. This supports the separation of banks into these separate categories.

Results for Research Question #1: B) Do model results and empirical results find that online banks pay higher interest than offline and hybrid banks?

Using the FDIC data set, the average interest rate paid was calculated, as shown in Table 26. The results are consistent with the Viswanathan model: online banks pay the most interest, followed by hybrid, and offline pay the least.

Table 26: Observed Average Interest Rate by Primary Channel

Online	**Hybrid**	**Offline**
1.45%	1.41%	1.38%

According to the Viswanathan model (under the assumption that hybrid firms have no markup, i.e., $k = P_B / P_A$), however, the interest paid by hybrid and online banks should be identical. The model predicts the banks will have interest rates as per Table 27.

Table 27: Interest Rate Model Estimates by Primary Channel

Online	Hybrid	Offline
1.50%	1.50%	1.42%

These results are similar to the actual results, although the observed interest rates are lower than the model estimates. This is odd, because the model interest rates should have been lower than actual interest rates observed (which excluded zero interest rate cases). So while the model is consistent with empirical findings regarding pricing, it tends to overestimate.

Results for Research Question #2: Utilizing the Viswanathan profitability model, in equilibrium, will hybrid banks are predicted to be more profitable than their offline or offline counterparts. Does this model hold for FDIC-insured hybrid, online, and offline banks?

This model predicts that, in general, hybrid firms will be the most profitable and online firms the least profitable. Utilizing the equations stated in the previous section, the analysis finds that to be the case, even when the hybrid firm does not price differentiate over the online firm. The data for the three primary channels is shown Table 28.

Table 28: Profitability Model Estimates (in 1000s of $) for Online, Offline and Hybrid Banks

Online	Hybrid	Offline
$6,110,783	$18,873,404	$4,923,694

Results for Research Question #3: How do the profitability results from the model compare to traditional measures of profitability (ROA) for these banks?

One of the metrics commonly used for profitability is return on assets, as measured by a firm's net income over its assets. However, the model only estimates the numerator (the total net income for all firms in this primary channel for the Apr – Jun 2006 quarter), so the net income is shown for the three types in Table 29.

Table 29: Net Income for Online, Offline and Hybrid Banks (in 1000s of $)

Online	**Hybrid**	**Offline**
$6,111,425	$58,047,946	$3,740,923

Net income agrees with the model estimates. There is higher profitability among hybrid firms; traditional firms being the least profitable. While net income measures nominal profit, however, hybrid banks may simply have more profit because they have more assets to provide return. It is the percentage return on assets (ROA) which is typically used in measuring profitability. The ROA for the Apr – June 2006 quarter for each type is shown in Table 30. When the amount of assets is taken into consideration, the hybrid firm actually has the least profitability. This is consistent with the theorized result in the strategy literature (Porter 2001; Carr 2003), where hybrid firms must incur costs of competing in both channels but do not necessarily receive revenues in line with those costs.

Table 30: ROA for Online, Offline and Hybrid Banks for Apr– June 2006

ROA for online	ROA for hybrid	ROA for traditional
0.81%	0.59%	0.75%

4.5. Discussion and Conclusions

Profitability for a firm is a necessary but not sufficient condition for competitive advantage. Profitability leads to operational effectiveness, which in turn leads to competitive advantage. For hybrid, online and offline firms, it is necessary that they both be profitable and be more so than their competitors under Bertrand equilibrium. Using the model estimates of profitability allows determination of the competitiveness of each of these channels. While the model and the findings support that hybrid firms will be the most profitable, this actually seems likely to be an artifact of how profitability is measured in the model. Namely, the model does not take into account the assets used when calculating the profitability of the firm. The amount of profit is not as important as how many ways it must be divided.

In fact, if using traditional accounting measures such as return on assets, which do take into account the assets used to achieve that profit, the opposite conclusion can be made: hybrid firms are the least profitable and online firms the most. That is the same conclusion as drawn in the strategy literature regarding competitive advantage: hybrid firms will be "stuck in the middle" as they must offer higher interest rates (lower prices) to compete with firms in the online channel and simultaneously experience higher costs of operating both the offline and online channels. Additional research, perhaps examining other accounting profitability measures, may provide some insight on this.

Finally, with respect to pricing, the empirical results and the model agree: online banks pay the highest interest, followed by hybrid, with offline banks paying the least. Strategically, this suggests that online banks may be trading one cost for another: lower fixed costs in terms of number of branches, but higher marginal costs in terms of interest paid to depositors. Given that online firms have less price stickiness than other channels, this may be advantageous – they can alter interest rates much more readily than branch locations. This result is in accordance with prior literature on the subject addressing prices for homogeneous products in online, hybrid and offline channels (Brynjolfsson and Smith 2000).

4.6. References

Bauer, C. and J. Colgan (2001). "Planning for electronic commerce strategy: an explanatory study from the financial services sector." Logistics Information Management 14(1/2): 24 - 32.

Brynjolfsson, E. and M. D. Smith (2000). "Frictionless Commerce? A Comparison of Internet and Conventional Retailers." Management Science 46(4): 563.

Campbell, D. (2003). The Cost Structure and Customer Profitability Implications of Electronic Distribution Channels: Evidence from Online Banking.

Carr, N. (2003). "Does IT Matter? Nicholas Carr responds." Harvard Business Review 81(7): 112-112.

Chen, P.-Y. and L. M. Hitt (2002). "Measuring switching costs and the determinants of customers retention in Internet-enabled businesses: A study of the online brokerage industry." Information Systems Research 13(3): 255.

Farrell, J. and P. Klemperer (2006). Coordination and Lock-In: Competition with Switching Costs and Network Effects.

Graeber, C. (2003). Want to Get More Online Bill Payers? The TechStrategy Report. Cambridge, MA, Forrester Research: 13.

Grimm, C., H. Lee, et al., Eds. (2006). Strategy as Action: Competitive Dynamics and Competitive Advantage. Strategic Management Series. Oxford, Oxford University Press.

Hitt, L. M. and F. X. Frei (2002). "Do better customers utilize electronic distribution channels? The case of PC banking." Management Science 48(6): 732.

Kiser, E. K. (2002). "Household Switching Behavior at Depository Institutions: Evidence from Survey Data." Federal Reserve Board: Finance and Economics Discussion Series 2002(44): 1-30.

Lin, M., J. Bailey, et al. (2007). Banking Efficiency from Internet Adoption. Workshop in Information Systems Economics (WISE) 2007. Montreal, Quebec, Canada.

Moore, A.-M. and N. Katkov. (2001). "Customer Retention and Cost Savings Drive Online Banking ROI." Retrieved Feb 16, 2008, 2008, from http://www.celent.com/PressReleases/20011017/ROI.htm.

Moore, A.-M. and N. Katkov. (2001). "Finding the ROI from Online Banking Retail Applications." Retrieved March 3, 2008, 2008.

Porter, M. E. (1990). "The Competitive Advantage of Nations." Harvard Business Journal(March-April 1990): 74-91.

Porter, M. E. (2001). "Strategy and the Internet." Harvard Business Review 79(3): 63-78.

Roust, T. and P. Witman (2006). Strategic Implications of Online and Bill Pay Use in Banking: A Transactional Analysis. Global Information Technology Management Association (GITMA), Orlando, FL, Global Information Technology Management Association (GITMA).

Shi, M., J. Chiang, et al. (2006). "Price Competition with Reduced Consumer Switching Costs: The Case of "Wireless Number Portability" in the Cellular Phone Industry." Management Science 52(1): 27.

Vatanasombut, B. (2001). Factors affecting retention of customers who are users of computerized applications on the Internet: The case of online banking Information Systems and Technology. Claremont, CA, Claremont Graduate University. PhD: 115.

Viswanathan, S. (2005). "Competing Across Technology-Differentiated Channels: The Impact of Network Externalities and Switching Costs." Management Science 51(3): 483.

Witman, P. and T. Roust (2008). "Balances and Accounts of Online Banking Users: A Study of Two US Financial Institutions." International Journal of Electronic Finance(4).

Witman, P., T. Roust, et al. (2006). Profitability as a result of bill pay: tracking and mapping end user behavior. Digital Insight National Client Conference. Orlando , FL.

Wright, P. (1987). "A Refinement of Porter's Strategies." Strategic Management Journal 8(1): 93-101.

CHAPTER 5: CONCLUSIONS

The introduction of electronic banking in its many forms has the potential to benefit both customers (in the form of any time, any where access to their funds) as well as the firm (reducing costs by use of lower cost channels). These benefits may accrue solely to the customer, however, if the bank is not able to maintain or increase customer retention. If customers have high "switching costs", then they are disincentivized from leaving, and higher customer retention results. While "switching costs" cannot be directly observed, they can be extrapolated from customer behavior. "Switching costs: include equipment costs, transaction costs for switching suppliers, learning costs, quality uncertainty, contractual devices, and psychological costs (Klemperer 1987). Customer behavior that involves use of an idiosyncratic website (learning costs), establishing numerous payments with third-parties and automatic deposits (transaction costs), will have higher switching costs than those that do not. Bill pay and internet banking customers fall into this category (with Bill Pay having higher transaction costs than Internet Banking).

This study examined bill pay and internet banking customers found that they were less likely to switch banks than their offline counterparts. The number of transactions was also found to be positively related to customer retention, and new customers were found to have more transactions than customers who had been with the bank for several months. This corresponds to the transaction costs and startup costs (another kind of switching cost), respectively. As the literature has found that these customers yield an additional $96 to $905 per customer per year, a firm which can gain these customers early is likely to yield a first-mover competitive advantage.

Bill pay customers have also been found to be a better source of profit for the bank, with higher balances and numbers of accounts in addition to higher customer retention. Once these customers become dissatisfied, however, they have a probability of leaving the bank of 29%. The other 66% of dissatisfied bill pay customers change to internet banking. If the firm surveys those making this transition for sources of dissatisfaction, they may be able to increase their customer retention even further. In either case, the high customer retention among bill pay customers can yield a first-mover competitive advantage for the firm which enters the market early.

Whether the additional monetary benefits and customer retention ultimately result in profits for the firm was also examined. In accordance with model expectations, this study found that online banks paid higher interest and were less profitable than their offline counterparts when the model was applied to FDIC empirical data. "Hybrid" banks that provide services both online and offline were the most profitable. When traditional accounting measures were examined, however, the opposite was true – the online banks were most profitable and "hybrid" banks the least. This indicates that online banking may yield a comparative advantage over offline and hybrids.

This study contributes to development of IT economics and e-commerce theory by testing existing theory with empirical data. It points out flaws and inconsistencies for improvement of these models. This study expands the marketing and economics literature into new domains and provides concrete descriptions of the sources of profitability and competitive advantage. Finally, this study adds to the empirical research in IT economics using real-world data in an approachable way. The results are as relevant to practitioners in banking as they are to researchers in academia.

5.1. Limitations and Key Assumptions:

In developing estimates of customer attrition, transaction data was utilized. Customers who had no transaction activity on their account for six months were defined as attrited and considered to have switched banks. This statistic also includes customers who closed accounts. A bigger risk to a bank's competitive advantage, however, may be the 35% of customers each year who "significantly" reduce their balances while keeping their accounts open (Sciglimpaglia and Ely 2006). These customers may be a drain on profitability for the firm.

Although profitability and economic issues such as positive network externalities were discussed, this research does not address the real options that come about due to use of online banking or bill pay services. For example, the reduction in float (the time between a transaction being transmitted and its being received by the respondent) may allow for better alignment of cash inflows and outflows, which in turn results in a higher credit rating for the customer. That, in turn, also has numerous positive effects, but can be addressed in other research.

While this chapter provides a framework for examining the strategic advantage due to customer retention in banking, it is worthwhile to note that the data examined comes from two large, retail, financial institutions. This was done because of the desirability of having comparable financial institutions with a similar customer base. It is possible that these results do not hold in generality. Additionally, although this data is longitudinal, the two data points are four months apart. This may not be a sufficient period to measure the differences in the number of transactions for new customers (or determine whether

the relationship is nonlinear). This leads to the supposition that the number of transactions does in fact measure switching costs. There are many different types of switching costs, and the other types may mitigate the effect of the number of transactions on switching. In examining switching, the equivalent treatment of closed accounts and accounts with no transactions for six months may yield spurious results.

5.2. Directions for Further Research

This study only examines the association between variables, not a causal relationship between them. Causality could be determined using propensity score matching methods in future work. Additionally, this longitudinal study could be continued over time to see if the trends observed in the "Research Results" sections hold. It may be that some customers experience startup costs that exceed one year in duration.

5.3. Consolidated References

Barney, J. (1991). "Firm Resources and Sustained Competitive Advantage." Journal of Management 17(1): 99.

Bauer, C. and J. Colgan (2001). "Planning for electronic commerce strategy: an explanatory study from the financial services sector." Logistics Information Management 14(1/2): 24 - 32.

Brynjolfsson, E. and L. M. Hitt (1998). "Beyond the productivity paradox." Commun. ACM 41: 8.

Brynjolfsson, E. and M. D. Smith (2000). "Frictionless Commerce? A Comparison of Internet and Conventional Retailers." Management Science 46(4): 563.

Bucks, B., A. B. Kennickell, et al. (2006). Recent Changes in U.S. Family Finances: Evidence from the 2001 and 2004 Survey of Consumer Finances. Federal Reserve Bulletin. 92: A1-A38.

Campbell, D. (2003). The Cost Structure and Customer Profitability Implications of Electronic Distribution Channels: Evidence from Online Banking.

Carr, N. (2003). "Does IT Matter? Nicholas Carr responds." Harvard Business Review 81(7): 112-112.

Chakravarty, S., R. Feinberg, et al. (2004). "Relationships and individuals' bank switching behavior." Journal of Economic Psychology 25(4): 507.

Chen, P.-Y. and C. Forman (2006). "CAN VENDORS INFLUENCE SWITCHING COSTS AND COMPATIBILITY IN AN ENVIRONMENT WITH OPEN STANDARDS?" MIS Quarterly 30: 541-562.

Chen, P.-Y. and L. M. Hitt (2002). "Measuring switching costs and the determinants of customers retention in Internet-enabled businesses: A study of the online brokerage industry." Information Systems Research 13(3): 255.

Duxbury, D., Peter Moizer, Wan Azmimi Wan-Mohamed (2007). "Effects of the PricewaterhouseCoopers the UK audit services market." Managerial Auditing Journal 22(2): 121.

Farrell, J. and P. Klemperer (2006). Coordination and Lock-In: Competition with Switching Costs and Network Effects.

Floh, A. and H. Treiblmaier (2006). "WHAT KEEPS THE E-BANKING CUSTOMER LOYAL? A MULTIGROUP ANALYSIS OF THE MODERATING ROLE OF CONSUMER CHARACTERISTICS ON E-LOYALTY IN THE FINANCIAL SERVICE INDUSTRY." Journal of Electronic Commerce Research 7(2): 97.

Gehrig, T. and R. Stenbacka (2004). "Differentiation-Induced Switching Costs and Poaching." Journal of Economics & Management Strategy 13(4): 635-655.

Gehrig, T. and R. Stenbacka (2007). "Information sharing and lending market competition with switching costs and poaching." European Economic Review 51(1): 77-99.

Ghemawat, P. (2002). "Competition and business strategy in historical perspective." Business History Review 76(1): 37-74.

Giesen, L. (2004). ""Not so sticky?"" Banking Strategies LXXX(1).

Graeber, C. (2003). Want to Get More Online Bill Payers? The TechStrategy Report. Cambridge, MA, Forrester Research: 13.

Grimm, C., H. Lee, et al., Eds. (2006). Strategy as Action: Competitive Dynamics and Competitive Advantage. Strategic Management Series. Oxford, Oxford University Press.

Henry, N. (1971). "The Retention Model: A Markov Chain with Variable Transition Probabilities." Journal of the American Statistical Association 66(334): 264-267.

Hitt, L. M. and F. X. Frei (2002). "Do better customers utilize electronic distribution channels? The case of PC banking." Management Science 48(6): 732.

Kauffman, R. J. and Y.-M. Wang (2002). "The Network Externalities Hypothesis and Competitive Network Growth." Journal of Organizational Computing and Electronic Commerce 12(1): 59-83.

Kennickell, A. B. and M. L. Kwast (1997). Who Uses Electronic Banking? Results from the 1995 Survey of Consumer Finances. Western Economic Association, Seattle, Washington.

Kim, M., D. Kliger, et al. (2003). "Estimating switching costs: the case of banking." Journal of Financial Intermediation 12(1): 25-56.

Kiser, E. K. (2002). "Household Switching Behavior at Depository Institutions: Evidence from Survey Data." Federal Reserve Board: Finance and Economics Discussion Series 2002(44): 1-30.

Klemperer, P. (1987). "Markets with Consumer Switching Costs." The Quarterly Journal of Economics 102(2): 375-394.

Klemperer, P. (1995). "Competition when Consumers have Switching Costs: An Overview with Applications to Industrial Organization, Macroeconomics, and International Trade." The Review of Economic Studies 62(4): 515-539.

Lin, M., J. Bailey, et al. (2007). Banking Efficiency from Internet Adoption. Workshop in Information Systems Economics (WISE) 2007. Montreal, Quebec, Canada.

Moore, A.-M. and N. Katkov. (2001). "Customer Retention and Cost Savings Drive Online Banking ROI." Retrieved Feb 16, 2008, 2008, from http://www.celent.com/PressReleases/20011017/ROI.htm.

Moore, A.-M. and N. Katkov. (2001). "Finding the ROI from Online Banking Retail Applications." Retrieved March 3, 2008, 2008.

Pfeifer, P. E., Carraway, Robert L. (2000). "Modeling Customer Relationships as Markov Chains." Journal of Interactive Marketing 14(2): 43-55.

Porter, M. E. (1985). Competitive advantage : creating and sustaining superior performance / Michael E. Porter. New York : London :, Free Press ; Collier Macmillan.

Porter, M. E. (1990). "The Competitive Advantage of Nations." Harvard Business Journal(March-April 1990): 74-91.

Porter, M. E. (2001). "Strategy and the Internet." Harvard Business Review 79(3): 63-78.

Prasad, B. and P. Harker (2000). Pricing online banking services amid network externalities. Proceedings of the 33rd Hawaii International Conference on Systems Sciences (HICSS-33), Maui, HI, IEEE Computer Society Press, Los Alamitos, CAq.

Ross, S. M. (1997). Simulation, Academic Press.

Roust, T. and P. Witman (2006). Strategic Implications of Online and Bill Pay Use in Banking: A Transactional Analysis. Global Information Technology Management

Association (GITMA), Orlando, FL, Global Information Technology Management Association (GITMA).

Sciglimpaglia, D. and D. Ely (2006). "Customer account relationships and e-retail banking usage." Journal of Financial Services Marketing 10(4): 109-122.

Shi, M., J. Chiang, et al. (2006). "Price Competition with Reduced Consumer Switching Costs: The Case of "Wireless Number Portability" in the Cellular Phone Industry." Management Science 52(1): 27.

Southard, P. B. and K. Siau (2004). "A survey of online e-banking retail initiatives." Commun. ACM 47(10): 99-102.

Thatcher, M. E. and D. E. Pingry (2004). "An Economic Model of Product Quality and IT Value." Information Systems Research 15(3): 268.

Vatanasombut, B. (2001). Factors affecting retention of customers who are users of computerized applications on the Internet: The case of online banking Information Systems and Technology. Claremont, CA, Claremont Graduate University. PhD: 115.

Vesala, T. (2007). "Switching costs and relationship profits in bank lending." Journal of Banking & Finance 31(2): 477-493.

Viswanathan, S. (2005). "Competing Across Technology-Differentiated Channels: The Impact of Network Externalities and Switching Costs." Management Science 51(3): 483.

Witman, P. and T. Roust (2008). "Balances and Accounts of Online Banking Users: A Study of Two US Financial Institutions." International Journal of Electronic Finance(4).

Witman, P., T. Roust, et al. (2006). Profitability as a result of bill pay: tracking and mapping end user behavior. Digital Insight National Client Conference. Orlando , FL.

Wright, P. (1987). "A Refinement of Porter's Strategies." Strategic Management Journal 8(1): 93-101.