POLICY STUDIES

**The Importance of Payments-Driven Revenues
to Franchise Value and in Estimating
Bank Performance**

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Abstract

This paper examines how the production of payment services impacts the franchise value of banks. It also explores whether analysts are incorrectly measuring the performance of the banking sector and failing to realize the full importance of payments-driven revenues to banks. In initial empirical analysis, we find limited evidence to suggest that higher payments-driven revenues are associated with higher franchise value. We find, also, that estimates of productive efficiency change dramatically for a small number of banks heavily involved in payments services. We find evidence to suggest that traditional efficiency estimates that exclude nontraditional bank activities inaccurately measure the relative performance of some types of BHCs. We infer from these results that estimation of efficiency must take into account the different mix of traditional and nontraditional activities in which banks engage.

1. Introduction

The objective of this paper is to explore two questions relating to the value that payments-related activities may add to the bank. First, does the production of payment services impact the franchise value of banks? We examine whether the degree of BHC involvement in payments-related activities (measured by the revenue derived from the production of these services) adds value to a bank. We first calculate Tobin's Q, a ratio of the market value of the firm to the book value of its assets and liabilities. We then empirically examine whether increased payments-driven revenues contribute to the franchise value of the bank.

The second question asks whether banking sector output is being mismeasured by underestimation of payment-related revenues. Does exclusion of payments activities from the cost and/or profit function affect the measurement of bank performance? Do payments services offer opportunities for revenue enhancement? We explore whether analysts are incorrectly measuring the performance of the banking sector and failing to realize the full importance of payments-related revenues to banks. We first estimate productive efficiency using the traditional empirical framework. We modify that framework to better account for payment activities at banking companies, re-estimate productive efficiency, and compare the traditional and modified efficiency estimates in empirical analysis.

The remainder of the paper is organized as follows. Section 2 discusses potential reasons for a bank to produce payments services. Section 3 addresses the first question regarding the franchise value of the bank, while section 4 addresses the second question, concerning the profitability of banks. Section 5 concludes and offers some inferences based upon our initial empirical analysis.

2. Potential Reasons for BHCs to Offer Payments Services

The payments system, as defined by Hancock and Humphrey (1998), consists of a legal framework, rules, institutions, and technical mechanisms for the transfer of money. As such, it is an integral part of the monetary and financial system in a smoothly operating market economy (Hancock and Humphrey, 1998).

Banks traditionally have offered payments-related services to their customers, but more recently, nonbanks[1] have entered into the industry and provide either supporting or competing payments-related services to bank customers. Yet these firms do not provide the same set of services that banks offer. Bradford, Davies and Weiner (2002) examine the involvement of nonbanks in payments activities, and find that nonbanks, while pervasive in the payments system, are not directly involved in settlement activities[2].

Furthermore, banks are provided by their charters with the ability to hold specialized assets (i.e., commercial loans) and to issue some specialized liabilities (i.e., demand deposits). The bank charter also gives banks access to the discount window and deposit insurance. Thus, banks have two unique features/connections with regard to the payments system:

(1) they have the ability to offer settlement activities, and,

(2) due to their ability to accept deposits, and the fact that the payments systems is heavily reliant upon deposit-based instruments, they are in a unique position to offer payments-based products and services to their customers.

However, as Berger, Hancock and Marquardt (1996) note, three types of innovation, technological, financial and regulatory, are transforming the payments system in the US. While banks maintain a unique connection with the payments-system, the system and its players are changing rapidly. A Boston Consulting study (February 2003) concludes that while the volume

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[1] Any financial services firm that is not a depository institution.

and value of payments are increasing around the world, banks are collecting less revenue for each transaction. The authors conclude that competitive pressures on the banks are driving down their revenue per transaction, and in order to gain market share, the banks must provide new products and technologies to its customers (*American Banker*, March 4, 2003). Banks are providing an increased number of products and services, due to financial innovation and deregulation, which has eased some restrictions on bank-eligible activities. However, competition is increasing as nonbank firms and banks outside of the traditional market, as discussed, are also able to offer competing products and services. Banks, therefore, are pressured to keep current customers and gain new ones.

DeYoung and Hunter (2002) discuss the switching costs to bank customers, but focus on the effects of the particular payment service: the internet. These authors contend that, prior to recent innovation of the internet as a payment service distribution channel, customers were "captive": they would not typically move their deposits to a different bank because of high switching costs. High switching costs resulted from the proximity of bank branches to a customer's home because most transactions required visits to physical bank offices. DeYoung and Hunter (2002) state that internet distribution channel offers to customers increased convenience (banking can be performed at home), at a reduced costs to the bank (processing these transactions costs significantly less than paper-based transactions). With the rise in the number of banks offering internet banking services, comes the ability to move to banks outside a narrow geographic area. Customers have more choices and switching costs have decreased.

To counter the decrease in switching costs, banks may increase cross-selling in order to embed the customer more firmly in the local branch network (DeYoung and Hunter, 2002). Chakravorti and Kobor (2002) interviewed a number bank holding companies (BHCs) between June and November 2002. Based on their interviews, these authors find, in fact, that many of the

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[2] Settlement is defined by Bradford, Davies and Weiner (2002) as the irrevocable transfer of funds between parties in a payments system.

BHCs offered payments services to retain customers. The Chakravorti and Kobor study suggests that payment activities provide profit enhancement to the BHCs in one of two ways: either through product bundling or as a stand-alone product. BHCs may bundle payment activities into other products, where each product need not contribute directly to profit alone, but to the retention and acquisition of customers. Stand-alone payment activities contribute to revenue enhancement directly by increasing profit, or decreasing costs.

Chakravorti and Kobor (2002) also cite the "stickiness" of using some payment services as a way of retaining customers and discuss the high cost to customers using automatic debit payments and ACH networks of switching to another institution. Most businesses require two weeks written notice in advance of an account change/closure which makes transferring to another institutions difficult and time-intensive for a customer.

Furst, Lang and Nolle (1998), who conduct a survey of bank payment systems in 1997-8, come to a similar conclusion. These authors find that many banks are concerned that they will lose profits and market share if their competitors are better able to take advantage of low-cost delivery channels such as ACH, internet and ATMs. In their survey, these authors find that banks are investing in electronic delivery channels of payment services and "counting on a payoff in the near-term from technological improvements in their traditional delivery channels." One of the larger goals banks hoped to achieve through this investment was to increase their cross-selling. These authors define cross-selling as the sale of additional products and services to a customer based on an analysis of data about the customer's current purchases of products and services (p. 28).

These studies argue that competitive pressure from nonbanks and other financial institutions is leading banks to offer new products and technologies in order to retain their customers over the long term. Thus, banks that offer or are in a position to offer a greater variety of payments services, or are able to do so at a lower cost have a competitive advantage over their bank competitors. Furthermore, because payments services are an intricate part of a bank's

activities, appropriately measuring the profitability of these activities is vital for management in determining bank business strategies.

While a number of recent studies discuss the motivation for banks to offer payment services, very little empirical work has attempted to test these hypotheses. Part of the problem is the lack of consistent data and of an understanding of the volume of revenue that payment services contribute to the bank. This paper addresses how payment services contribute to the bank franchise value and profitability by empirically examining the effect that payments-driven revenues at large US BHCs have on value and performance. We employ a data set, following Rice and Stanton (2003), that measures categories of payments-driven revenues that until 2001 were immeasurable. An added level of detail in income reporting by BHCs allows more precise measurement of payments-related noninterest income. We, therefore, have an ability to test a number of hypotheses regarding the effects of payments-driven revenues on franchise value and in estimating bank performance.

Specifically, we ask whether payment activities add value to the bank. If payment services do, in fact, add franchise value to a banking firm, then payments-driven revenues would be positively associated with a higher degree of franchise value. Alternatively, if payment activities do not contribute to the franchise value of a bank, but are considered a part of a banks total product mix, then we expect that business strategy and not individual payment activities to be positively associated with franchise value.

While most researchers agree that banks of different size or organizational structure do not operate in the same manner, few studies identify the various bank strategies. Amel and Rhodes (1988) test for the existence of strategic groups in banking by focusing on differences in balance sheet composition. They find that a number of bank types based on business strategy exist, and conclude the following. First, the groups are not based on size alone but also on portfolio choices available to banks. Second, strategy choices rather than efficiency differences may be the explanation for observed intraindustry differences in bank performance. Their findings suggest

that industries or markets may generally be defined too broadly and that studies of market performance should take in to account bank characteristics as well as general industry characteristics.

DeYoung and Hunter (2002) consider how recent technological innovation affects bank business strategy and describe two banking strategies, large banks, and small (community) banks. These authors contend that while payments services have always been a primary service provided by banks, technological innovation (namely, the internet) has potential to change the production of payments services, away from paper-based transactions, which will, in turn, have differential effects on banks of varying business strategies. We extend this analysis by dividing the large bank business strategy into four strategies: conglomerates, Global Processors, credit card banks and regional banks, and examining the effect of payments-driven revenues on each of these bank business models. Future research will also include community banks as a business strategy.

3. Does the production of payment services impact the franchise value of banks?

Tobin's Q is a widely-used, market-based measure of valuing intangible assets. The value of the intangible assets is its franchise value. Franchise value is defined as the present value of a firm's future profits (revenues in excess of all costs, including the cost of capital). It is the market value of the firm divided by the replacement costs of assets.

If BHCs which offer a greater amount of payments services have a competitive advantage over their bank competitors, then the intangible value of those firms would be higher, all else held constant, because the market price of publicly traded companies is based on the present value of their future earnings. We calculate the franchise value for a sample of 98 BHCs and empirically test whether increased payments revenue is associated with increased franchise value.

Calculating Tobin's Q

Several definitions of Tobin's Q exist. We employ the measure used by Demsetz, Saidenberg and Strahan (1996). We quantify franchise value by taking the difference between a firm's market value and its replacement cost, where replacement cost is the expense of rebuilding the firm today. We denote franchise value (FV) as:

$$FV = \text{market value} - \text{replacement cost.}$$

The difference between market value and replacement cost will be large when franchise value is high, or when there are profits associated with the firm as a going concern. We cannot, however, measure market value or replacement costs directly. Demsetz, Saidenberg and Strahan (1996) approximate the market value of a bank holding company's (BHC) assets by adding the market value of its equity (shares of stock outstanding times price per share) and the book value of its liabilities.

When a BHC purchases an asset for more than its book value, the difference between its book value and the purchase price is accounted for on the purchaser's books as goodwill. Because this difference is a component of the purchaser's franchise value, Demsetz, Saidenberg and Strahan (1996) approximate the replacement cost of a BHC's assets using the book value of its assets minus goodwill. They divide the franchise value by book value of assets (net of goodwill) as such:

$$\frac{FV}{(A - goodwill)} = \frac{E + L - (A - goodwill)}{(A - goodwill)}, \tag{1}$$

where E is the market value of equity, L is the book value of liabilities and A is the book value of assets. Adding 1 and simplifying gives a proxy for the measure of "Tobin's q":

$$Q = \frac{E + L}{(A - goodwill)}. \tag{2}$$

One caveat in using this measure: it includes both franchise value and government guaranteed deposit insurance. For that reason, we examine the franchise value of a sample of publicly traded BHCs, excluding nonbank financial holding companies.

In equation 2, equity (E) equals the stock price at the end-of-year 2001 times the total number of shares outstanding. Stock prices and number of shares outstanding are obtained from Bloomberg. The book-value data (total liabilities, total assets and goodwill) for end-of-year 2001 are obtained from the "Consolidated Financial Statements for Bank Holding Companies" or Y9 reports. Payments-related revenue and other BHC-specific financial data are taken from the Y9s. We draw our sample of 98 BHCs from the American Banker's list of the top 150 Bank and Thrift Holding Companies. We exclude foreign BHCs, because the equity of the top holder BHC is issued in another country. Also excluded are thrift holding companies. The remaining data set has 98 observations. We rely on 2001 changes to the bank and BHC reporting forms, thus cannot use data before 2001.

Measurement of Payments-Related Revenues

Based on the approach outlined in Rice and Stanton (2003), we create measures for the five categories of payments-related revenue listed above: Service charges on deposit accounts, foregone interest revenue, payments-related trust revenues, payments-related credit card revenue, and revenue from ATMs.

Briefly, these variables are defined as follows:

Service Charges on Deposit Accounts

Service charges on deposit accounts are aggregate fees charged the depositors. These include: maintenance of the account, failure to maintain minimum balances, check-clearing fees, actual transfer of currency, fees for drawing checks on accounts with insufficient funds, and for issuing stop payments orders. We draw this information directly from the Y9 reports.

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Foregone Interest

To measure foregone interest revenue, we estimate the amount of interest expense that banks would earn if they had to pay the federal funds rate to all deposit account holders. We also estimate the amount of interest expense that banks pay to the transactions account holders. The difference between the two is the amount of interest that the bank "saves" by offering customers transaction accounts. We calculate foregone interest (FI) revenue as follows:

$$FI = \$DDA*(fed\,funds)+\$NOW*(fed\,funds-NOW_r)+\$MMDA*(fed\,funds-MMDA_r), \quad (4)$$

where \$DDA denotes aggregate balance in dollars in demand deposit accounts, \$NOW denotes the balance in negotiated order of withdraw accounts, and \$MMDA denotes the balance in money market deposit accounts.

The subscript, r, on each of the account types denotes the average rate those accounts paid to deposit holders. The rates for each of the account types are national averages on the last reported date of the year 2001 obtained from the Bank Rate Monitor, a weekly publication of deposit rates. Future research will use a local rate, rather than a national rate (i.e., state or MSA rate). The balances on each deposit account types are obtained from the FR-Y9C reports.

Payments-Related Trust Revenues

Dependent upon the type of trust account that is managed or held by an BHC's trust department, the BHC earns a wide range of revenues from payment activities. We, therefore, estimate a range of revenues earned through payments-related activities in trust accounts. We include, on the low end, one category of trust revenue, "custody and safekeeping accounts". On the high end, we aggregate four of the eleven revenue categories listed in the Y9: revenues from

employee benefit (defined contribution and defined benefit) accounts, corporate trust and agency accounts, and custody and safekeeping accounts.

Payments-related Credit Card Revenues

We estimate the payments-related credit card revenue from on balance sheet receivables and for payments-related securitized credit card receivables. Credit Card Management (2001) breaks down 1999 revenues of Visa and MasterCard into six subcategories: interchange fees, annual fees, penalty fees, cash-advance fees, enhancements, and interest. We consider interchange fees, annual fees, and enhancements to be payments-related revenues. Based on this figure, 14 percent of total MasterCard and Visa revenues come from interchange fees, another 2 percent from annual fees, and 1 percent from enhancements. Generalizing this result, we assume that 17 percent of all credit card revenues are derived from payments-services. We then take total revenue from credit cards and multiply that by 0.17 to give us an estimate of on balance sheet payments-related credit card revenue.

We then estimate the payments-related revenue from the securitized credit cards by converting the off balance sheet securitized credit card receivables into an on balance sheet equivalent. Payments-related revenue from securitized credit card receivables includes the same activities as the on balance sheet receivables, except that the revenues from these activities accrue to the credit card master trusts. These revenues include similar fees as in the on balance sheet credit card receivables, such as annual fees and late fees.

We first assume that the securitized credit card receivables earn the same rate of return that the on balance sheet credit card receivables earn. This assumption implies that the portfolio composition of the off balance sheet credit card receivables is the same as the on balance sheet credit card receivables and that fees earned from these activities are roughly similar. We then multiply 0.17 (our on balance sheet estimate of payments-related revenue) times a rate of return

that the on balance sheet receivables would earn. The calculation of payments-related securitized credit card revenue (SCC) is as follows:

$$SCC = 0.17 * securitized\ credit\ card\ receivables \left(\frac{on\ balance\ sheet\ credit\ card\ revenue}{on\ balance\ sheet\ credit\ card\ receivables} \right)$$
(5)

ATM revenues

Beginning in 2001, the Bank Call reports require that banks report the "income and fees from automated teller machines" (ATMs) in the category of "other noninterest income" when it exceeds 1 percent of total revenue (defined as total interest income plus total noninterest income). We aggregate the ATMs fees by BHC. By collecting data on all bank subsidiary ATM fees and summing those fees for each BHC by linking each bank subsidiary with its parent BHC. One issue with using this variable is that, because banks must only report this item when it exceeds 1 percent of total revenue, some BHCs show ATM revenues of zero (or missing), when in fact, they are just below the 1 percent threshold.

Aggregate Payments-Services Revenue

Finally, we include an aggregate BHC measure of payments-related revenue by summing up all five categories of payments-related revenue. Thus, AGG_PS is the sum of SC, FIR, TR, CC, and ATM.

Business Strategy

We include indicator variables for BHC business strategy or operations. Four BHC types are identified: Conglomerate BHCs, Global Processing BHCs, Regional BHCs, and Credit Card BHCs. Foreign BHCs are excluded. We define each of the BHC types as follows:

Conglomerate BHCs are BHCs composed of affiliate companies in a variety of businesses including, but not limited to, insurance, securities, commercial banking, and payments-processing activities.

Global processing BHCs handle the cross-border safeguarding, settlement, and reporting of clients' securities and cash on a worldwide basis. These global custodians execute security trades, collect dividend and interest income on securities and cash holdings, recover taxes imposed on such income by the local governments and notify clients of corporate actions affecting their securities holdings. Accounting tasks include reporting all transactions, providing an accurate listing of a fund's assets, and valuing the fund's individual assets as well as the fund itself, if so desired by the client.

Credit Card companies are defined as either monoline companies focused on credit card operations or banking companies that are not mono-line but have large credit card operations.

Regional BHCs focus on large and middle-market commercial lending and retail banking. These companies have a presence in specific geographic areas of the country, i.e., the Southwest or the Midwest.

Correlation Analysis of Franchise Value and Payments-Driven Revenues

Table 1 presents the summary statistics of the set of 98 BHCs while Table 2 presents the summary statistics for a larger sample of 284 BHCs, used in the empirical analysis of efficiency. Table 3 presents the correlation (_) between Tobin's Q and the five categories of payments driven revenue, plus the sum of those five categories. We find payments-related trust revenues to have the highest positive correlation (0.368) among the five types of payments-driven revenues. The

correlation between payments-related credit card revenues and franchise value is 0.103. Service charges on deposit accounts, a measure more closely associated with traditional bank activity of taking deposits, has the lowest correlation with franchise value (0.045). We also test, for each of the payments-driven categories, the hypothesis H_0: _=0, or that the correlation between payments-driven revenues and franchise value, at a given confidence level, is greater than zero. We denote in Table 3 those correlation coefficients that are statistically significantly different from zero at the 10 percent level with a "*". We find the correlation of payments-related trust revenues and franchise values to be significantly different from zero. We also find the correlation (0.172) of "all" payments-driven revenue and franchise value to be significantly different than zero. While limited, this finding suggests that increased payments-related revenues are associated with increased franchise value. A caveat: this table is based on end of year 2001 data for publicly-traded BHCs. Future research will include more firms over a greater number of time periods.

4. Is Banking Sector Output Mismeasured by Underestimation/Omission of Payment-Related Revenues?

This section explores whether exclusion of payments activities from the cost and/or profit function affects the measurement of bank performance. If analysts are incorrectly measuring the performance of the banking sector, we could be failing to realize the full importance of payments-related revenues to banks. We first estimate productive efficiency using the traditional empirical framework. We modify that framework to better account for payments-services activities at banking companies and re-estimate efficiency. We compare the efficiency estimates in empirical analysis.

Profit inefficiency (or "X-inefficiency") is a statistics-based measure that estimates deviations from "optimal" firm costs and profits. Estimates of "optimal" costs and profits are generated by constructing "best practices" cost and profit frontiers using data from all the firms in the industry.

Profit inefficiency is a preferred measure over cost inefficiency, because a seemingly inefficient bank might be offsetting higher expenses with higher revenues (Sprong, Sullivan and DeYoung, 1996). This allows us to examine the "bottom line" and to measure the degree to which banks are managing their inputs and costs to produce the highest, or "best practice" profit.

Profit inefficiency estimates (or X-efficiencies) are defined deviations from optimal firm behavior and are generated by estimating a minimum-cost or maximum-profit frontier and measuring each firm's deviation from that frontier (Berger, 1993, Örs, 1999). Inefficiency estimates include both technical inefficiency (errors that result in overuse of inputs) and allocative inefficiency (errors in choosing an input mix consistent with relative prices), (Berger, 1993).

Since we cannot observe the optimal frontier, we use the "best-practice" firms to substitute for the optimal firm behavior and then benchmark the performance of all other firms by deviations from this frontier. Efficiency is overstated to the extent that the best-practice firms within the sample fail to achieve true allocative and technical efficiency (Berger, 1993). Appendix A describes the method for obtaining inefficiency measures.

4.1 Estimation

We estimate the profit inefficiency in three stages. The profit function is first estimated using ordinary least squares (OLS), and the coefficients and standard deviation of the OLS residuals are saved for the second stage. Next, the profit inefficiency ratio is estimated by Maximum Likelihood Estimation (MLE) using the information saved from the first stage. Third, the profit inefficiency ratio is again estimated by MLE, this time using as initial values the coefficient estimates and standard deviation of the MLE residuals from the second-stage estimation.

The profit efficiency of 284 BHCs is estimated using end-of-year 2001 data. The bank-specific financial data are taken from the Federal Financial Institutions Examination Council's

Consolidated Reports of Condition and Income (call reports). The parent BHC consolidated financial data are collected from the Federal Reserve Board's FR Y-9C reports.

We estimate profit efficiency for the 284 BHCs using the traditional or intermediation model specification. Next, we identify payments-services driven revenues excluded from traditional model specification. Where possible, we include relevant revenue measures from the FR Y-9 report for BHCs and/or Bank Call report as additional output vectors in the efficiency estimation. Not all payments-driven revenues have observable counterparts in the Y-9 or Call reports, however. For these measures, we have created proxy variables for those revenues not directly itemized in the Y-9 or Call reports. The payments-related output vectors are described below.

4.2 Traditional Estimation of Efficiency

Mester (1987) notes two approaches to a multi-product framework for efficiency estimation: the "production" approach and the "intermediation" approach. According to the production approach, the BHC produces a variety of individual accounts of different sizes using labor and capital as inputs. In the intermediation approach, the production process for a BHC involves financial intermediation, that is, the borrowing of funds and subsequent lending of those funds. The production approach is limited in its use, since the BHC Y-9 and Bank Call reports do provide information on the number of accounts per BHC (Mester 1987). The only data that contain information on the number of accounts is the Functional Cost Analysis (FCA) data. Therefore, this approach is not frequently used. Humphrey (1985) finds that the approaches yield average costs that are roughly consistent.

The intermediation approach measures output as the dollar value of the firm's earning assets. Deposits, in addition to labor and capital, are treated as inputs in the production of the assets. Costs include both interest and operating expenses.

The variables included in the intermediation model are as follows:

C = variable operating plus interest costs (for cost efficiency estimates),

π = variable profits (for alternative profit estimates)

w_1 = the price of labor (salaries and employee benefits / number of full-time equivalent employees),

w_2 = the price core deposits,

w_3 = the price of purchased funds,

y_1 = securities (all non-loan financial assets),

y_2 = loans and leases (book value of consumer and business loans),

z_1 = physical capital (book value of fixed assets and premises),

z_2 = equity capital.

Specifically, we measure the traditional cost and profit functions using the FR-Y9 items listed in Table 4.

4.3 Modified Estimation of Efficiency

DeYoung (1993) modifies the balance sheet outputs by including *fee income minus services charges on deposit accounts* (service charges on deposit accounts are included below in y_3, the transactions based fees on deposits) to account for the increasing importance of noninterest income to commercial banks (and bank holding companies).

Accounting for payments-driven revenues, we modify the output vector (the y vectors) of the cost and profit functions to include the outputs from banking activities other than lending. The modified output vector includes:

(a) total loans = y1

(b) total securities = y2

(c) payments-related outputs = y3

(d) all other noninterest income = y4

The *payments-related outputs,* described in Section 2 include:

(1) Service charges on deposit accounts,

(2) Foregone interest revenue,

(3) Payments-related income from fiduciary accounts (trust revenues),

(4) Payments-related fees from credit cards (from both on-balance sheet credit card receivables and securitized credit card receivables), and

(5) Fees from ATMs (third-party fees not included in service charges on deposit accounts).

We, therefore, modify the traditional cost function accordingly, and alternate our cost and profit function specification, where

y_3 = payments-related outputs, and

y_4 = noninterest income - y_3.

Items included in y_3 and y_4 are listed in Table 2.

Sum of Payments-related revenues

We measure separately each of the payments-related revenue streams (service charges on deposit accounts, ATM Fees, payments-related credit card revenue, foregone interest, and payments-related trust revenues). For estimating efficiency, we aggregate these measures into one variable and define this variable "y_3 = payments services related outputs" as follows:

y3 = service charges + payments-related card revenues + ATM revenues + foregone interest + payments-related trust revenues

We also include in the estimation:

y_4 *= All other noninterest income*
      = noninterest income – (y3).

Business strategy

Banks which are heavily involved in payments services, or that produce a different output mix, have a different production function than banks which produce few payments services. This may also differ by specific payments service, i.e., banks primarily involved in credit cards or in processing. Thus, estimation of production function must include non-intermediation outputs such as payments-services and fee income. We include a measure of business strategy in our analysis, and also vary the inclusion of bank by business strategy in our estimation.

4.4 Tests Of Hypotheses In Efficiency Estimation Including Payment Services.

The first hypothesis is that the payments-driven revenues omitted in the traditional estimation are substantial and that by including additional (payments-related) output vectors in our estimation, the efficiency estimates change substantially. The second hypothesis is that business strategy and not specific payment activities affect efficiency. If this is the case, then we do not expect the relative ranking, or efficiency order, of these BHCs to change for many of the BHCs in the sample.

We conduct three tests. First, we test for a statistically significant difference in efficiency estimated by the traditional approach and the modified approach. Next, we split the sample into quartiles and test for statistically significant differences in efficiency between the traditional and modified approach. Finally, we rank the BHCs by traditional efficiency, and record those rankings, then we rank the BHCs by modified efficiency and compare the rankings, by business strategy with the traditional efficiency rankings.

Estimated Efficiency

Tables 5 lists the mean efficiency estimates in the traditional and modified approach. Also included are the standard deviation of those estimates and the mean Tobin's Q. Table 5 shows that, on average, all BHCs increase efficiency by about 20%. Global Processors, specifically, increase

efficiency by about 50% when we include payments-driven revenues into the production function, a statistically significantly greater increase in efficiency then the sample. This suggests that one type of BHC may be more greatly affected by inclusion of payments-driven revenues than other BHCs.   Table 5 also lists the mean franchise value or Tobin's Q by BHC type. Note that despite the lower traditional efficiency estimates, the Global Processors have higher mean franchise value than the other three BHC types. This difference is statistically significant at the 1 percent level. This suggests that although estimates of traditional efficiency may indicate that Global Processors are less efficient, the market values these BHCs at a higher level than other BHC types. We infer from this result that traditional efficiency estimates which exclude nontraditional bank activities inaccurately measure the relative performance of some types of BHCs. Further research on this topic is warranted to identify additional activities that should be included in efficiency estimation. Payment activities are just one of many activities excluded from traditional efficiency estimation. Rogers (1998) discusses some of the other activities that may be included in future research.

Tests of Efficiency Differences in Quartiles

If the traditional approach to efficiency estimation significantly understates the profit efficiency of banks that generate a large portion of their income through these activities and overstates the profit efficiency of banks that generate only a small portion of their income through these activities.

Because efficiency estimates are not directly comparable across frontiers, the traditional estimates are not directly comparable to the modified estimates. We, therefore, rank the estimates by traditional and by modified efficiency and divide the sample into quartiles.

We split the sample into quartiles and test for changes in efficiency in the lowest-efficiency and highest-efficiency quartile between the traditional and the modified model specifications. Efficiency is estimated for 284 BHCs using the traditional approach. The sample is split into quartiles by efficiency and averaged by quartile. We maintain the quartile subsamples and re-

estimate efficiency using the modified approach. We average the efficiency by the subsample created in the first step and test for significant changes in efficiency among subsamples. If we are underestimating efficiency in the traditional method, then we expect to find that the lowest quartile shows a significant increase in average efficiency when efficiency is re-estimated in the modified method.

We find, in fact, that we are underestimating efficiency for the lowest quartile. In the lower quartile, average efficiency goes from 21.5 in the traditional estimation to 27.6 in the estimation that includes payment services, a 28.8 percent increase in estimated efficiency. Moreover, three of the four Global Processors were in the bottom quartile and all four were in the bottom half of the sample using the traditional approach. If we rank the BHCs by modified efficiency, we find that all four of the Global Processors move to the top half of the sample.

In the upper quartile, the most efficient BHCs ranked by traditional standards have an average efficiency of 43.2 in the traditional estimation and 49.8 in the modified estimation, a 15.6 percent increase. We infer from this result that (1) both the lower quartile and upper quartile have higher profit efficiency estimates when we include revenues from payment services and (2) that the lower quartile BHCs, by traditional standards, does indeed show a significant increase in average efficiency in the modified specification.

Further research is warranted to determine more precisely how the profit efficiency is affected by the choice of inputs in the production function. We note that our results are limited by data availability on payments-driven revenues. As more years of data become available, we will include them in our sample. Future research will include a great number of firms and will use a panel set of banks, rather than year-end 2001 only.

5. Summary and Conclusion

This study explores two issues relating to the value that payments-related activities may add to the bank. We first explore the effect of payment-driven revenues to the franchise value of

BHCs. We then examine whether banking sector output is being mismeasured by underestimation of payment-related revenues.

In exploring the first issue (franchise value), we find a small but positive correlation between payments-driven revenues and franchise value (Table 3). We find, also, that those BHCs with greater franchise value have a different business strategy than other BHCs (Table 5). Conglomerates have statistically significantly lower franchise values, while Global Processors and Credit Card banks have higher franchise values on average.

With regard to the second issue (bank efficiency), we find that business strategy affects profit efficiency and suggest that empirical analysis must separate BHCs by activity. Profit efficiency shows the greatest change in one type of business strategy (Global Processors) when payments-driven revenues are included. Our estimation shows that, on average, BHCs increase efficiency by about 20%. Global Processors, specifically, increase efficiency by about 50% when we include payments-driven revenues into the production function. These BHCs show a dramatic change in relative efficiency ranking; the Global Processors were in the lower half of the sample when ranked by traditional efficiency, but all moved to the top half of the sample when ranked by modified efficiency.

Assessing the results from these two issues of franchise value and efficiency together (Table 5) provides additional insight. Despite *lower traditional efficiency estimates*, the Global Processors have *higher mean franchise values* than the other three BHC types. We find evidence to suggest that traditional efficiency estimates which exclude nontraditional bank activities inaccurately measure the relative performance of some types of BHCs. Further research is warranted to determine more precisely how the profit efficiency is affected by the choice of inputs in the production function. We note that our results are limited by data availability on payments-driven revenues.

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Table 1
Summary Statistics
N=98

Definition	Mean	Std Dev	Min	Max
Tobins Q (N=98)	1.113	0.094	0.916	1.475
Service Charges on Deposit Accounts ($mil)	211.68	557.57	0	4,559.00
Payments-related Credit-card Revenue ($mil)	52.03	258.11	0	2,327.49
ATM Fees ($mil)	39.66	135.04	0.420	1,114.40
Trust Revenues – Lower Bound ($mil)	94.11	378.37	0	3,311.13
Foregone Interest Revenue ($mil)	163.08	368.98	0	2,483.29
Assets ($mil)	53,722.20	147,691.78	2,069.99	1,051,450.0

Table 2
Summary Statistics
N=284

Definition	Mean	Std Dev	Min	Max
Service Charges on Deposit Accounts ($mil)	80.16	339.60	0	4,559.00
Payments-related Credit-card Revenue ($mil)	18.37	152.68	0	2,327.49
ATM Fees ($mil)	16.44	82.94	0	1,114.40
Trust Revenues – Lower Bound ($mil)	32.53	225.20	0	3,311.13
Foregone Interest Revenue ($mil)	62.24	227.51	0	2,483.29
Assets ($mil)	21,406.41	90,638.67	1,005.45	1,051,450.0
Profit ($mil) (Non interest income + interest income – noninterest expense- interest expense)	440.05	2,017.47	1,824.0	28,119.0
Total Revenue ($mil)	1,947.51	8,552.36	56.69	111,444.0
Securities ($mil)	7,095.30	37,495.35	44.87	449,973.00
Loans and Leases ($mil)	10,481.52	38,702.27	118.97	408.21
Profit Efficiency, Traditional Model (%)	31.24	10.10	14.44	100.00
Profit Efficiency, Payment Systems (%)	37.38	12.75	18.45	100.00

Table 3
Correlation Analysis of Franchise Value and Payments-Driven Revenues:
2001

Franchise value is measured as Tobin's Q. It is calculated as Q=(E+L)/(A-goodwill), where E is the market value of equity, L is the book value of liabilities and A is the book value of assets. * denotes that correlation is significantly different from zero at the 10 percent level. The category "All payments-driven revenues" is the sum of the first five categories of payments-derived revenues listed below. N=98 BHCs.

Service Charges on Deposit Accounts	0.045
Payments-Driven Credit Card Revenue	0.103
ATM Fees	0.083
Payments-Related Trust Revenues	0.368*
Foregone Interest Revenue on Transaction Accounts	0.053
All Payments-Driven Revenues (sum of rows 1-5)	0.172*

Table 4
Definition of Variables Included in Profit Efficiency Estimation

Variable	Definition	Calculation
P	Variable Profits	Interest Income + Interest Income – (Interest Expense + Noninterest Expense) – Extraordinary Items
w_1	Price of Labor	Salaries and Benefits / Number of Full Time Employees
w_2	Price of Core Deposits	Interest Expense on "Other" Deposits (All Deposits Other than in Foreign Offices and Domestic Time Deposits, or CDs) / [(Demand Deposits + NOW, ATS, Other Transactions Accounts + Money Market Deposit Accounts and Other Savings Accounts) *In Commercial Bank Subsidiaries* + (NOW, ATS, Other Transactions Accounts + Money Market Deposit Accounts and Other Savings Accounts*) In Other Depository Institutions Or Nonbank Subsidiaries*]
w_3	The Price of Purchased Funds	(Expense of Federal Funds Purchased and Securities Sold Under Agreements To Repurchase + Interest on Trading Liabilities and Other Borrowed Money + Interest Expense on Subordinated Notes and Debentures and on Mandatory Convertible Securities) / Total Liabilities
y_1	Consumer and Business Loans	Loans And Leases, Net
y_2	Securities	Interest Bearing Balances in US Offices + Interest Bearing Balances in Foreign Offices + Securities Held-To-Maturity + Securities Available-For-Sale + Federal Funds Sold and Securities Purchased Under Agreement To Resell + Trading Assets
y_3	Sum of Payments-Related Outputs (See below)	Sum Of Payments-Related Revenues, Listed Below: (1) Service Charges On Deposit Accounts in domestic accounts (including demand deposits, excluding savings deposits), (2) Payments-Related Fees From Credit Cards (From Both On-Balance Sheet Credit Card Receivables And Securitized Credit Card Receivables), (3) Fees From ATMs (Third-Party Fees Not Included In Service Charges On Deposit Accounts), And (4) Foregone Interest Revenue (Deposits in DDAs*(fed funds)+ Deposits in NOW accounts*(fed funds-NOW rate)+deposits in MMDAs*(fed funds-MMDA rate)) (5) Income From Fiduciary Accounts*.
y_4	All Other Noninterest Income	Total noninterest income minus y3
z_1	Physical Capital	Expense Of Bank Premises, Furniture, Etc.
z_2	Equity Capital	Total Equity Capital

Table 5
Profit Efficiency
Including ALL BHCs
N=284

This table displays efficiency estimates averaged by BHC type. Standard deviations are listed in parentheses below average efficiency estimates.

	N	Tobins' Q	Traditional Profit Efficiency	Modified Profit Efficiency	Percentage Change
All BHCs	284		31.24	37.38	19.65%
			(10.10)	(12.75)	
Conglomerates	6	1.12	25.65	34.83	35.79%
			(1.65)	(8.77)	
Global Processors	4	1.29	23.64	35.66	50.85%
			(2.81)	(15.27)	
Credit Card BHCs	4	1.23	29.06	32.57	12.08%
			(8.21)	(12.30)	
Regional BHCs	270	1.10*	31.51	37.53	15.20%
			(10.07)	(12.43)	

* Only 85 observations of Tobin's Q available for Regional Banks

Table 6
Difference of Means Tests for Upper and Lower Quartiles
Traditional and Modified Efficiency Estimates

Difference of Means Test - Upper Quartile

	Traditional	*Modified*
Mean	43.2	49.8
Variance	11.2	13.4
Observations	76	76
t-statistic	-3.37	
Percentage Change in Efficiency		15.65%

Difference of Means Test - Lower Quartile

	Traditional	*Modified*
Mean	21.5	27.6
Variance	27.7	10.4
Observations	70	70
t-statistic	-4.81	
Percentage Change in Efficiency		28.80%

Hypothesized mean difference in both tests is 0.00
Critical t-statistic for two-tailed standard normal distribution is 1.98

Appendix A

Efficiency Concepts

Alternative Profit Inefficiency

Profit inefficiency measures how close a BHC is to earning maximum profits given its output levels. (Berger and Mester, 1997). Standard profit maximization takes output *prices* as given. Alternative profit maximization takes output *quantities* as given. We estimate alternative profit efficiency in initial analysis.

The alternate profit function in log form is:

$$\ln (\pi + \_) = f(w,y,z) + \ln u_c + \ln \_c, \tag{6}$$

where π measures variable profits, w is the vector of quantities of prices of variable inputs, y is the vector of quantities of variable outputs, z indicates the quantities of any fixed netputs (inputs or outputs). A constant, $\_$, is added to each firm's profit, so that the log is taken of a positive number.

Stochastic Frontier Approach (SFA)

The SFA estimates a cost or profit function with a composite error structure that separates the random error and the profit inefficiencies. The random error term, *ln* $\_$, is assumed to be two-sided (usually normally distributed). The inefficiency term, *ln u*, is assumed to be one-sided (usually half-normally distributed).

One disadvantage of this approach is that the SFA imposes distributional assumptions on the error term and the inefficiency. Two studies (Bauer and Hancock, 1993 and Berger, 1993) find that the inefficiency terms, *ln u*, behave more like symmetric normal distributions than half-normal distributions.

Functional Forms for the Parametric Methods

The functional form that we choose for our profit functions (equations 2, 3, 4) is the Fourier-flexible functional form. This functional form is a global approximation that includes a standard translog plus Fourier trigonometric terms (Berger and Mester, 1999). One disadvantage of this functional form is that its assumes mutual orthogonality between the profit inefficiency estimates and the profit function exogenous variables. This orthogonality is perfect only if the data are evenly distributed over the $[0,2\pi]$ interval (defined in equation 4 below), which is not the case with US banking data (Berger, 1993). This functional form, however, has been shown in recent studies to fit data for US financial institutions better than other functional forms, namely the translog functional form (McAllister and McManus, 1993; Berger, Cummins and Weiss, 1997; Berger and DeYoung, 1997; Mitchell and Onvural, 1996).

The profit function is specified as:

$$
\begin{aligned}
\ln(P/w_3 z_2) = \alpha &+ \sum_{i=1}^{2} \beta_i \ln(w_i/w_3) \\
&+ \frac{1}{2}\sum_{i=1}^{2}\sum_{j=1}^{2} \beta_{ij} \ln(w_i/w_3)\ln(w_j/w_3) + \sum_{k=1}^{2}\gamma_k \ln(y_k/z_2) \\
&+ \frac{1}{2}\sum_{k=1}^{2}\sum_{m=1}^{2} \gamma_{km} \ln(y_k/z_2)\ln(y_m/z_2) + \delta_1 \ln(z_1/z_2) + \frac{1}{2}\delta_{11}\ln(z_1/z_2)^2 \quad (7)\\
&+ \sum_{i=1}^{2}\sum_{k=1}^{2}\eta_{ik} \ln(w_i/w_3)\ln(y_k/z_2) + \sum_{i=1}^{2}\mu_i \ln(w_i/w_3)\ln(z_1/z_2) \\
&+ \sum_{k=1}^{2}\theta_k \ln(y_k/z_2)\ln(z_1/z_2) + \ln u + \ln \varepsilon
\end{aligned}
$$

where:

P = variable profits, plus a constant, _,

w_1 = the price of labor (salaries and employee benefits / number of full-time equivalent employees),

w_2 = the price core deposits,

w_3 = the price of purchased funds,

y_1 = securities (all non-loan financial assets),

y_2 = loans and leases (book value of consumer and business loans),

z_1 = physical capital (book value of fixed assets and premises),

z_2 = equity capital,

$\ln u_c + \ln \_c$ = the composite error term, and

cos(_) and sin (_) are mutually orthogonal trigonometric Fourier terms included to improve

the fit of the model and span the interval [0,2π].

Inefficiency Ratio

We measure profit inefficiency as the ratio of estimated BHC costs required to produce its

given outputs if it were as efficient as the best-practice BHC producing the same exact output. The

profit inefficiency ratio (Berger and Mester, 1997) is:

$$Alternative\ \pi\ EFF^i = \frac{\hat{\pi}^{min}}{\hat{\pi}^i} = \frac{\{\exp[\hat{f}(w^i, y^i, z^i)] \times \exp[\ln \hat{u}_\pi^i]\} - \theta}{\{\exp[\hat{f}(w^i, y^i, z^i)] \times \exp[\ln \hat{u}_\pi^{max}]\} - \theta}, \quad (8)$$

where $\hat{u}_\pi^{max}$ is the maximum value of $\hat{u}_\pi^i$ in the sample, *i* indexes the individual BHCs. This

ratio can be considered as the proportion of profits that are used *efficiently*. Likewise, if we subtract

that ratio from one (1 – profit EFF^i), then we have the proportion of costs that are used *inefficiently*.

For example, if a BHC profit ratio is 0.75, then that BHC is *75% efficient, or 25% inefficient*. The

range of this ratio is between 0 and 1, with 1 being a wholly efficient BHC.