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Trends in relationship lending and factors affecting relationship lending efficiency

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Abstract

This paper investigates the efficiency of relationship managers at the Canadian Imperial Bank of Commerce (CIBC) one of Canada's largest banks. Data envelopment analysis (DEA) efficiency scores are analyzed using regression. The results demonstrate that managers are less efficient when facing larger numbers of loans or smaller loans. M. Berlin and L.J. Mester (On the profitability and cost of relationship lending, Working paper no. 97-43, The Wharton School, University of Pennsylvania, 1997) show that credit smoothing is generally suboptimal. A more complete explanation is obtained by taking a micro-level focus. Other results indicate that banks may improve profitability by reserving relationship lending for loans of larger size. Tests of relationships between efficiency and nonperforming loans and of the skimping hypothesis are conducted.

JEL classification: G21; D2; L21

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1. Introduction

As global financial markets converge and borrowers find new avenues to obtain financing without bank intermediation, interest in bank efficiency has increased among bankers and academic researchers alike. In this environment, mergers between exceptionally large banks have become increasingly frequent as the banks strive to capture economies of scale and scope in order to deal with the heightened levels of competition. Canada's banking industry is not isolated from these pressures. An announcement of merger plans between two of Canada's largest banks (Royal Bank and Bank of Montreal) in January 1998, was quickly followed by an announcement in April of 1998, that two of the remaining large banks [Canadian Imperial Bank of Commerce (CIBC) and Toronto Dominion] had similar intentions. The Canadian government subsequently denied the mergers in December of 1998, on the grounds that the industry is already too concentrated, but this issue will likely re-emerge in the future, perhaps as early as the year 2001. Although their merger plans may have been put on hold, CIBC is continuing to study the efficiency aspects of all operational areas.

The primary purpose of this study is to explore the efficiency of the commercial-lending relationship managers at CIBC. Using a combination of standard econometric techniques and data envelopment analysis (DEA) a linear programming technique, we also investigate the factors underlying such changes. Relationship lending, has generally been an area of strength for banks particularly on its traditional turf of loans to small and mid-size firms, where there are distinct benefits to close monitoring, renegotiability of loans and implicit long-term contracts. The alternative to relationship lending is essentially a replication of the retail lending market in small-business lending. It is characterized by the use of credit scoring models, automated decision making and securitization. This is the form of lending which Berlin and Mester (1997a) refer to as transactional lending. However, it is the relationship-lending role in which individual managers can be expected to have the most significant effect on the profitability of their loan portfolio because of the heightened importance of discretionary decision making and the potential for more extensive interaction with borrowers.

Unlike most of their competitors, CIBC has not moved as rapidly toward the transactional lending model, but has relied more extensively on the skills of the relationship managers to assess credit risk and to monitor borrower performance, even at the smaller end of the loan-size spectrum. For this strategy to succeed, the additional costs of the relationship-lending approach would have to be compensated by some combination of reduced loan losses, and improved customer allegiance, where the latter eventually leads to increases in future lending business. Otherwise, it would be more profitable to adopt the transactional approach. CIBC has not abandoned relationship lending, but the average loan size in the relationship-lending segment is smaller than in earlier years and both the dollar value and number of relationship loans have declined.

Although relationship lending captures the essence of what we think of as traditional banking, it has not received much attention from researchers and there have been no studies of relationship banking using Canadian data. There are a few recent empirical studies which have focused on the issue of loan-rate smoothing as a distinctive feature of relationship lending. Berger and Udell (1992) provide evidence that banks smooth loan rates in response to interest-rate shocks. The underlying intuition is that customer relationships are strengthened if the bank does not immediately raise borrowing rates in response to increases in the market interest rate. The bank is able to recapture the cost of this strategy by damping any adjustments to downward movements in the interest rate. That is, the borrower bears less of the impact of increases in interest rates in exchange for somewhat higher borrowing costs when interest rates fall. The borrower is willing to pay the higher costs when interest rates fall, based on the implicit understanding that in future periods, any upswings will also be damped. The existence of a contracting region is a natural consequence of this structure.

Peterson and Rajan (1995) and Berlin and Mester (1997a) find related evidence that banks smooth loan rates in response to changes in credit risk in a manner similar to their interest rate smoothing strategy. However, Berlin and Mester (1997b) suggest that the smoothing of credit risk changes does not seem to support optimal contracting, whereas interest-rate smoothing may enhance profitability. In short, the difficulty with smoothing credit risk changes is that unlike the fluctuating patterns of interest-rate changes, downgrades in credit quality, or increases in credit risk are all too often followed by further increases in credit risk. This leaves scant opportunity to implement a smoothing strategy that does not systematically lose money.

The changes in individual performance levels across time cannot be properly dealt with in isolation from the circumstances in which the individuals are operating. It is also necessary to review the overall structure of the relationship-lending environment at the bank level.

Exploration of the environmental changes improves our understanding of the factors affecting changes in performance at the individual manager level. In particular, the effects of the recession in the early 1990s, perhaps enhanced by some "window dressing" in accounting practices, impede the determination of the factors influencing changes in efficiency over the 1990–1995 period.

Banks have been quick to recognize that achieving peak operating efficiency is an essential ingredient to remaining competitive. And if any of the gains from improvements to operating efficiency make their way through to the consumer, the results ought to be better prices and service. Ultimately, safety and soundness in the banking industry will be enhanced as well, if any portion of the cost savings from efficiency improvements is used to augment bank capital.

The bank is interested in finding methods of measuring the performance of the relationship managers and even more importantly, they need to know if there are any keys to improving operating efficiency. That is, if certain strategies lead to improvements in future profitability then identifying those strategies is a valuable endeavor. Due to the nature of relationship lending, insights gained from its investigation are likely to be transferable to other lending and portfolio management activities.

With the benefit of highly detailed data, which is disaggregated down to the individual-loan level, we can explore the effects on efficiency over time of changes in various attributes of the relationship managers' portfolios. Other than smoothing the rate on loans, relationship managers also have control over the structure of their portfolios in terms of the overall level of risk. They can also adjust the amount of effort they devote to screening and monitoring loans. These issues are further intertwined with the issue of credit quality. We recognize that the spread over the prime rate, which the bank describes as a risk premium, also reflects their perception of the quality of the credit, so the term quality spread may be equally appropriate. Although we employ the bank's terminology, the distinction is not important for our purposes.

The remainder of the paper is organized as follows. Section 2 outlines the relationship-lending environment during the 1990–1995 period and reveals some of the changes that took place. Section 3 describes the highly detailed micro-level data set provided by the CIBC for the purposes of this study. Section 4 explains the DEA methodology and the results of its application to the relationship-lending data. Section 5 details the second stage analyses of the factors affecting the DEA scores. Section 6 summarizes the main results and offers some concluding comments.

2. Trends in relationship lending from 1990 to 1995

CIBC provided individual-loan level data for all of their relationship-lending centers, Canada-wide, for the years 1990–1995. To measure the managers' efficiency levels, the information on individual loans was aggregated to the relationship-manager level to reconstruct their portfolios for each year. But aggregating the individual-loan information all the way up to the bank level reveals several broad trends across the period that will need to be kept in mind when we analyze changes in the managers' efficiency levels.

Table 1 includes an overview of the number of loans, the number of non-performing loans and the number of loan centers across the 1990–1995 period. As loans are originated and retired over time, the number of loans fluctuates from a high of 21,838 in 1990 to a low of 12,156 in 1995. We can see that the

Table 1
Descriptive statistics, loans, loan centers and relationship managers, 1990–1995[a]

	1990	1991	1992	1993	1994	1995
Total number of loans	21,838	20,755	18,260	14,623	12,883	12,156
Number of NPLs	824	975	1332	1400	1376	1162
Number of loan centers	65	62	63	66	57	56
Number of loans/manager						
Average	64	69	55	42	44	45
Maximum	318	3673	1543	188	192	190
Minimum	1	1	1	1	1	1
S.D.	40	213	90	28	27	32
Number of managers	341	300	330	352	296	271
Average per center	5.2	4.8	5.2	5.3	5.2	4.8
Maximum	33	41	46	38	21	21
Minimum	1	1	1	1	1	1
S.D.	5.1	5.8	6.6	5.7	4	3.9
Total loan value (millions)	30,576	31,988	31,670	26,601	12,572	13,328
Average loan (millions)	1.4	1.55	1.7	1.82	0.98	1.1
Maximum	852.9	591.58	552.22	331.08	210.41	211.491
Minimum	0	0	0	0	0	0
S.D.	11.3	11.8	11.77	11.02	4.91	5.39
Value of NPLs (millions)	747.5	825.43	2,158.71	1,871.46	1,063.67	1,108.07
Average NPL (millions)	0.91	0.85	1.62	1.3	0.77	0.95
Maximum	103.72	93.21	313.33	248.45	53.99	50.53
Minimum	0	0	0	0	0	0
S.D.	5.46	3.84	12.02	8.06	2.53	3.46
Operating profit	400.19	386.62	352.76	239.19	154.59	195.74
Relationship costs	56.85	54.69	47.9	49.04	37.88	41.05
As % of operating profit	14.20%	14.10%	13.60%	20.50%	24.50%	21.00%

[a] All amounts are in current Canadian dollars.

number of portfolio managers varies over the six-year period with 341, 300, 330, 352, 296, and 271 annual observations. Although we would expect a reduction in the number of loans to be accompanied by reductions in the numbers of managers and lending centers, the relationship is not one-to-one. Since problem loans require more management attention, the large increase in the number of nonperforming loans in 1992 probably restricted the bank's ability to eliminate managers. Still, over the six-year period, the number of centers declined from 65 in 1990, to 56 in 1995 and the number of managers was reduced from 341 to 271. The most noticeable change occurs in the largest lending center which cut its staff of 46 managers in 1992, to 21 in 1994. Although CIBC did not indicate whether individual managers were transferred or dismissed, they did indicate that year-to-year adjustments in the number of managers primarily involve transfers, promotions and retirements rather than dismissals due to poor performance. The data include several managers who were apparently called back into service after one or more years on hiatus.

The average number of loans per manager varies over the 1990–1995 period from a high of 69, in 1991, to a low of 42 loans in 1993. The relatively high values for the maximum number of loans and the standard deviations are driven by loans to real estate developers who establish individual loans for each development project. As a result, individual developers dealing with a single relationship lender tend to have unusually large numbers of loans.

The next section of Table 1 displays the values of the bank's relationship loans in Canadian dollars (C$). In 1990, the total value of loans booked by relationship managers exceeded C$30 billion but by 1995, the dollar value had declined to just over C$13 billion. C$14 billion of the decrease occurred during the single year, 1994. A large portion of the one-year drop was comprised of relatively large loans which can be seen by looking at the average loan-size figures. In 1993 the average loan size was greater than $1.8 million but dropped to values near C$980,000 in 1994 and 1995.

Table 1 also reveals the changes in the dollar value of nonperforming loans. In 1990 and 1991, the levels of nonperforming loans were below C$1 billion but ballooned to values of C$2.2 billion in 1992 and C$1.9 billion in 1993. In 1994 and 1995, nonperforming loans dropped from the lofty levels of 1992 and 1993, but were still in the region of C$1.1 billion. In percentage terms, the value of nonperforming loans in 1994 and 1995 are approximately 8.5% of the total loans. This is even higher than the 7% levels of 1992 and 1993 and well above the 2.5% levels of 1990 and 1991.

The general impression so far is that of a declining number of loans, with smaller dollar values and a greater fraction of nonperforming loans in the bank's portfolio. In this environment, we would expect to see a decline in overall efficiency for two primary reasons. The first reason is that the average loan quality is lower, given the increased fraction which is nonperforming. Lower-quality loans require more extensive monitoring by the relationship manager which is a costly activity. Alternatively, if lower-quality loans do not receive additional monitoring, then subsequent increases in nonperforming loans, possibly combined with reductions in recovery rates in the event of default, will increase costs and lower revenues.

The second reason to expect lower efficiency is the reduction in average loan size. Table 1 shows that the average loan size changed dramatically over the course of 1994. In 1993, the average loan size was above C$1.8 million, but in 1994, the average was under C$1 million. The changes are not business-cycle effects, since the recession took place in the early 1990s and the economy began to recover in the second half of our sample period. However, the change in loan size may be a loan demand effect, or a deliberate strategy by bank management to replace larger relationship loans with bonds, issued through their securities subsidiaries. In general, the average size of nonperforming loans was significantly below the overall average size although in 1992, the gap is narrowed due to the influence of a small number of extremely large loans classed as non-performing.

The relevance of average loan size relates to the role of the relationship manager as delegated monitor as described in Diamond, 1984. Monitoring a few large loans ought to be a simpler and less expensive task than monitoring a large number of small loans. Combining the effects of reductions in average loan quality with the smaller average loan size, we might expect to find lower levels of efficiency in 1994 and 1995 than during 1990 and 1991.

The bottom panel of Table 1 shows the substantial decline in operating profit over the period and the general increase in relationship costs as a percentage of operating profit. In 1990, the operating profit of the relationship managers exceeded $400 million, a figure which is double the 1995 level. At the lowest point, reached in 1994, operating income averaged only C$150 million. A cursory inspection of the relationship cost data further supports our initial impression. Relationship costs are somewhat lower during 1994 and 1995, but as a fraction of operating profit, relationship costs climbed from 14% in 1990 to nearly 25% in 1994. The fraction for 1995, was only slightly lower than 1994, at 21% of operating profit.

The macro-level view of the relationship-lending environment we developed to this point serves as a valuable backdrop in evaluating the performance levels of the individual managers. We will need to refer to any special circumstances in the relationship-lending sector overall, when we analyze changes in efficiency of individual managers. In the next section, we turn our attention to the individual loan data and the relationship managers' portfolios.

3. The data

CIBC provided comprehensive information on 71,426 loans, each of which existed for at least part of the period from 1990 to 1995. For each loan observation, we retained figures for the net income generated by the loan, the amounts of capital and deposits involved, the direct relationship costs of the loan and the risk premium. Deposits include the compensating balances plus the amounts held as deposits by the borrowers in excess of any compensating balance requirements. Therefore, the net income figures reflect the combined cost of compensating deposits and other deposits. Net income is the sum of net interest income from assets, loan fees and contributions from cash management, minus taxes, deposit insurance, and relationship costs. [1] Relationship

[1] Taxes, deposit insurance and other expenses, are allocated to the individual loans based on being directly attributable to the loan itself, or to any related deposits. The cost of deposit insurance is dictated by the size of any deposits connected with the loan.

costs include the relationship manager's salary and other costs directly attributable to the loan. The risk premium, expressed in basis points above the prime lending rate, serves as a risk proxy for each loan.

With the exception of the risk premium, aggregating the variables to the manager portfolio level required only that we sum the loan level data. The risk premium for each loan was weighted by the value of the loan as a fraction of the manager's loan portfolio, yielding an average-weighted risk factor (AVWRSK) for each portfolio.

Summary statistics for the aggregated variables appear in Table 2. The manager level data generally reflect the trends found at the bank level. Net income levels drop after 1992, but the average relationship costs are relatively stable. The worst individual portfolio losses in the years after 1992, were several standard deviations below the mean net income figures and the magnitudes of those individual portfolio losses are large. Across time, the levels of all of the

Table 2
Manager portfolio net income and cost data (C$ thousands), 1990–1995[a]

	1990	1991	1992	1993	1994	1995
Net income						
Average	473	505	433	223	160	268
Maximum	8627	7897	7067	5547	2084	4523
Minimum	−1771	−1417	−1526	−10542	−3033	−4729
S.D.	1002	1050	934	1147	489	752
Relationship costs						
Average	168	187	151	148	134	159
Maximum	1112	5808	681	1118	584	1002
Minimum	0.01	0.00	0.01	0.01	0.01	0.00
S.D.	111	341	105	119	91	130
Deposits						
Average	13020	15852	15771	20449	13366	17399
Maximum	347289	346988	328259	571918	221196	294029
Minimum	0.01	0.00	0.01	0.01	0.01	0.00
S.D.	26613	31869	33617	52503	21071	29420
Capital						
Average	5581	6449	5368	4501	2570	2892
Maximum	69257	68880	107002	57780	39616	39719
Minimum	0.02	0.07	0.02	0.01	0.01	0.00
S.D.	8624	9555	9903	7826	4042	4271
Average-weighted risk (basis points)						
Average	113	110	114	114	120	113
Maximum	455	496	364	623	594	504
Minimum	7.5	2.0	1.1	0.01	0.01	0.01
S.D.	63	66	67	90	88	83

[a] All amounts in current Canadian dollars.

inputs exhibit far greater stability than the levels of net income. After even the most casual inspection of the data, it is not difficult to imagine what generated the heightened attention paid to efficiency in the banking sector.

Before we can discuss any changes in efficiency, we must first compute efficiency scores for each manager for each of the years in our sample period. In the next section, we explain how we obtained the efficiency scores, using DEA.

4. DEA estimates of efficiency

Data envelopment analysis is a linear-programming approach to estimating the efficient frontier by constructing the production possibilities frontier in a piece-wise linear manner. [2] DEA is quite flexible, in the sense that the inputs in the model may be quite dissimilar in terms of units of measurement, or other fundamental characteristics and yet we obtain a single number summarizing the efficiency of production. Attractive properties of the technique are that it allows us to easily compare the utilization of very dissimilar inputs in the production process and the DEA scores may be easily analyzed using standard econometric techniques. It is common practice to use the efficiency scores from DEA as inputs in a second-stage analysis of the factors underlying the efficiency scores. Examples of this approach in banking applications include Aly et al. (1990), Miller and Noulas (1996), Resti (1997) and Fried et al. (1999).

DEA is conceptually very simple. In mathematical terms, the efficiency of a decision making unit (DMU) using n different inputs to produce m outputs, is measured as the ratio of weighted outputs to weighted inputs. If there are N decision making units, the efficiency measure for the ath DMU is

$$h_a = \sum_{i=1}^{m} u_i y_{ia} \Big/ \sum_{j=1}^{n} v_j x_{ja}, \qquad (1)$$

where y_{ia} is the ith output produced by the ath DMU, x_{ja} is the jth input used by a, and u_i and v_j are the corresponding weights attached to the ith output and jth input. The efficiency ratio for the ath DMU (h_a) is maximized subject to the constraints that h_a be less than or equal to unity and the weights are non-negative.

Using the transformation developed in Charnes et al. (1978), the fractional linear program is converted into an ordinary linear program, which has as its dual:

[2] Charnes et al. (1995) provide a complete description of DEA and its applications.

$$\text{minimize } \theta_a$$

$$\text{subject to} \quad \sum_{r=1}^{N} \phi_r y_{ir} \geqslant y_{ia}, \quad i = 1, \ldots, m, \tag{2}$$

$$\theta_a x_{ja} - \sum_{r=1}^{N} \phi_r x_{ir} \geqslant 0, \quad j = 1, \ldots, n, \;\; \phi_r \geqslant 0 \text{ and } \theta_a \text{ free.} \tag{3}$$

The measure of technical efficiency, θ_a, must be between 0 and 1. The linear program as described in (2) and (3), assumes constant returns to scale (CRS). But imposing the additional restriction, that the sum of the ϕ_rs from 1 to N equals 1, allows for variable returns to scale (VRS). The conceptualization of the workings of DEA will be made easier by referring to the simple case of one input and one output shown in Fig. 1. Under the assumption of constant returns to scale, the frontier is depicted as the line OC, and the corresponding variable returns to scale frontier is MGBDEV. Once constructed, the measure of efficiency for any DMU is derived by comparing Euclidean distances from points on the frontier to the axis, with corresponding distances from the axis to points which lie below the frontier. Decision making units such as B, or D, lie on the frontier and are efficient whereas points such as S, or T, can be viewed as inefficient. S uses the same level of inputs as D but produces less output. Alternatively, it can be seen that S has the same output as F, or G, but employs more of the single input.

From an economic standpoint, the most attractive measure of efficiency would be based on the shortest distance from S to a point on the frontier, but

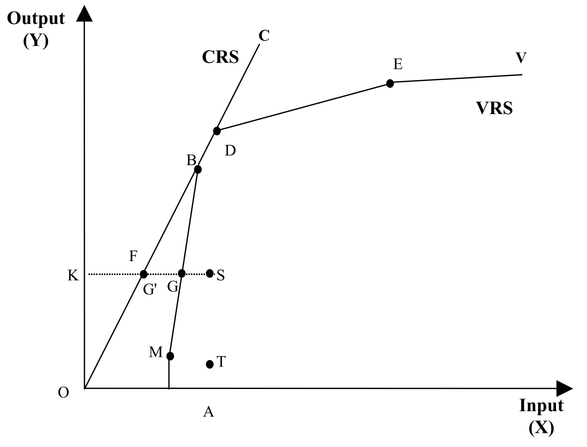

Fig. 1. Graphical representation of the DEA frontier.

this turns out to be a very difficult measure to derive due to technical reasons. [3] Therefore, the usual measures are based on either an input-oriented approach, or an output-oriented approach. To explain, consider the CRS frontier as the basis to which all the DMUs will be compared. In that case, the input-oriented measure of efficiency (θ_S) for decision maker S, is computed as the ratio of distance KF to the distance KS, which is the ratio of the level of input employed by frontier DMUs, to the level of input used by S to achieve the same level of output. Or taking an output-oriented approach the measure ϕ_S is the ratio ASD/AS. An inefficient unit such as S, would yield values of θ less than 1, and ϕ greater than 1. For example, if the computed value of θ is 0.75 then the same level of output could be produced using 25% less of the input. It is perhaps important to note that ϕ has no upper bound.

The literature surrounding DEA is vast. Many of the studies which use DEA focus on specific productivity factors in bank branches incorporating the measures of productivity which have traditionally been used in ratio form, such as transactions per employee and other financial and accounting ratios (Sherman and Gold, 1985; Oral and Yololan, 1990; Zenios et al., 1995; Sherman and Ladino, 1995 are representative). More recent examples focus more broadly on bank cost efficiency and profitability. [4]

To this point, we have not addressed the issue of adjusting the loan portfolio returns for differences in risk. Berg et al. (1992) made the original observation that prior efficiency studies had ignored the risk issue entirely. Their adjustment was to add nonperforming loans as a risk proxy in a nonparametric study of bank production. Berger and DeYoung (1997) however, left the question as to whether or not researchers should control for problem loans up to the researcher, depending on the objective of the study.

In our efficiency estimates, since we have detailed information on each individual loan, we include in the DEA model, a weighted average spread over the prime rate (AWRSK) to proxy portfolio risk, as an input in generating profit. AWRSK is computed by multiplying the spread over the prime rate for each loan, by the value of the loan as a fraction of the portfolio value. In treating risk as an input we assume that the acceptance of additional risk ought to be compensated by a higher rate of return. That is, a low-risk manager can be expected to earn low profits since she charges lower interest rates on her relatively safe loans. If we compare her performance to high-risk managers, she

[3] The issue here hinges on whether or not the point is "properly enveloped". In admittedly simplified terms, DEA software, which appears to provide a measure based on the minimum Euclidean distance to the frontier, provides the correct measure only when the reference point is on a facet of the multi-dimensional frontier. When the point is on an extension of a facet, this is no longer the case and the meaning of the efficiency score obtained is no longer clear. This technical issue is an area of research that is not as yet satisfactorily resolved.

[4] See, for example, Resti (1997) and Miller and Noulas (1996).

will appear inefficient in most years, not because she is truly inefficient, but because she makes low-risk loans. [5] The addition of the risk measure controls for this effect. Even though the bank employs internal risk measures, they are revised from time to time as the risk of the loan changes and therefore, the risk premium incorporated in the AWRSK variable is preferred since it is a better reflection of the risk assessment at the time of loan origination.

The DEA model we employ takes a profit-based approach that is similar in nature to Hughes et al. (1995). [6] That is, $\pi_t = f_t(K_t, D_t, \mathbf{X}_t, \omega_t) + \epsilon_t$. In period t, a manager produces net income (π_t), using inputs of capital (K_t), and deposits (D_t), as well as an aggregate of other inputs (X_t) captured as relationship costs. Relationship costs primarily reflect salaries paid to relationship managers, so labor is treated in the same fashion as any other input. [7] This point is important since if salaries were not included in the model, a manager shown to be *technically* inefficient, could still be *economically* efficient if her salary was sufficiently small.

Solution of the DEA program determines the production technology, unlike parametric methods in which the technology must be specified in advance. The program seeks to maximize the efficiency score of each manager based on the profit obtained from the inputs employed. However, the profit function approach does introduce joint pricing and other considerations that make the analysis more complex. In our case, we assume that since the managers are within a single firm, they face the same input prices. [8]

We assume that the relationship managers can control attributes of the loan, but not the rates paid on deposits. The latter would be controlled by the bank rather than the relationship manager and consequently, the individual manager could not increase available deposits simply by offering higher rates. It is also the case that banks often allocate additional capital to loan portfolios that are of higher risk. This could detrimentally affect the efficiency scores related to riskier portfolios but we need only assume that the pricing of such loans adequately reflects the additional cost to resolve this issue.

Motivated by the literature surrounding the appropriate choice between the transactional or production models of financial intermediation, we might have included the dollar value of loans as an additional input. However, there is a

[5] Thanks are extended to an anonymous reviewer for suggesting this intuition.

[6] The advantages to employing a profit-based approach are explained in Mullineaux (1978), Berger et al. (1993) and Berger and Mester (1997).

[7] Accounting rules used to allocate relationship costs could potentially affect individual efficiency measures if, for example, overhead costs are allocated on the basis of salary. If this were the case, higher salaried managers would appear inefficient since they would also bear a larger share of the overhead costs. However, this is not a very likely method of allocating overhead expenses.

[8] For a more thorough discussion of the linkages between profit functions and DEA models, see Chambers et al. (1998) and Färe and Grosskopf (2000).

high level of collinearity between loans and deposits. Although convergence issues ruled out further exploration, this remains an interesting issue that is not discussed in the transactional/production arguments. Left with choosing only one of loans or deposits as inputs, deposits seemed the more natural choice. Furthermore, parsimony is desirable in DEA models since larger numbers of inputs increase the likelihood that an observation will be improperly enveloped. [9]

The additional input included in the model is the level of risk (ω_t) proxied by our weighted average risk measure, AWRSK. In the DEA framework, the ϵ_t term is assumed to be fully attributable to inefficiency. Note that we also allow for the possibility that managers alter their production technology across time.

The software used in estimating the DEA scores requires that all inputs and outputs be nonnegative. However, in our case the output is net income, which need not satisfy this constraint. Managers can lose money. This made it necessary to translate the net income data by adding a positive translation factor, with a magnitude equal to that of the largest net loss observed in the six-year period spanned by the data. Since the output-oriented DEA scores are ratios of the frontier level of output in relation to the output of the manager being assessed, adding a constant to both the numerator and the denominator necessarily alters the measure obtained. Although it is a relatively simple matter to adjust the scores for the effects of the translation, in our case the magnitude of the translation is sufficiently large that the effects on computational precision are severe. Since only the outputs were translated, efficiency scores based on comparing inputs were not affected. We computed the input-oriented scores, which are ratios of the weighted inputs that would be required using the technology of the frontier, in relation to the weighted inputs used by the manager under assessment.

Data envelopment analysis was conducted for each of the years 1990–1995 obtaining input-oriented efficiency scores (Theta-R) for each manager. In order to explore the effects of the risk measure AWRSK on the efficiency scores, the model was estimated once again for each of the years with the risk proxy excluded, yielding the efficiency scores Theta-NR. [10] The averages obtained

[9] Alternative approaches, in which both loans and deposits could be incorporated as inputs, include the use of instrumental variable techniques, or employing the shadow prices of loans and deposits as weights in order to reduce the collinearity. The advantages of DEA for our present purpose, outweigh the importance of adding an input which is highly collinear but this does not rule out using alternative means in future work.

[10] As one reviewer pointed out, DEA models which exclude this risk measure do not include any proxy for the output price. This implies that such models are not specified in a manner that is consistent with economic theory. Nonetheless, the DEA model can still be optimized without including the AWRSK variable and serves to demonstrate the sensitivity of the DEA scores to the exclusion of the AWRSK risk proxy.

Table 3
Descriptive statistics of the DEA scores Theta-R and Theta-NR

	1990	1991	1992	1993	1994	1995
Theta-R (DEA model includes risk measure)						
N	341	300	330	352	296	271
Mean	0.37	0.31	0.34	0.28	0.32	0.36
S.D.	0.27	0.25	0.30	0.32	0.32	0.32
Theta-NR (DEA model does not include risk measure)						
N	341	300	330	352	296	271
Mean	0.35	0.30	0.27	0.27	0.25	0.33
S.D.	0.27	0.27	0.30	0.31	0.31	0.31
Correlation coefficients between Theta-R and Theta-NR						
	0.981	0.941	0.947	0.968	0.950	0.975

across managers in each year, for both Theta-R and Theta-NR, appear in Table 3. If we focus on the scores obtained in 1990, using the version of the DEA model which included the AWRSK variable, the average of the efficiency score Theta-R was 0.37. Managers on the frontier are efficient and receive scores of 1.0. If a manager has a score of 0.37, then this tells us that the most efficient, or frontier managers, were able to produce at least as much output using only 37% of the inputs used by the inefficient manager.

Our risk proxy, AWRSK, warrants some discussion at this point. AWRSK can be interpreted as an output price, or as a simple indicator of the riskiness of the portfolio. It seems reasonable to assume that the input prices are the same for all of CIBC's managers. However, the managers must price the loans to reflect the expected risk. If they get it right, by correctly anticipating any additional monitoring costs or loan losses and adjusting the lending rate accordingly, then the profits generated by a riskier portfolio should be equal to the profits generated by lower risk portfolios. Otherwise, managers of risky portfolios will appear less efficient since their loan loss rates and their costs will be higher. We explore this possibility by computing DEA scores without including the risk proxy.

When we omit the risk proxy from the model, the average DEA score for 1990, is 0.35. As can be seen in the last row of Table 3, the two efficiency measures are highly correlated with all coefficients greater than 0.94. It is not surprising that the average scores are higher in each year for the estimates that include the risk proxy AWRSK. Intuitively, this is allowing the algorithm one more direction in which to optimize the DEA score for each manager. Since the program chooses the weights on the reference set of managers to maximize each individual's score, allowing one more direction in which it can move to do so, is more likely to increase, rather than to decrease, the scores obtained.

In most years, the effect of excluding the risk proxy shows relatively little effect on the average scores and the averages of both Theta-R and Theta-NR are reasonably stable across time. Referring back to Fig. 1, this may indicate that the slope of the frontier is very shallow in terms of the risk measure. If that is the case, then large changes in the risk variable can be expected to generate very little change in output. This may also indicate that managers are successfully pricing the risk such that profits are not adversely affected. Nonetheless, the efficiency scores of some managers, whose portfolios were of exceptionally low risk, obtained much higher efficiency scores when the risk proxy was included. This is expected in the DEA framework since inputs used in minute quantities are likely to receive larger weights in computing the efficiency score. It also highlights our contention that individual scores ought to be interpreted cautiously. [11]

Since we are interested in finding trends in efficiency and any factors contributing to higher efficiency scores, the actual values of the DEA scores obtained have less importance than changes in the comparison of scores across managers, or changes in managers' efficiency rankings. In the sections that follow, we explore these issues further.

5. Second stage analyses of the DEA efficiency scores

In this section, we use ordinary least-squares regression and other simple statistical methods to explore the stability of the DEA scores and some of the factors which generate differences in the efficiency scores across individual managers, as well as across time. [12] Beyond the differences in the levels of risk and other inputs consumed in the production process, the individual portfolios also differ in terms of the number of loans in the portfolios, as well as in terms of the average size of the loans and credit quality. As mentioned in Section 2, when we discussed trends in the relationship-lending environment, these factors have changed over time and we now turn to estimating the effects of these changes on managerial efficiency.

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[11] When using DEA, it is a recommended practice to test the stability of the frontier and the effects of any unusual observations by re-estimating the model after excluding the original frontier DMUs.

[12] There are alternative one-step approaches which we might have employed. For example, we may have hedonically adjusted the loan prices for "quality" effects such as loan size, number of loans, nonperforming loans and industry classification. The efficiency scores could then be obtained using the profit function specification. This remains an interesting area for future research.

5.1. Stability of DEA scores

A benefit to the DEA procedure is in its ability to reduce the efficiency measure for each manager to a single number. Once the efficiency scores are computed, they can easily be utilized as inputs to secondary procedures in order to conduct further analyses of the data. In Table 3, it appears that the averages of the DEA scores are relatively stable across time. Before further analysis however, we are interested in determining whether the consistency in the average scores extends to the individual scores. If managers are able to achieve higher levels of performance, then their strategies ought to be repeatable allowing them to achieve higher scores in future periods. On the other hand, if higher scores in one year are not associated with higher scores in the following period, then this would suggest that chance, or other factors excluded from our DEA model are important.

To address this question, we explored the relationships between performance quartiles in 1990 and performance quartiles in subsequent years. [13] Since the results for Theta-R and Theta-NR are nearly identical, only the results for Theta-R are presented in Table 4. The declining sample sizes as we compare DEA score rankings across longer time spans, emphasizes that there are some problems associated with survivorship of managers. There were 341 managers in 1991, but as shown in the table, only 220 were also active in 1991, 193 in 1992, 168 in 1993, 121 in 1994, and 101 in 1995. Looking at the cell in the top left corner, we see that of the managers in the best performing quartile of 1990, who were also active in 1991, 62.7% maintained their position in the top performing quartile in 1991. Similarly, only 8% of the managers in 1990's best performing quartile experienced a drop in performance large enough to enter the bottom quartile in 1991. Scanning down the first column, we see that a decreasing fraction of 1990's best performers remain in the top quartile. Still, by 1995, 37.6% of those top performers from 1990 are contained in the top two quartiles. A similar level of persistence appears if we focus on those in the lowest quartiles.

There are two nonmutually exclusive interpretations of these findings. First, individual performance levels appear to be stable over the short-run, but survivorship biases make it difficult to measure over longer periods. Naturally, the managers who define the distributions are the most likely to leave – the most efficient are also the most likely to be promoted and the least efficient are likely to be "reallocated" due to poor performance. Secondly, efficiency may also be affected by changing local, or sector specific economic conditions. In particular, for managers with less diversified portfolios, changes in economic factors could

[13] Thanks are extended to an anonymous referee for recommending this approach and for greatly improving the interpretation of the results.

Table 4
Stability of performance quartiles across time

	Quartiles of Theta-R '90			
	1	2	3	4
% within quartiles of Theta-R '91, N=220				
1	62.7	20.3	8.5	8.5
2	24.2	37.1	21.0	17.7
3	7.1	33.9	32.1	26.8
4	8.0	10.0	30.0	52.0
% within quartiles of Theta-R '92, N=193				
1	41.0	20.5	23.1	15.4
2	27.9	32.8	19.7	19.7
3	14.3	36.7	16.3	32.7
4	18.2	13.6	31.8	36.4
% within quartiles of Theta-R '93, N=168				
1	42.1	15.8	23.7	18.4
2	22.9	33.3	16.7	27.1
3	15.2	37	23.9	23.9
4	25.0	19.4	30.6	25.0
% within quartiles of Theta-R '94, N=121				
1	29.0	22.6	32.3	16.1
2	7.3	43.9	19.5	29.3
3	33.3	19	23.8	23.8
4	21.4	28.6	28.6	21.4
% within quartiles of Theta-R '95, N=101				
1	17.6	35.3	17.6	29.4
2	20.0	43.3	16.7	20.0
3	18.2	39.4	18.2	24.2
4	28.6	38.1	14.3	19.0

overwhelm differences in individual abilities. The impact of industry specific effects on efficiency scores remains as an interesting avenue for future research.

DEA scores can be quite sensitive to the inclusion or exclusion of individual decision-making units so the size of the correlation coefficients should not be overemphasized. Rankings will change across time-periods since the frontier managers against whom individual DEA scores are computed also change over time. Bearing such qualifications in mind, the results still support the contention that managers who perform at efficient levels in one year tend to be efficient in following years as well. Taking the more pessimistic view, it also tells us that inefficient managers tend to remain inefficient.

The evidence presented in Table 4 encourages us to look for explanations of differences in efficiency. In the following section, we outline why efficiency may be related to levels of nonperforming loans as well as the size and number of loans in the portfolio.

5.2. The relationships between efficiency and portfolio composition

As previously mentioned, Berg et al. (1992) suggested the use of the fraction of the loan portfolio that is nonperforming as a proxy for the riskiness of the portfolio. Berger and DeYoung (1997) further explored this issue but left the question as to whether or not one should control for problem loans up to the researcher. In formulating our DEA model, we could have incorporated nonperforming loans as a risk proxy. However, much like some of the other risk assessment variables recorded by CIBC, it is a backward-looking measure. In our model, the risk-spread variable is a more appropriate indicator of CIBC's perceived level of risk at the time of origination, whereas levels of nonperformance reflect the eventual outcomes.

Berger and DeYoung (1997) describes how nonperforming loans may be the result of "bad luck" in the event of an economic downturn, "bad management" due to inadequate underwriting and monitoring, or strategic behavior designed to improve short-run profits. Higher levels of nonperforming loans can result from inadequate screening and monitoring of loans, or they can result from a deliberate strategy of accepting higher risk loans in exchange for higher risk premia. If the risk premia are sufficient to offset higher future period monitoring costs, and other expected losses associated with higher levels of problem loans, then this strategy will not generate lower efficiency. On the other hand, if increased levels of nonperforming loans are the result of skimping on screening and monitoring effort, then efficiency levels in later periods will be lowered as a result. By regressing the efficiency scores on lagged values of the fraction of nonperforming loans in the portfolio, we can investigate whether managers are establishing risk premia that adequately offset future cost increases.

A related hypothesis focuses on the effect on efficiency of changes in the fraction of the portfolio that is nonperforming. A manager could, by investing some effort in monitoring and screening their loan portfolio, reduce the fraction of problem loans. However, the effort they expend is not costless, so this should only alter the product mix, not efficiency. They will reduce the expected costs of problem loans, but only by increasing investments in effort. Alternatively, if managers reduce monitoring and screening efforts in order to reduce short-run costs, then increases in the fraction of nonperforming loans should result. We may be able to shed some light on this skimping hypothesis by regressing changes in the nonperforming fraction on efficiency scores.

In Section 1, we discussed the differences between transactional lending and relationship lending. It is the importance of interactions between the borrower and the relationship manager that distinguishes the two forms of lending. By taking a more "hands-on" approach, the managers are able to exert greater influence over the performance of their loan portfolios. However, this additional effort requires that managers invest greater amounts of time in monitoring the loans and dealing with borrowers than their transactional lending counterparts. If all relationship loans require similar monitoring effort, regardless of their dollar value, then it may be more profitable to alter lending practices by more closely emulating the transactional lending model when issuing smaller loans. In making performance comparisons across the relationship managers, it may also be the case that managers who have smaller numbers of high dollar value loans achieve greater efficiency scores in large part because they have more time available to manage their portfolio.

The issue of loan size is important from two aspects. First, if efficiency scores are employed as a performance-measurement tool, it is important that the assessment instruments treat managers fairly. If, for example, a manager is placed in charge of 500 small real-estate loans, while a colleague monitors only three very large loans to an oil company, then the manager with the oil company loans may find it far easier to be efficient. The effects of diversification may partly offset the advantage of having a very small number of loans in a portfolio. Since our manager with the three large oil loans essentially has all of her eggs in one basket she may be highly exposed to company specific risks. However, we might expect that at some point, the marginal benefit of further diversification will be offset by the manager's inability to adequately monitor his portfolio. Consequently, there ought to be some point of optimal portfolio size that is unlikely to be at either of the extremes found in our sample.

Particularly, if the managers' compensation packages are tied to their efficiency, it is important to know the effects of the portfolio structure on their efficiency scores. Secondly, if there are any relevant size effects, knowing their nature may allow the bank to reorganize the distribution of loans in a manner that more efficiently utilizes the relationship managers' time. We can test for the effects of loan size and the number of loans on efficiency by regressing the efficiency scores on the number of loans and the average size of the loans contained in the portfolio. In the following section, we summarize our hypotheses and detail the test results.

5.3. Regression analyses

Briefly summarizing our hypotheses, we expect that if managers are correctly pricing lending risk, then the fraction of their portfolio listed as nonperforming in the preceding year should not be related to lower efficiency. However, if they are skimping on efforts directed to monitoring and screening their loans in order to reduce short-run costs, then increases in the fraction of problem loans ought to negatively affect efficiency. Lastly, we expect that smaller numbers of loans and larger average loan sizes should be positively related to efficiency. We now turn to the task of testing these hypotheses.

The efficiency scores and the explanatory variables for the years 1991–1995 were combined into a single data set in order to run the following regression model:

$$\text{Theta\_R}_i = \text{constant} + \beta_1 \text{D92}_i + \beta_2 \text{AVSZ}_i + \beta_3 \text{NUM}_i + \beta_4 \text{NUMSQ}_i + \beta_5 \text{LagNPL}_i + \varepsilon_i,$$

where for each manager i, Theta-R_i is the efficiency score obtained from the DEA model which included the risk proxy, AVSZ_i is the average loan size in the portfolio, NUM_i indicates the number of loans in the portfolio, NUMSQ_i is the squared value of NUM_i [14] and LagNPL_i is the fraction of the loan portfolio which was nonperforming in the previous year. Initially, the model included dummy variables indicating the year but an *F*-test demonstrated that only the 1992 indicator, D92_i was required. Since we include lagged values of the fraction of nonperforming loans in our regression model, the 1990 efficiency scores are excluded from the sample leaving us with 1097 observations on portfolios that are active in at least two consecutive years.

The parameter estimates appear in Table 5. The explanatory power of the regression is not high. The *R*-squared and adjusted *R*-squared are 0.143 and 0.139, respectively. However, all of the coefficients are highly significant with *p*-values for all but the 1992 indicator variable smaller than 10^{-3}. The coefficient on D92, the indicator variable is still highly significant with a *p*-value of 0.036. Given that the dollar value of nonperforming loans peaked in 1992, the negative sign on the indicator variable is not surprising. The additional effort required in managing the nonperforming loans is not costless and consequently, the average efficiency levels in 1992 are significantly lower.

As we anticipated, the coefficient on AVSZ, the average loan size, is positive. The incremental costs associated with managing large loans rather than small loans are of less importance than the fixed costs. Therefore, managers whose portfolios are comprised of smaller loans show lower efficiency than their colleagues managing mostly larger loans. If the average loan size is not considered in performance assessment, then managers of larger loans will have an unfair advantage. On the other hand, we might reasonably expect senior management to allocate the large loans of important clients to their best managers. It will remain important to ensure that any performance comparisons across relationship managers adjust peer groups for the disadvantage imposed by smaller loan sizes.

Contrary to our hypothesis that if loans are correctly priced then the lagged value of nonperforming loans should not be related to current efficiency, the

[14] We thank an anonymous reviewer for suggesting the regression formulation and for recommending the inclusion of the squared value of the number of loans since the relationship between efficiency and the number of loans need not be linear.

Table 5
Factors affecting efficiency scores

Model: Theta-$R_i = \beta_0 + \beta_1 D92_i + \beta_2 AVSZ_i + \beta_3 NUM_i + \beta_4 NUMSQ_i + \beta_5 LagNPL_i + \varepsilon_i$
Full sample, $N = 1097$; R-squared = 0.143; adj. R-squared = 0.139

	Coefficient	Standard error	t-Statistic	Significance
(constant)	0.402	2.038E−02	19.714	0.000
D92	−4.028E−02	1.922E−02	−2.096	0.036
AVSZ	5.923E−06	7.809E−07	7.585	0.000
NUM	−4.170E−03	5.722E−04	−7.288	0.000
NUMSQ	2.150E−05	3.415E−06	6.296	0.000
LagNPL	−0.307	5.727E−02	−5.359	0.000

coefficient on LagNPL is negative. It is unfortunate that we cannot properly determine whether this is the effect of "bad management", or "bad luck". Either managers are not obtaining sufficiently large premia to offset additional monitoring and workout costs in following periods, or we are simply detecting the results of bad luck. If misfortune deals a manager a large fraction of bad loans, the additional costs may well extend over several periods causing reductions in efficiency scores. Although not entirely convincing, this suggests that either managers may be setting risk premia too low, or attempts to reduce short-run costs by skimping on efforts directed to monitoring and screening are likely to reduce efficiency in following years.

In our model, we included both the numbers of loans in each portfolio and their squared values. The squared term was included since the relationship between the number of loans and efficiency need not be linear. Our regression results show that increases in the number of loans, NUM, are accompanied by reductions in efficiency. However, the sign of the parameter for the squared value, NUMSQ, is positive. This indicates that as we initially increase the number of loans there is a negative effect on efficiency, but at some point, adding more loans to the portfolio has no further negative effect. Therefore, as the square of the number of loans becomes large, the positive coefficient offsets the efficiency reductions predicted by the linear term.

To investigate the relationship between efficiency and the number of loans more thoroughly, we divided the data into two subsets based on the number of loans in the portfolio. Selecting managers with 43 or fewer loans provided 547 observations and the sample of portfolios larger than 43 loans included 549 observations. The parameter estimates for the two subsets appear in Table 6.

The parameter estimates for the sample of small portfolios are noticeably similar to the full sample estimates in terms of both signs and magnitudes. Focusing on the estimates related to NUM and NUMSQ, the difference in signs that we found in the full sample persists. Apparently, the advantage to having very few loans in the portfolio is dissipated at the low end of the size spectrum. As we see in the bottom half of Table 6, neither of the coefficients

Table 6
Factors affecting efficiency scores (split sample results)

Model: Theta-$R_i = \beta_0 + \beta_1 D92_i + \beta_2 AVSZ_i + \beta_3 NUM_i + \beta_4 NUMSQ_i + \beta_5 LagNPL_i + \varepsilon_i$

Subset: Number of loans $\leqslant$ 43; $N = 548$; R-squared = 0.198; adj. R-squared = 0.191	Coefficient	Standard error	t-Statistic	Significance
(constant)	0.581	4.194E−02	13.857	0.000
D92	−1.109E−02	3.316E−02	−0.335	0.738
AVSZ	5.043E−06	9.200E−07	5.481	0.000
NUM	−1.967E−02	4.181E−03	−4.705	0.000
NUMSQ	2.652E−04	8.988E−05	2.951	0.003
LagNPL	−0.309	8.296E−02	−3.728	0.000
Subset: Number of loans > 43; $N = 549$; R-squared = 0.132; adj. R-squared = 0.124				
(constant)	0.170	4.838E−02	3.505	0.000
D92	−6.142E−02	1.939E−02	−3.167	0.002
AVSZ	2.882E−05	3.987E−06	7.228	0.000
NUM	6.693E−04	1.005E−03	0.666	0.506
NUMSQ	2.296E−07	4.529E−06	0.051	0.960
LagNPL	−0.258	7.078E−02	−3.649	0.000

associated with the number of loans is any longer significant. It is possible that managers with large numbers of loans may be able to offset some of the additional monitoring costs through economies of scale. As an example, if a manager discovers that one of her clients in a particular economic sector is experiencing difficulties, then she may use this information as an indicator that she should monitor other clients in that sector more closely. By the same token, she may also be able to economize on monitoring clients in some sectors based on information gathered from a sample of borrowers.

One remaining issue to be explored further is the possibility that managers may skimp on monitoring efforts in order to reduce short-term costs and improve efficiency. If a manager can improve efficiency in the current year by reducing monitoring costs, then we ought to find that it is at the expense of increasing the fraction of nonperforming loans in the following period. To investigate this possibility, we ran the following regression:

$$\Delta\text{NPL}(t, t+1) = \beta_0 + \beta_1 \text{Theta}(t) + \beta_2 \text{D92} + \varepsilon_t,$$

where $\Delta\text{NPL}(t, t+1)$ is the change in the fraction of nonperforming loans from year t to year $t+1$, D92 is an indicator variable which equals one if the observation is for the year $t = 1992$, and Theta is the current period DEA score.

Since the dependent variable is the difference between the current fraction of nonperforming loans and next period's fraction, the sample included 1134 observations using DEA scores for the years 1990 through 1994. Although the estimates of the slope coefficients shown in Table 7 are statistically significant, the explanatory power of the regression model is extremely low with

Table 7
Efficiency and changes in nonperforming loans

Model: $\Delta\text{NPL}(t, t+1) = \beta_0 + \beta_1\text{Theta}(t) + \beta_2\text{D92} + \varepsilon_t$
Full sample: $N = 1097$; R-squared = 0.014; adj. R-squared = 0.012

	Coefficient	Standard error	t-Statistic	Significance
(constant)	6.034E−04	0.006	0.093	0.926
D92	−2.771E−02	0.010	−2.699	0.007
Theta	4.538E−02	0.016	2.908	0.004

an R-squared of only 0.01. Although the regression results are weak, they are consistent with the skimping hypothesis.

6. Concluding comments

Earlier in this paper, we discussed some of the overall changes that occurred within the relationship-lending sector over the 1990–1995 period. The economic downturn during the early nineties was accompanied by substantial increases in nonperforming loans and reduced operating profits. Relationship managers faced loan portfolios at the end of the period where the average size of the loans was much smaller than had been the case prior to 1994. And relationship costs did not shrink to the same degree as the revenues. With these environmental conditions as a backdrop, we analyzed the efficiency of the relationship managers to determine the underlying factors affecting the efficiency scores.

The most significant findings were that the composition of a manager's portfolio affects the manager's efficiency. Our expectation was that constructing a loan portfolio from a large number of small value loans would have an adverse effect on a manager's ability to monitor the individual loans. The reasoning was that monitoring effectiveness should vary inversely with the amount of time available to oversee the loans. When there is less time devoted to monitoring the financial condition of the clients the levels of nonperforming loans are likely to increase. And since any attempts to smooth credit risk necessarily require a high degree of monitoring, credit-smoothing practices are likely to be unprofitable when the manager's time is spread across too many loans.

Our findings demonstrate that efficiency scores are higher with smaller numbers of larger loans in the portfolio. However, the efficiency advantage from having smaller numbers of loans is no longer present once the number surpasses a certain point. As we discussed previously, there may, in fact, be economies of scale in monitoring if the customers in the portfolio are sufficiently similar in terms of lines of business and risk profiles. This is an important issue for the bank in determining the optimal role of relationship managers and in deciding how to allocate the workload. The bank must also understand the effects of these factors on the performance assessments of their managers. If these factors are not under the manager's control but rather conditions imposed by the bank, then at the very least, measures of performance will need to be adjusted if they are to be fair to the managers.

The importance of the size effects goes right to the heart of the relationship lending structure itself. If it is easier for relationship managers to add value to larger loans than to smaller loans, which is the conclusion drawn from our size-effect findings, then it may suggest that the transactional lending model is more appropriate for the smaller loans currently being handled through relationship managers. This is consistent with what we observe in practice. Banks are adopting the transactional lending approach and applying credit scoring to smaller loans that in the past would have been handled by relationship managers. In aggregate, the bank may be able to improve profitability by utilizing the human capital of the relationship managers in the areas where the greatest rate of return is obtained. That would not seem to be in loading the managers up with large numbers of small dollar value loans.

With respect to the relationships between levels of nonperforming loans and efficiency scores, our evidence shows that having a higher fraction of nonperforming loans in a portfolio is associated with lower efficiency scores in the following period. This is as we might expect, since higher levels of problem loans will require extra attention from the relationship manager, increasing costs and if performance is not restored, efficiency suffers even further when the loan is written off.

The hypothesis that managers may skimp on monitoring costs in order to improve short-run efficiency levels was also tested using year-to-year changes in the fraction of the portfolio listed as nonperforming as a proxy for the effort directed towards monitoring and screening loans. The tests provide very little support for the hypothesis. Berlin and Mester (1997b) explored this behavior but they did not address the cost tradeoffs involved in adjusting monitoring effort. We explained these tradeoffs in relation to credit screening but the same principles apply in any exploration of skimping behavior. Increasing the number of loans under a manager's control necessarily reduces the amount of effort that may be devoted to monitoring individual clients which is likely to result in higher levels of problem loans.

Accounting issues could also be an important factor affecting the year-to-year changes in nonperforming loans. There may well be a clustering effect in writing off problem loans since it will be easier for managers to show improved performance in the following period, if they clear out as many problem loans as possible in one single period. In the corporate finance area, this type of behavior is often related to executive compensation structure and is referred to as "taking a bath".

With the benefit of a very rich data set, we have been able to explore several hypotheses relating to the performance of CIBC's relationship managers and the findings may be useful information in improving profitability of the relationship lending sector. Other avenues of research yet to be explored include the effects of the area of sectoral specialization on manager performance and the degree to which managers specialize in a single lending sector.

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