

**A SCIENTIFIC APPROACH TO THE MEASUREMENT  
OF IT BUSINESS VALUE - PART 2: A CASE STUDY OF  
ELECTRONIC BANKING OPERATIONS AT MERIDIAN BANCORP**

by

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## Measuring Business Value: A Problem for ATM Managers

An important problem confronting electronic banking managers today is how to determine the "business value" of automated teller machines (ATMs) in order to guide investment decisions. Most ATM investment decisions involve considerable judgment about how similar kinds of investments have performed in the past. As a result, there is a need for a procedure to help managers discriminate alternative investment strategies. Since ATMs carry no direct revenue benefits other than interchange fees for ATM use by a bank's competitors' customers, the indirect benefits must be considerable, even if they are not readily measured. Most electronic banking managers would agree that the relevant way to guide this process is the concept of cost-benefit analysis.

As we discussed in Part One, this approach is problematic for investments which involve information technology (IT). Electronic banking managers are frequently unable to accurately quantify the size of the benefits that accrue from IT investments. Though adding to an ATM network involves site-specific costs, the benefits to the bank are probably realized elsewhere in the organization, and so it hard to operate an electronic banking operation as a profit center. In addition, ATM investments are recognized as short run operating costs, not capitalized. They flow through very rapidly to the bank's income statement. The impacts, meanwhile, may take considerable time to show up. And when they do, the bank may only gain transient competitive advantage, since its competitors react to shift the competitive balance in their favor. Thus, the indirect contributions of ATMs tend to be ignored in most cost-benefit analyses because they are difficult to quantify. One unsettling result is that ATM site proposals may be underestimating the true value of ATMs, and the investments may be decided on faith alone. A *benefit-myopic* view of ATM investments would lead to underinvestment by senior management, and the bank's long-term strategic position might be harmed. On the other hand, it also is not difficult to understand why some ATM site proposals which are later approved "for business reasons" may initially carry red ink.

This article presents an application of a promising new approach for measuring the business value of ATM investments: "business value linkage (BVL) impact analysis." It involves constructing simple econometric tests to gauge the strength of the relationship between IT investments and specific economic impacts within the firm. This relationship is termed the "*business value linkage*," and econometric analyses which provide evidence for these impacts are called "*BVL impact analyses*." The purpose of using this approach here is to provide evidence to support managerial intuition about the strategic impacts of ATMs, in view of the large investments banks have made in them.

The findings we present are the results of an extended study on ATM business value conducted during 1987 and 1988 at Meridian Bancorp, Reading, Pennsylvania. All three kinds of business value impacts discussed in Part One were identified in this context: operating costs savings, direct revenue impacts and improved market share. So, ATMs offer a good illustration of how to carry out this kind of analysis.

## **BVL Impact Analysis: An Application at Meridian Bancorp**

The Meridian Bancorp ATM Project had several purposes:

- to *develop and apply state-of-the-art methods* in business value linkage assessment;
- to *test specific hypotheses* about the ways in which ATM business value is created within a bank;
- to *quantify ATM business value* in Meridian Bancorp's electronic banking operations.

These goals related to specific questions managers at the bank had been asking about ATMs. For example, what was the value of belonging to the MAC ATM network, then the largest in Meridian's region? <sup>1</sup>How many dimensions of ATM business value can be quantified? Do ATMs provide the bank with greater benefits in some settings than in others? Do branch ATMs create deposit market share effects? Is the overall size of the deposit market influenced by ATMs? Do ATMs change the performance of branch tellers? To measure ATM business value, we carried out the project in three major phases.

### **Phase I: Creating a Business Value Linkage for the Bank's ATM Investment**

In the first phase of the study, a *business value linkage* was developed for the bank's ATM network. Considerable effort was expended by managers at the bank, in consultation with us, to define the BVL so that it conformed to the organization's view of the perceived strategic impacts of ATMs. Defining the BVL for ATM impacts required several iterations with key managers in the bank's marketing research, electronic banking and branch banking administration areas. Expending this extra effort up front, however, ensured that the study would be more useful to those who evaluated its results. The business value linkage defined at Meridian Bancorp is shown in Figure 1 below.

Creating the business value linkage involved specifying the input resources (e.g., cash on hand, fixed ATM and site costs, and maintenance labor) that are transformed by the production technology for ATM services into a set of valuable output commodities. This required identifying which ATM outputs make a direct impact on bank profitability (e.g., interchange fees), and which result in beneficial impacts felt by other related production processes (e.g., teller labor cost savings, and deposit volume increases in branches). Thus, in addition to the site-specific production, ATMs also influenced local branch operations, in the market for regional interchange transactions, and in the regional competition for retail deposits and customer accounts.

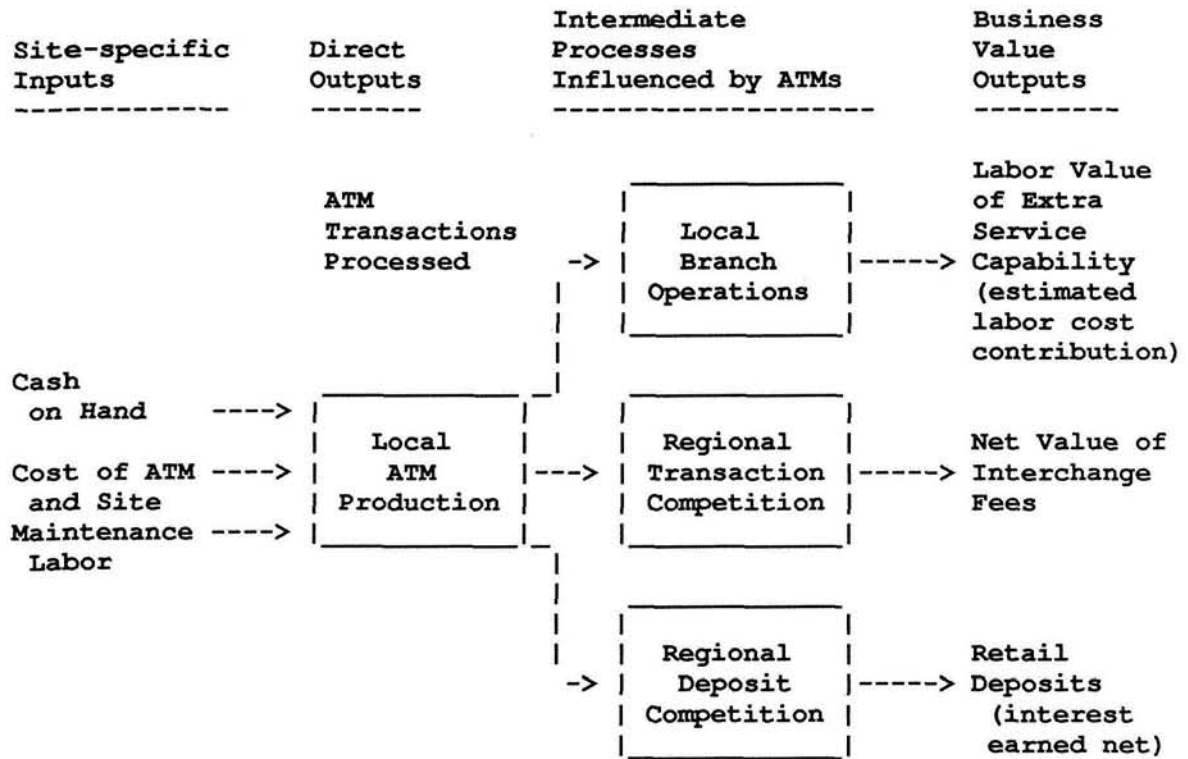
### **Phase II: Output Modeling and Econometric Estimation**

The next step in the study was to create models to estimate how important the ATMs were in contributing to the creation of the three classes of outputs. Teller labor produces banking transactions demanded by a bank's clientele. Branch ATMs can change the mix and volume of transactions tellers are required to process. They also extend the capability of a branch and its teller labor to around-the-clock production.

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<sup>1</sup>At the time the study was conducted, both the MAC and Cashstream networks operated in southeastern Pennsylvania. Cashstream's operations have since been purchased by the owners of the MAC network, Philadelphia National Bank/Core States Financial.

Figure 1: The Business Value Linkage for ATMs at Meridian Bancorp



The production of retail deposit market share occurs in a local competitive environment in which branches configure service delivery mechanisms and offer products that generate accounts, deposits and business for the bank.

To estimate how much ATMs contributed to the substitution of teller labor, we built estimation models which estimated an ATM's transaction volume if it were located at a branch or elsewhere, and the productivity of teller labor in the presence and absence of an ATM. Data for these estimations were drawn from branch platform automation, from electronic banking records kept by the bank and the MAC network, and demographic data obtained from a local marketing research firm.

Since the study was carried out to create a baseline of ATM performance at the bank, we did not attempt to build a predictive model for an ATM's ability to capture regional interchange transactions. Instead, we identified monthly interchange transaction data from electronic banking records for the ATM sites being studied, evaluated their stability from month to month, and calculated their revenue value directly.

In order to develop an estimate for ATMs' marginal impact on branch deposit market shares, 1986 share data were obtained for 508 competing branches in Meridian Bancorp's operating region. Meridian's branch managers contributed a complete physical description of each bank branch competing with the one they managed. They also provided an assessment of each competing branch's interest rates and name recognition in the market. Among the most important data they gathered was whether a competing bank branch deployed an ATM, and the ATM network affiliation of the owning bank. These data were double-checked by comparing them with related information obtained by Meridian from the MAC and CashStream networks.

The econometric models we developed were used to provide evidence for links between ATM investments and their strategic and operating impacts. Thus, the goal in this phase was the major challenge of the project as a whole: to isolate the business value of ATMs and ATM network membership in the context of the deposit market competition and branch transaction processing activities.

### **Phase III: Validation and Business Value Estimate Calculation**

Phase III concluded the project. The results obtained in Phase II were validated by partitioning the bank's operating region into logical subsets and re-running the econometric tests. Since the data sets were very large, little statistical power was lost in the tests carried out on partitioned data. This approach proved helpful in refining our understanding of the competitive circumstances under which ATM business value is maximized. Finally, dollar estimates for ATM business value were calculated from the results, to estimate the relative magnitude of different impacts of ATMs.

## **BVL Impact Analysis: Results**

The study obtained some surprising results and useful insights for the bank. Estimates for two key ATM-related outputs were obtained that managers find difficult to measure in practice:

- the impact of ATM network choice and branch ATM deployment on local market share of retail demand and savings deposits;
- the impact of a branch ATM on teller labor productivity and branch service value.

### **ATM Impacts on Branch Teller Labor and Service Value**

The impact of a branch ATM on teller labor productivity and branch service value was examined with two related BVL impact models. The first model forecasted ATM transaction demand in terms of population demographics, competitive factors, ATM availability, and ATM location. Although this model was interesting by itself as a transaction volume forecasting tool, the results also provided deeper insight into how ATMs can affect the demand for branch teller labor. Branch ATMs were found to process 25% higher transaction volumes than other ATM locations.

The second model was designed to determine whether teller labor becomes more or less productive in the presence of a branch ATM. Teller labor hours were estimated in terms of a variety of transaction types that tellers process, with and without a branch ATM present nearby. The results showed that teller labor becomes less productive in its processing of deposit transactions in the presence of branch ATMs.

A review of teller transaction processing activities suggested that the ATM transactions represented the easiest kinds of window transactions that tellers could have handled. So, tellers were experiencing a shift in the mix of transactions; easier transactions were more often processed at the ATM. For this reason, the decrease in teller labor efficiency in the presence of a branch ATM does not diminish the business value of a branch ATM. Instead, the business value of the ATM becomes apparent if the costs of adding tellers to handle the cumulative demanded transaction volume (window plus ATMs) are considered. Although some observers might argue that there is a "technology effect" associated with ATMs (i.e., that bank customers demand more transactions from ATM than they would ever demand at the teller windows), the business value implications are clear. The "technology effect" should be recognized for what it is -- *extra service capability* that only becomes available as bank customers use ATMs. Providing such service at the teller windows would be prohibitively expensive.

### **Direct Interchange Revenues**

The results we obtained for interchange revenue business value suggested that the bank's branch operating territories exhibit equilibria in the competition for ATM transactions. We found that 75% of the bank's ATMs exhibit less than a 4% deviation from the mean percent of interchange transactions created at each ATM during the three-month study period. We assumed that all interchange transactions earned the same fee, and then multiplied interchange transactions times the fee to arrive at interchange revenues.

Our results suggest it would be worthwhile to develop a forecasting model to estimate how interchange transactions are redistributed when a new branch or off-site ATM is deployed. This can provide an electronic banking manager with an estimate of what level of interchange revenues can be expected for a new ATM. Also, it would be possible to predict how this estimate would change if a competitor responds by placing another new machine nearby.

### **ATM Impacts on Branch Deposit Market Share**

In order to investigate the impact of ATM network membership and locating an ATM at a branch on its competitive deposit collection ability, a "gravitational model" of competitive interaction was used to represent branch-to-branch competition. In this kind of model, favorable characteristics and design features of a branch "attract" retail accounts and deposits. To predict a branch's market share (MS), we used a set of IT and non-IT variables to describe its service delivery capabilities and attractiveness. Fixed branch features in the model include bank type within Pennsylvania (e.g., commercial, savings and loan, or mutual savings bank) and age. Other non-IT design features include interest rates, bank name recognition, the presence of service windows, and the number of platform service stations. The IT variables include the bank's choice of ATM network (MAC or Cashstream) and the presence of an ATM at the branch. The model can be summarized as follows:

$$MS = \frac{\text{Relative attractiveness of branch's features}}{\text{Sum of the relative attractiveness of all competing branches in territory}}$$

The model states that a branch's deposit market share is a function of its own design choices, divided by the sum of similar functions of its competitors' design choices. Thus, it provides a means to test for

incremental branch deposit market share which is due to a bank's decision to join an ATM network or deploy a branch ATM. It simultaneously takes into account decisions made by the branch's competitors.

A second model was also constructed to predict the size of demand and savings deposit markets in which branch banks competed in southeastern Pennsylvania. The model attempted to explain the overall size of local demand and savings deposit markets in terms of demographic, competitive and ATM variables.

A thumbnail sketch of the results is shown in Table 1 below. Overall, a bank's ATM network decision was shown to be an important determinant of branch market size in southeastern Pennsylvania. Membership in the MAC network was particularly beneficial in securing market share when *two-thirds or more* of nearby branches were members of the regionally smaller Cashstream network. Validating results were also obtained from separate estimations of demand and savings deposit market shares.

**Table 1: Territorial Impacts of Branch ATMs and MAC Membership**

Region	Branch ATM Deployed	MAC Membership
Meridian's Operating Region	No impact	1-2% Gains in Demand and Savings Deposit Market Share Present
Philadelphia Center City	No impact	No impact
Other Territories Dominated By MAC Network	No impact	No impact
Territories Not Dominated By MAC Network	Increase in Savings Deposit Market Share Only	Demand Deposit Share Increased by 1.7%  Savings Deposit Share Increased by 3.6%

In branch operating territories where Cashstream was dominant, the benefits of access to this regionally smaller network was not sufficient to induce bank depositors to forego the benefits of access to the regionally larger network. This effect was absent, however, in other partitions of the data that we tested. For example, in central city Philadelphia and other territories where the MAC network dominated locally, our estimations confirmed that no single branch's deposit-taking ability was enhanced by MAC member-

ship. This makes sense since no branch can differentiate itself from its competitors on the basis of MAC membership.

Branch ATMs were shown to have significant strategic value for increasing deposit market shares only in the partitions of the data set for territories not dominated by MAC. Thus MAC banks, prior to the MAC buyout of Cashstream, may have been justified in "backfilling" ATMs at branches that did not have them, when there were few MAC machines locally.

A final result was derived from the deposit market size model. No evidence was found to suggest that high density ATM deployment helps banks to increase the overall size of the deposit market. Nor was there evidence to suggest that greater representation by MAC or Cashstream was responsible for increasing the size of the deposit market.

### **Calculating Estimated ATM Business Value: An Illustration**

In order to illustrate how we can arrive at a business value estimate from the impact analyses discussed above, let's look more closely at one of Meridian's branch operating territories. The branch operating territory chosen for the illustration is representative of a small number of the bank's branch and ATM locations in which ATM deployment provides special benefits to the bank. The local area around the branch did not have a dominant number of MAC machines, and the branch had an ATM deployed. This ATM processed about 18,500 transactions during the three-month study period. Of these, 4,700 were identified as having been drawn from teller windows. Another 25% of the transactions were interchange transactions. This branch held about \$21 million in demand deposits and \$92 million in savings deposits; these deposit levels represented about 12.6% and 15.0% of the local market for the respective deposit types. During the study period, there was a 3.45% spread between the bank's marginal cost of funds and its deposit interest costs.

Table 2 summarizes the annualized business value created by the ATM in the three output classes. The estimated value of branch labor displaced is based on an estimate of what it would have cost to have tellers perform the transactions the ATM drew from the teller windows. Annual interchange revenues were extrapolated from the three-month interchange transaction volume at the ATM. The value of incremental deposits was calculated by multiplying the portion that was attributable to MAC membership by 3.45%, the net value of funds to the bank. This yielded the annualized business value estimates of incremental deposits shown in the table.

The illustration suggests that an ATM's marginal contribution to deposit market share can be quite substantial. Where the MAC network was not well represented the least tangible output of ATMs *appears to have the greatest potential bottom line impact*. This points out the importance of being able to track differential performance of ATM investments. One result is clear for electronic banking: high ATM transaction volume alone is not a sufficient statistic for ATM business value.

The work conducted at Meridian Bancorp has broken new ground in ATM and IT performance assess-



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**Table 2: A Summary of the Business Value of a Branch ATM**

Source of Business Value	Business Value of a Branch ATM Territory Not Dominated by MAC (Adjusted for 12-month period)
Costs of Branch Labor Replaced	\$ 16,872
Creation of Interchange Transaction Revenues	\$ 6,896
Incremental Value of Market Share for	
* Demand Deposits	\$ 12,612
* Saving Deposits	\$113,632
<b>Total Estimated Business Value</b>	<b>\$150,012</b>

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ment methods. Based on the scope of the study, the amount of data collected, the support and participation of key managers within the bank, and the interesting results which emerged, this study is a "benchmark" for the kinds of results which can be achieved using business value linkage impact analysis. Employing the new technique shifts the focus in cost-benefit analysis for IT from using only direct impacts, to providing validating evidence for the "right" set of strategic outputs. Models which empirically evaluate the linkages between IT deployment and the classes of strategic outputs we have emphasized help the managers get a clearer picture of the returns on their IT investments.