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Costs and competition in bank credit cards

Christine Pavel and Paula Binkley

Last year consumers said "Charge it" with Visa or MasterCard 76 times every second, 4,500 times every minute, and nearly 275,000 times every hour of every day. Credit cards, especially bank cards, are being used more frequently both as a method of payment and as a way of taking on consumer debt. There are more than three times as many purchases made with a bank card today than there were ten years ago, and the number of transactions per account is up from 18 per year in 1975 to 23 per year in 1985. Over 2 million merchants accept MasterCard, Visa, or both and about 3,000 institutions issue the cards.

In addition, bank card debt as a percent of total consumer installment debt is up since 1975. Then bank cards accounted for only 6 percent of all installment debt outstanding; today bank cards account for about 14 percent.

This article shows that the recent surge in banks' efforts to market bank credit cards are a result of the existing cost structure of bank card plans. It is shown that there were no major changes in the cost structure of bank card plans from 1975 to 1983, but bank card operations were characterized during those years by increasing returns to scale. That is, as output increased, per unit costs fell. Suppliers of bank cards, therefore, would want to increase output in order to become low cost producers. As long as the demand for bank cards is not fully exhausted, suppliers would probably concentrate on selling bank cards to those who do not have them. But, as saturation is reached, suppliers would have to increase output by taking other suppliers' market share through lower overall prices, lower credit standards, or greater product differentiation.

This article examines the cost functions of bank card plans since 1975. The first section briefly reviews the history of bank cards, and the second section provides some institutional detail on the credit card industry. In the third section, the cost structure of the industry is examined. In this section, we show that there are increasing returns to scale in bank card operations and that this cost structure can help explain the rapid growth in bank card activity. There have been several references made to the presence of economies of scale in credit card operations, but to our knowledge this is the first attempt to demonstrate their existence empirically.[1] The fourth section tests the notion that credit cards can be used effectively as a marketing tool to cross-sell other bank products. Our analysis shows that other bank products, such as demand deposits and retail CDs, are better vehicles for cross-selling bank cards than bank cards are for cross-selling these other products. Finally, a summary and conclusions are presented.

A brief history

The development of the modern bank card occurred between 1950 and 1966. The first bank card plan was produced by Franklin National Bank of New York in 1951. But the first bank cards resembled today's travel and entertainment cards, such as American Express and Diners' Club, although the early bank card plans did not charge a membership fee. Revenues were based on merchant discounts and free credit was extended over the billing period, usually 30 days. In 1958 the revolving credit feature became a part of bank card plans. In addition to offering banks an additional source of revenue via interest charges, the extension of credit beyond the usual free period gave cardholders the advantage of being able to extend their repayments.

Until 1966, bank card plans were local or regional in nature and almost all plans were run independently, rather than jointly or by associations. High start-up costs coupled with the fact that in most cases bank cards were accepted only by merchants in the issuing bank's immediate area proved to be a major obstacle to the rapid spread of bank credit card plans. This hindrance was accentuated by the lack of widespread branching systems due to state laws limiting or prohibiting branching. Consumers were not interested in bank cards unless they were widely accepted, but for merchants to ac-

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cept the cards, they must be in the hands of many potential customers. To get around this problem, banks would often send unsolicited cards to consumers. This tactic led to huge fraud and credit losses. Some banks discontinued or sold their plans after a few years of unsatisfactory performance.[2]

In response to these problems, the first national bank card plan was started in 1966. Bank of America began the nationwide clearing of bank card sales slips and the nationwide licensing of banks to issue cards using the name BankAmericard, later renamed Visa and owned by Visa International. Several other large banks formed the Interbank Card Association, later known as MasterCard International, and thus began a second national card system. The advent of such nationwide systems was a turning point in the development of bank cards because it made bank credit cards acceptable to a significantly larger number of merchants, and the cards became more attractive to consumers because local cards were transformed into national cards.

The use of credit cards as a payments vehicle and as a major source of unsecured credit began to take off in the late seventies. From 1976 to 1979, the number of bank card accounts rose 65 percent to 75 million, and the number of transactions also rose 65 percent to 1.5 billion.[3] Credit card loans outstanding at banks more than doubled over this period and accounted for about 16 percent of all consumer installment debt held by banks in 1979.[4]

Just as bank card programs were showing promise, however, soaring interest rates made usury ceilings binding, bringing the growth in bank cards to a halt. In addition, the credit restraint measures of 1980 reduced the use of bank cards. These setbacks, however, were only temporary. The special credit restraints, initiated in March 1980, were phased out beginning in July of the same year.[5] Usury ceilings became less binding, either because they were relaxed or because credit card operations were shifted to states that did not have usury ceilings. Since 1981, the growth in bank card activity has been strong, particularly over the 1983-84 period when the number of bank card transactions grew 34 percent.

While the recent surge in bank card activity could be viewed as a natural progression through the product life cycle, this paper suggests yet another reason for the growth in bank card activity. This explanation is rooted in the cost structure of bank cards.

The mechanics of bank card transactions

In the last 20 years, the bank card industry has evolved into a complex network that involves banks, merchants, cardholders, bank card associations, and independent processors. The mechanics of bank card transactions can become quite complex, and they have important consequences for the bank card industry's cost structure.

A credit card transaction cannot begin until a bank customer receives a bank card (usually a MasterCard or Visa credit card) from an *issuing* or participating bank. An issuing bank sets up its own card operation. It obtains a license to use the Visa or MasterCard logo, determines the nature and price of services offered to the cardholder, establishes a credit limit, sets annual fees, interest rates, and payment and finance charge calculation procedures, and arranges for or handles the processing of credit card sales slips. A *participating* bank is a bank that offers its customers the bank card of an issuing bank.

A bank card transaction begins when the cardholder uses his card as a means of payment. The merchant who accepts the card in a transaction then sends the signed credit card sales slip to his bank, a *merchant bank,* for processing. A merchant bank is the bank that maintains the account of a merchant who accepts bank cards as a means of payment.[6] When a merchant deposits bank card sales slips with its merchant bank, the bank credits the merchant's account for the amount on the slip less the merchant discount, usually 2 to 5 percent. The merchant bank then converts the information on the slip—the cardholder's account number, the merchant identifier number and address, and the specific purchase information—into machine readable form. This transformation can be performed by the merchant bank itself, an independent processor, or another bank.

After the slips are put into machine readable form, the information is sent to the interchange facilities of MasterCard or Visa. The interchange facilities act as clearing houses, transferring the information on the sales slips to the issuing banks. Visa or MasterCard send

the merchant bank the amount of the transaction less an interchange fee based on the dollar amount of the sales slip. Visa and MasterCard also collect a per-item fee for this clearing service. When a merchant bank uses an independent processor, which has a relationship with both the merchant and issuing banks, Visa or MasterCard are sometimes bypassed, and accounts are settled through the transfer of funds between the issuing and merchant banks. This situation is common among large credit card processors.

The issuing bank can now bill the cardholder. In cases where the merchant's bank is also the cardholders's bank this entire settlement process is simplified since no funds have to be transferred between interchange facilities and banks. When a participating bank is involved, the settlement between all parties depends on the type of agreement between the issuing and participating banks.

The cost structure

As is evident from the description of the bank card mechanism, a bank's credit card operation consists primarily of two activities. The first activity involves issuing the card, extending consumer credit, and providing a payments vehicle; the second activity involves accepting and discounting merchant sales slips.

These activities generate four outputs: a line of credit (i.e., a bank card account), loans, billings, and merchant sales slips. Initially when a customer applies for a bank card, the issuing bank performs a credit evaluation. If favorable, a card is issued to the customer and a new account is established. At that time a line of credit is established, but no loan is actually made. Only when the new cardholder uses the card to make a purchase or receive a cash advance does the bank make a loan to the cardholder. This loan may be for a few days or more depending on whether or not the cardholder decides to pay off his balance in full when billed or carry his balance over several months. The issuing bank bills each active account. An active account is one that was used to pay for a purchase, obtain a cash advance, or pay a previous balance during the past month. Each time a bank card is used a sales slip is created, cleared through the system described above, and the amount is debited to the appropriate cardholder's account.

These outputs explain the cost structure of a bank card operation, and the cost structure of a bank card operation may help to explain why interest in offering bank cards has increased recently among banks and nonbanks. If the underlying cost structure of a bank card plan has changed due to some technological advancement, such as improved automation, then bank card services may be cheaper to provide. Also, if there are economies of scale in offering bank card services, then suppliers would be expected to increase output in order to become more efficient producers.

Using the Federal Reserve System's Functional Cost Analysis (FCA) data on 40 card-issuing banks that participated in FCA from 1975 to 1979 and in 1981 and 1983, we estimated a cost function for bank card plans.[7] The FCA program is a cooperative venture between the 12 Federal Reserve Banks and the participating commercial banks. The program, which develops individual bank income and cost data for specific lines of business, is conducted annually and covers a full calendar year of operations. The program is voluntary and, consequently, the sample of banks that participate is small and not consistent from year to year. For example, in 1983, 553 banks participated, but in 1984, only 509 banks participated. A commonly stated problem with the FCA data is that large banks are underrepresented. In 1983, the largest bank that participated had $2.6 billion in assets, and only 12 of the more than 400 banks had more than $1 billion in assets.

A description of the sample of 40 banks that participated in the FCA program and were used in this study is presented in Table 1. These banks were chosen for two reasons. First, each of them participated in the Functional Cost Analysis program from 1975 to 1983. Second, each of these banks acted as an issuing bank and as a merchant bank in credit card transactions. The largest credit card issuers were not included in this study because they did not participate in the Functional Cost Analysis program; however, our sample does include banks among the top 30 percent of all bank card issuers.[8]

The average bank in the sample had total assets in 1983 of $266 million and about 10,000 active accounts. A bank with operations of this magnitude would be ranked around 300th based on number of active accounts according

Table 1
Sample of 40 banks' credit card operations: Summary statistics, 1983

	Mean	Median	Minimum	Maximum
Total assets	$293 mil.	$289 mil.	$27 mil.	$864 mil.
Active accounts	13,985	6,970	1,081	61,945
Accounts	19,714	8,715	1,413	91,058
Sales slips	326,942	163,255	16,512	1,450,574
Volume ($)	15,235,420	7,452,227	1,100,000	60,073,198
Retail loans outstanding ($)	6,031,868	2,926,202	364,515	33,031,000
Cash advances outstanding ($)	380,983	0	0	4,307,000
Rank*	300th	351st	398th	160th

*Based on *The Nilson Report* ranking of bank card issuers by number of active accounts. There are approximately 1500 bank card issuers according to this report. See *The Nilson Report,* Nos. 337, 338, 339, and 340.

to *The Nilson Report*. The largest bank in the sample had nearly $1 billion in assets in 1983 and about 54,000 active accounts. This institution would be ranked about 160th. The smallest bank, with only $33 million in assets, would be ranked 398th.

The activities of a credit card operation can be measured several ways. For example, the output of the lending/payment activity can be measured as the total dollar volume of loans outstanding, the number of accounts, the number of active accounts, or the number of times cardholders use their accounts (which is not available from FCA). The output of the processing activity can be measured as the dollar volume of sales slips discounted or the number of sales slips discounted.

To see if the cost structure could help explain why credit cards have become a popular product among many banks, we estimated a cost function based on bank card output. Ideally, we would have specified total operating costs as a function of new accounts opened, billing volume (i.e., the number of times cardholders use their accounts), and the number of sales slips. A new account causes the bank to incur costs when opened, but since we have two gaps in the data (1980 and 1982), this measure was unavailable for two of the seven years.[9] The best measure of output associated with the lending/payment activity would be the number of times cardholders use their cards for either cash advances or for purchases. This measure, however, is unavailable from the FCA program. As a proxy for this measure, therefore, we used the number of active accounts. An active account is one "with purchase activity, cash advance activity, unpaid balances, or any combination of the above." For the processing activity, we used number of sales slips rather than dollar volume of sales slips discounted because the dollar volume is what generates revenues, but the sales slips are what are actually processed and, therefore, generate costs.[10]

Thus, we estimated an equation for total operating costs associated with a bank card operation as a function of the number of active accounts and the number of sales slips discounted (see box). Bank card loans, i.e., receivables, were not included to measure the lending/payment activity because the primary cost associated with receivables is the cost of funds, which was not included in operating costs.

Since much of a bank card operation consists of the transmission of information, advances in reader sorter and computer technology over the last decade may have caused the cost structure of bank card plans to have changed, making them less expensive to operate. To test whether or not the underlying cost structure of bank card operations had changed since 1975, the cost equation was estimated for each of the years 1975-79 and 1981 and 1983. We tested separately the hypotheses that the coefficients and intercept are each significantly different from year to year and, therefore, that the cost structure of bank card plans had changed.

To test whether or not the intercept had changed over time, all the years were pooled

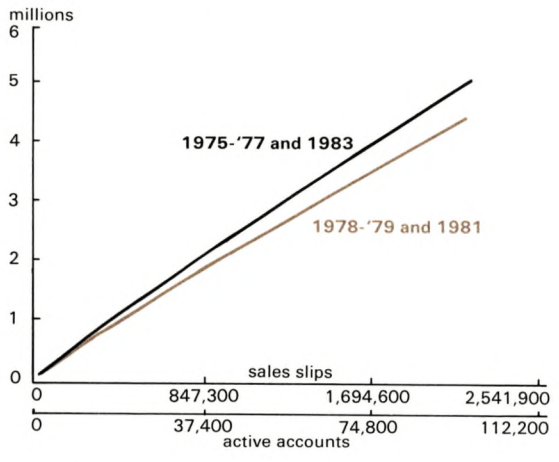
and the cost equation was estimated, using dummy variables to control for changes in the intercepts. The results revealed that the coefficients on output were not different from year to year, but that the intercept had changed.[11]

Figure 1 shows the total cost curves of a bank card operation when the output mix is held constant and output is increased proportionately. That is, the ratio of active accounts to sales slips is held constant while each grow proportionately. The output mix shown in Figure 1 is that of the median bank in 1975. The figure shows that the cost curve shifted downward in 1978, but the curve shifted back up again in 1983. The shift represents a 12 percent difference in total costs.

Because the shift in the cost curve is only temporary, a technological development is probably not the reason for the change. There are, however, other possible explanations. One is that bank card costs are cyclical and tied to default rates. We tested this hypothesis by excluding net loan losses from the dependent variable, total operating costs, and re-estimating the equation. The newly estimated cost curve still shifted downward temporarily in 1978.

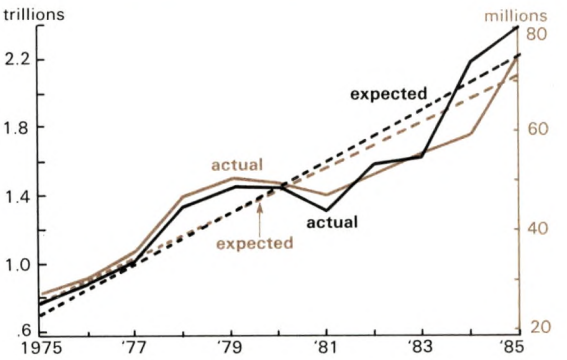
A second possible explanation for the shift in the cost curve is that, for the years in which the curves changed, some important variable was omitted from the equation. A likely candidate is billing volume, or the number of times cardholders use their cards. As mentioned above, this measure of output would perhaps more accurately explain the operating costs associated with bank card plans because processing costs are incurred by issuing banks every time a cardholder uses his card. However, because this measure is not available from FCA data, we could not test this hypothesis.

Figure 1
Ray total cost as a function of active accounts and sales slips



NOTE: Ratio of active accounts to sales slips is held constant at .04, the ratio for the median bank in the 40-bank sample.

Figure 2
Bank card active accounts and transactions



NOTE: These figures are for all banks from 1975 to 1985. The trends are comparable for the 40 banks in our sample.

SOURCE: *The Nilson Report,* various issues.

A third, and we believe most likely, explanation is that actual output may have differed significantly from expected output levels. As shown in Figure 2, bank card output fell somewhat from 1979 to 1981. If a constant growth path were expected such as that shown by the dashed line in Figure 2, output would have been greater than expected in 1978 and 1979 but less than expected in 1975 to 1977 and 1981 to 1983. Investments in plant and equipment that were made with the expectation of higher output would have been underutilized from 1981 to 1983.

Thus, based on the 40 banks in this study, changes in the cost structure do seem to have occurred since 1975, but they have been only temporary and do not seem to explain the widening popularity of bank cards among banks and other financial institutions.[12] The cost structure of bank card plans, however, can still help to explain the rapid growth in bank cards recently. If there are increasing returns to scale in bank card operations, bank card managers would feel pressure to increase output, i.e., bank card activity. This would enable

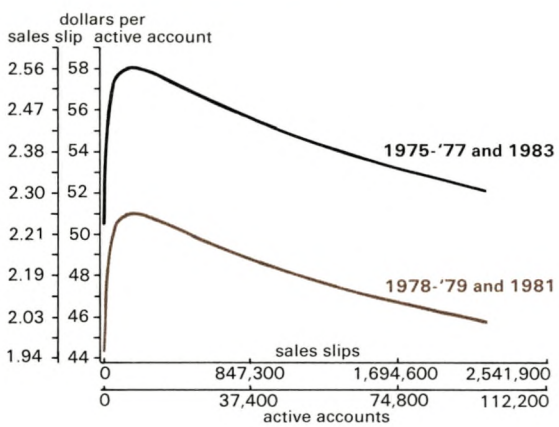
the banks to move down the average cost curve and become more efficient producers.

The estimated cost curves (shown in Figure 1) indicate that economies of scale in bank card operations exist within the range of output in our sample. The largest bank in our sample had only 91,000 accounts, while the largest supplier of bank cards in 1983, Bank of America, had over 5.5 million accounts.

Figure 3 shows the estimated relationship between the average cost of a bank card operation and active accounts and sales slips when the output mix is held constant and output is increased proportionately. Within the range of output for our sample, the curves exhibit rapidly decreasing and then increasing returns to scale, which may be explained by the adoption of different operating procedures at various output levels. For example, at very low output levels, a firm may perform most of its bank card activities in-house with a low capital-to-labor ratio; at moderate output levels, a firm may farm out tasks to outside vendors; and at high output levels, a firm may bring those activities back in-house but with a high capital-to-labor ratio.

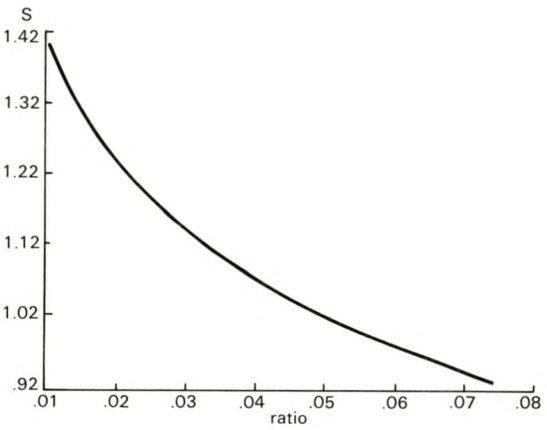
The humped average cost curve shown in Figure 3 indicates that the output mix, i.e., the ratio of active accounts to sales slips, is as important to a firm's operating costs as is the level of output. This is shown in Figure 4 above, where scale economies are measured by S.[13]

Figure 3
Ray average cost as a function of active accounts and sales slips



NOTE: Ratio of active accounts to sales slips is held constant at .04, the ratio for the median bank in the 40-bank sample.

Figure 4
Economies of scale vs. ratio of active accounts to sales slips



When S is less than 1, there are increasing returns to scale; when S is equal to 1, constant returns to scale; and when S is greater than 1, decreasing returns to scale. As a firm increases its ratio of active accounts to sales slips, it moves toward increasing returns to scale. In our sample of 40 banks, 16 banks were operating in the range of increasing returns in 1983. In other words, the elasticities of cost with respect to the various output measures were less than 1, indicating that there are increasing returns to scale (see Figure 5). The point where average costs begin to decrease depends on the output mix (see box).

Thus, over the 1975-83 period three forces seem to have been affecting bank card operations. First, for certain output prices, there were increasing returns to scale. Second, the cost curves were changing temporarily, and third, output was decreasing over the 1979-81 period and did not pick up again until 1982. These last two forces were often too strong to allow the increasing returns to scale to keep average costs on a downward path.

These results have important implications. As banks attempt to move down the cost curves by increasing output, the prices charged for bank card accounts and for sales slip processing should fall. As low-cost producers earn abnormal profits, they encourage entry, which would then cause prices to fall.

As prices fall, those firms that are not low-cost producers should be driven out of the

Cost and cross-selling models for bank cards

To help explain why bank cards have gained popularity among issuers recently, we examined the cost structure of bank cards and their usefulness as tools for cross-selling other bank products. Two separate models were estimated, using ordinary least squares regression.

Cost structure

To model the cost structure of a bank card operation, we estimated a translog cost function, using active accounts and sales slips as output measures. A translog cost function allows for the estimation of a U-shaped average cost curve. The cost function is expressed as follows:

$$lnTC = a + b(lnSS) + c(lnATV) + 1/2d(lnSS)^2 + 1/2e(lnATV)^2 + f(lnSS*lnATV) + u$$

Where TC = total operating cost in 1984 dollars, including credit card activity and franchise fees and fraud losses but excluding the cost of funds

SS = total number of sales slips deposited by merchants

ATV = total number of active accounts, defined as "the number of accounts with purchase activity, cash advance activity, unpaid balances, or any combination of the above."

u = error term

This equation was used to test whether the cost structure of a bank card operation had changed from year to year. Such a change would be exhibited by coefficient changes and/or by changes in the intercept term.

The above equation was estimated separately for each of the years 1975 to 1979 and 1981 and 1983, using Ordinary Least Squares.* F-tests were used to test the hypothesis that the coefficients of the cost function, excluding the intercept term, had changed since 1975. If the F-statistics were statistically significant, then we could not reject the hypotheses and, therefore, conclude that the cost structure of bank card plans had changed since 1975. Such changes might indicate a change in the technology of providing bank cards. However, as discussed in the text, the coefficients had not changed over the 1975-83 period.

To test whether or not the intercepts had changed over this time period, all the years of data were pooled and the equation was estimated using dummy variables to control for changes in the intercepts. The results were as follows.

1975-77 and 1983:

$$TC = 9.06 + 2.78(ATV) - .14(ATV)^2 - 2.24(SS) + .09(SS)^2 + .04(ATV*SS)$$

1978-79 and 1981:

$$TC = 8.93 + 2.78(ATV) - .14(ATV)^2 - 2.24(SS) + .09(SS)^2 + .04(ATV*SS)$$

These equations explain 91 percent of the variability in total operating costs, and each of the variables was significant at the 1 percent level with the exception of the interaction term, ATV*SS.

Cross-selling

To see if bank cards are useful tools for cross-selling other bank products or if other bank products are better tools for cross-selling bank cards, we used a simple causation model.** This model tests whether variable A "causes" B, B "causes" A, or A and B simultaneously affect each other. This is necessary because if A is a function of B, then A and B are related in some way, but B does not necessarily "cause" A in the Granger sense; A may "cause" B, or the two variables may be reinforcing.

Accordingly, the following equations were estimated:

1) $P_{83} = P_{81} + P_{79} + P_{78} + C_{81} + C_{79} + C_{78}$

2) $C_{83} = C_{81} + C_{79} + C_{78} + P_{81} + P_{79} + P_{78}$

Where P = the number of other product accounts. P takes on values for the number of demand deposit accounts, retail (less than $100,000) time deposits accounts less retail certificate of deposit accounts, retail certificate of deposit accounts, and consumer installment loan accounts.

C = the number of bank card accounts (total or active).

An F-test was used to test whether C_{81}, C_{79}, and C_{78} in the first equation are equal to zero ($C_{81} = C_{79} = C_{78} = 0$). If not, then the number of bank card accounts "causes" the number of P accounts. If $C_{81} = C_{79} = C_{78} = 0$, then the number of bank card accounts does not affect the number of P accounts; i.e., there would be no benefits to cross-selling P accounts through bank cards. Similarly, an F-test was used to test whether P_{81}, P_{79}, and P_{78} in the second equation are equal to zero ($P_{81} = P_{79} = P_{78} = 0$) . If not, then the number of P accounts "causes" the number of bank card accounts; i.e., there would be benefits to cross-selling bank cards through P accounts.

The results are shown in Table 2 of the text. They suggest that the other bank products tested would be better for cross-selling bank cards than bank cards are for cross-selling other bank products.

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*Before the equation was estimated, we tested for heteroskedasticity and found none.

**C.W. J. Granger, "Investigating Causal Relations by Econometric Models and Cross-Spectral Methods," *Econometrica*, Vol. 37, No. 3 (July 1969), p. 431.

market. So if the bank card industry is characterized by increasing returns to scale, the industry should be experiencing significant consolidation. This is, in fact, what seems to be happening. Since 1980, the share of bank card loans held by the ten largest issuers of bank cards has increased 21 percentage points to 58 percent in 1985.[14]

There is further evidence that cost considerations are important. Rather than have each of 15,000 banks issue their own card, about 12,000 participating banks provide bank card services through 3,000 other issuing banks. The Independent Bankers Association recently formed an organization intended to issue bank cards for its members and, utilizing the resulting scale economies, provide bank card services at a lower cost than would be possible if members acted as independent issuers.[15] In addition, several banks are attempting to differentiate their bank cards and increase their market shares through "affinity-group marketing." Such strategies have various organizations cooperating with a bank to help promote its card by appealing to the potential cardholders' loyalty to a particular group or association.[16]

Bank cards and cross-selling

In addition to increasing returns to scale, another possible reason that bank cards have become popular products for banks and other financial institutions to offer to their customers is that bank cards may help banks to generate profits in other product lines, such as time deposits, auto loans, and other consumer loans, through cross-selling. Such cross-selling is usually achieved by including ads in monthly billing statements. Information from customers' bank card activity can also be used to cross-sell products by targeting products.

A bank would want to cross-sell products if it were more profitable than traditional selling techniques. Cross-selling might save advertising and marketing costs because advertising would be consolidated with regular mailings rather than sent to customers separately. Cross-selling may also reduce the need

Table 2
Bank cards as cross-selling tools

Other bank products as a function of bank cards

$(C_{81} = C_{79} = C_{78} = 0)$

Number of	Total accounts	Active accounts
	(- - - - F-statistics - - - -)	
Demand deposits	2.07	0.14
Time deposits	2.40	0.96
Retail CDs	1.02	3.61*
Consumer installment loans	0.14	0.92

Bank cards as a function of other bank products

$(P_{81} = P_{79} = P_{78} = 0)$

Number of	Total accounts	Active accounts
	(- - - - F-statistics - - - -)	
Demand deposits	3.81	6.03*
Time deposits	4.45*	5.68*
Retail CDs	5.71*	4.40*
Consumer installment loans	2.60	0.57

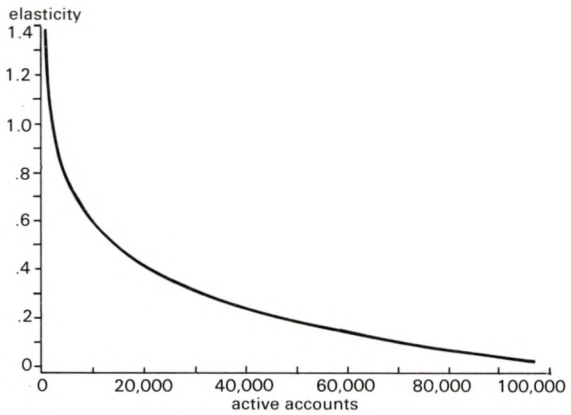
*Significant at the 5 percent level.

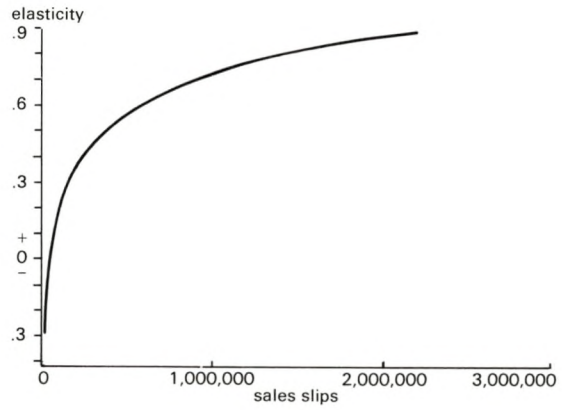
for some personnel, especially if bank card customers open accounts for other products by mail. A bank may also want to cross-sell other bank products with bank cards in order to penetrate out-of-state markets or to prepare for electronic banking. Of course, a bank might have to lower the prices on some accounts and/or raise the interest rates paid on some deposit accounts in order to get customers to bank by mail. However, if customers place a premium on "one-stop shopping," the opportunity to consolidate bank accounts might allow a bank actually to charge higher prices.

Some banks clearly use their credit cards to cross-sell deposit accounts, consumer loans, and insurance. Citibank Visa and MasterCard, for example, are vehicles for soliciting retail CD, student loan, and life insurance customers. Similarly, Sears uses its new Discover card to attract savings deposits for its nonbank bank, Greenwood Trust.

Because FCA data are not broken down sufficiently by product lines, we could not directly test these ideas; however, we were able to see if there is any relationship between bank card accounts and a few other bank products. By estimating one equation in which other bank products are a function of bank card accounts or active accounts, however, we cannot tell whether the other bank products influence the number of bank card accounts or vice versa. To overcome this problem, we used a simple test of causation, first developed by C. W. J. Granger (see box). In this model, other bank products are specified first as a function of the number of other bank products in previous years as well as the number of bank card accounts, and second, the number of bank card accounts is specified as a function of the number of bank card accounts in previous years as well as the number of other bank products.

Figure 5
Cost elasticity with respect to active accounts and sales slips





The bank products tested as cross-selling vehicles were demand deposits, time deposits, retail certificates of deposit, and consumer installment loans.

The results indicate that, for smaller banks, credit cards are of limited use as vehicles for cross-selling certain bank products (see Table 2 and box). The number of demand deposits and the number of time deposits excluding CDs are not influenced by the number of total or active bank card accounts, but the number of bank card accounts is affected by the number of demand deposit accounts and the number of time deposit accounts excluding CDs. Also, the number of bank card accounts does not seem to affect the number of retail CDs, although the number of active bank card accounts seems to influence them. The number of CD accounts does seem to influence the number of bank card accounts, both active and total. The number of consumer installment loan accounts, excluding bank card accounts, does not seem affected by the number of total or active bank card accounts, and bank card accounts do not seem affected by consumer installment loans. Thus, demand deposits and time deposits probably are good vehicles for cross-selling bank cards, but bank cards are not a good tool for increasing the number of demand deposit accounts and time deposits. However, there seem to be some reinforcing effects between the sale of bank cards and retail CDs.

Conclusions

The growth in credit card activity has been quite rapid recently. This growth can be explained, at least in part, by the induced demand generated by suppliers attempting to utilize cost economies present in the structure of a bank card operation. Our results do not suggest, however, that bank cards can be used effectively as a tool to cross-sell other bank products. Bank cards seem to be a good vehicle for selling retail CDs but not other types of time deposits or consumer installment loans.

The cost structure of bank card plans at small banks seems to have changed over the 1975-83 period for relatively small to medium-sized issuers of bank cards. These changes, however, were only temporary and so do not seem to lend any support to the hypothesis that technology has enabled bank cards to be offered more cheaply. However, the cost structure of bank card operations can still help to explain the recent surge in bank card activity because there are increasing returns to scale, at least for small to medium-size banks. Bank card managers, therefore, should want to increase output, e.g., active accounts and sales slips, in order to become more efficient and profitable producers.

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[1] See Dennis B. Fitzpatrick, "An Analysis of Bank Card Profits," *Journal of Bank Research*, Vol. 7, (No. 3, Autumn 1986), pp. 199-205, and Lewis Mandell and Neil B. Murphy, *Bank Cards*, American Institute of Banking, 1976, p. 87.

[2] Thomas Russell, *The Economics of Bank Credit Cards*, New York, 1975, p. 5.

[3] *The Nilson Report*, various issues.

[4] *Federal Reserve Bulletin* and *The Nilson Report*, various issues.

[5] See *Federal Reserve Bulletin*, October 1979, April 1980, and July 1980.

[6] If a merchant bank accepts MasterCard and/or Visa transactions but does not directly or indirectly offer bank cards to consumers, an issuing bank sponsors its membership in the Visa and/or MasterCard systems. Thus, these merchant banks can utilize the systems' settlement facilities.

[7] 1980 and 1982 data as well as data after 1984 for individual banks were not available to us.

[8] *The Nilson Report*, No. 337, August 1984, pp. 4-5

[9] For the years 1976 through 1979, we estimated a translog costs function that included the variables: active accounts; active accounts squared; sales slips; sales slips squared; new accounts; and new accounts squared. It also included the three interaction terms: active accounts times new accounts; sales slips times new accounts; and sales slips times active accounts. All variables except the interaction terms and new accounts squared were significant at the 5 percent level.

[10] Mandell and Murphy, pp. 86-87.

[11] An alternative method of testing for technological change is to use a time trend variable. We also tried this method and found similar results. See William C. Hunter and Stephen G. Timme, "Technological Change, Organizational Form, and the Structure of Bank Production," *Journal of Money, Credit and Banking*, Vol. 18 (No. 2, 1986), 152-66.

[12] As previously mentioned, our sample of 40 banks represents relatively small bank card issuers. Tech-

nological advances may have altered the cost structure of bank card plans for the largest 100 or so issuers. See "Interest Rate Controls on Credit Cards—An Economic Analysis," Lexicon Inc., October 1985.

[13] $S = \frac{\delta \ln(TC)}{\delta \ln(ATV)} + \frac{\delta \ln(TC)}{\delta \ln(SS)}$

[14] Board of Governors of the Federal Reserve System, *Reports of Condition*, 1980 and 1985.

[15] *American Banker*, October 13, 1986, p. 2.

[16] *American Banker*, November 10, 1986, p. 11.

Economic events of 1986—A chronology

George W. Cloos

1986 was a year of slow growth and moderate inflation, though both were slightly less than had been expected. However, the year contained an unusually large number of momentous events and developments, at home and abroad.

Oil prices declined sharply before staging a partial recovery as OPEC reasserted its power. The apartheid uproar caused most large U.S. corporations to pull out of South Africa. Governments changed hands in the Philippines and Haiti, and deep unrest was evident elsewhere. The Iraq-Iran war escalated. American aircraft attacked Libya. Hopes for a U.S.-Soviet arms pact were dashed as the Iceland Summit broke up.

The Democrats regained control of the Senate. The Administration's influence was undermined by the arms-for-hostages deal with Iran. The Chernobyl disaster deepened the shadow over nuclear energy. The U.S. space program was jolted by the Challenger tragedy.

Deficits in the federal budget and the nation's balance of trade set records. The dollar declined further against other leading currencies. Interest rates declined to the lowest levels in eight years. The stock market soared. Comprehensive tax overhaul was enacted. The six-year program to deregulate bank deposits was completed. Turnover on the Federal Reserve Board was unusually high.

Large mergers made headlines, prominently in banking, the airlines, and communications. Financial restructurings, layoffs, and plant closings altered the profiles of large corporations. Bankruptcy filings were frequent. Revelations of insider stock trades brought action by regulatory authorities. Problem credits in agriculture and energy threatened many financial institutions. Labor unrest was highlighted by lengthy shutdowns at USX and Deere. Consumers continued to support the economy, while business investment slowed. Motor vehicle sales set a record, aided by costly sales incentives.

Despite the barrage of unsettling events, of a sort that preceded past recessions, the national economy plowed ahead with surprising aplomb. An informed consensus held that it could duplicate the feat in 1987, extending one of the longest expansions in history.

Jan 1 Social Security benefit payments rise by 3.1%. Tax base rises to $42,000. Tax rate rises to 7.15%. (Benefits rise 1.3%, tax base rises to $43,800, and tax rate remains unchanged on Jan 1, 1987.)

Jan 1 Regulatory minimum deposits eliminated for Super NOW accounts, money market deposit accounts, and 7- to 31-day time deposits. (See Apr 1.)

Jan 1 Spain and Portugal join European Economic Community (EEC), raising membership to 12.

Jan 7 International Harvester, now exclusively a truck manufacturer, changes name to Navistar.

Jan 7 Executive order bans trade with, and travel to, Libya.

Jan 10 Federal Reserve Board applies margin requirements to certain "junk" bonds.

Jan 10 McLean Trucking, nation's fifth largest motor carrier, files for bankruptcy.

Jan 13 Yield on 20-year Treasury bonds (constant maturity index) rises to 9.86%, high for the year. (See Aug 29.)

Jan 13 FHLMC begins purchase of second mortgages.

Jan 14 Three-month Treasury bills yield 7.48% (coupon equivalent), high for the year. (See Oct 8.)

Jan 15 Union Carbide buys back 55% of its own stock for $3.3 billion to prevent takeover.

Jan 17 AT&T will close Teletype manufacturing facility in Skokie, IL.

Jan 17 Monsanto and Searle, merged in Oct 1985, will consolidate pharmaceutical research.

Jan 22 Dow Jones industrial stock average closes at 1502, low for the year. (See Dec 2.)

Jan 22 Supreme Court rules against Federal Reserve Board's attempt to stop spread of limited service banks.

Jan 23 Oil prices hit lowest level in 6 years, $18 per barrel, after 2-month decline. (See Apr 1.)

Jan 27 Global Marine, offshore driller, files for bankruptcy.

Jan 28 Space shuttle Challenger explodes, killing all seven aboard.

Jan 29 Bank of Japan cuts its discount rate from 5 to 4.5%.

Jan 29 Richard Lyng named to succeed John Block as Secretary of Agriculture.

Feb 4 Administration's budget for fiscal 1987 shows deficit of $143.6 billion, just under $144 billion limit set by Gramm-Rudman.

Feb 6 Economic Report of the President projects 4% rise in GNP fourth quarter 1985 to fourth quarter 1986, and 3.8% rise in price deflator. (Both were somewhat high.)

Feb 7 Federal district court rules key section of Gramm-Rudman deficit reduction law to be unconstitutional because of authority given to Comptroller General. (Confirmed by Supreme Court Jul 7.)

Feb 7 Haitian dictator Jean-Claude Duvalier departs following unrest.

Feb 7 Wayne Angell and Manuel Johnson sworn in as members of Federal Reserve Board.

Feb 11 Kodak will cut employment by 10%. (One of many such announcements by large corporations in 1986.)

Feb 11 United Airlines takes over Pan American's Pacific routes.

Feb 11 United States Steel buys Texas Oil & Gas for $3.0 billion in stock.

Feb 12 Farmers Home Administration ends two-year moratorium on foreclosure of farm loans, telling debtors to pay up or arrange new loans.

Feb 13 Japan will keep 2.3 million unit quota on auto exports to the U.S. for year starting Apr 1.

Feb 18 Eastern Airlines agrees to merger with Texas Air to create the nation's largest airline.

Feb 18 Farm Credit System reports $2.7 billion loss for 1985 because of farm loan write-offs.

Feb 19 Federal Reserve Chairman Paul Volcker testifies on monetary targets for 1986: M2 and M3, 6-9%; M1, 3-8%. (See Jul 18.)

Feb 20 Alabama passes interstate banking law. (West Virginia follows, Mar 17; Minnesota, Mar 19; New Jersey, Mar 28; Mississippi, Apr 14; Missouri, Apr 30; Wisconsin, Apr 30; Oklahoma, May 7; Pennsylvania, Jun 25; Louisiana, Jul 2; Texas, Sep 23; California, Sep 26.)

Feb 25 Corazon Aquino becomes Philippine president after flight of Ferdinand Marcos.

Feb 28 Olaf Palme, Swedish Prime Minister, assassinated in Stockholm.

Mar 3 President's Commission on Organized Crime calls drug traffic "the most serious problem." (Second report, Mar 6, criticizes Teamsters Union.)

Mar 6 Fox Television buys 6 TV stations from Metromedia for $1.5 billion in cash and stock.

Mar 7 Federal Reserve cuts discount rate from 7.5 to 7%, following similar cuts by Germany and Japan. Major U.S. banks cut prime rates from 9.5 to 9%. (See Apr 18, Jul 10, Aug 20.)

Mar 13 VA mortgage rate reduced from 10.5 to 9.5%, lowest since 1979. (See Nov 24.)

Mar 16 Reagan appeals for more aid to Contras fighting Sandinista government in Nicaragua.

Mar 16 French election shifts power to alliance of right wing parties. The presidency, held by socialist Francois Mitterrand, is not affected.

Mar 19 Federal Reserve Board issues Regulation D amendments preserving current treatment of money market deposit accounts and revising early withdrawal penalties to distinguish between transaction and time deposits for reserve requirement purposes.

Mar 21 Preston Martin, Vice Chairman of Federal Reserve Board, resigns, effective Apr 30.

Mar 21 Union Carbide agrees to pay $350 million in claims resulting from 1984 poison gas disaster in Bhopal, India.

Mar 24 U.S. Navy sinks two Libyan patrol boats.

Mar 25 John Deere, largest farm equipment manufacturer, will reduce employment further.

Mar 25 Maytag will buy Magic Chef.

Mar 25 Turner Broadcasting buys MGM/UA for $1.3 billion in cash and stock.

Mar 27 Federal Reserve Board implements limitations on daylight overdrafts.

Mar 27 Regulatory agencies relax capital and loan write-off standards for troubled agricultural and energy banks.

Mar 31 Bank One, Columbus, OH, issues first security backed by credit card receivables.

Apr 1 Regulatory deposit rate ceilings on passbook savings eliminated, ending 6-year deposit deregulation process. (See Jan 1.)

Apr 1 Public debt of the U.S. surpasses $2 trillion.

Apr 1 Milk Termination Program requires participating farmers to slaughter or export their dairy herds.

Apr 1 Oil prices drop below $10, low for the year, and down from $28 in Nov 1985.

Apr 1 Occidental Petroleum buys MidCon gas pipelines for $2.6 billion in cash and stock.

Apr 9 Caterpillar announces plan to cut costs an additional 5%.

Apr 10 Halley's comet, awaited 76 years, makes closest approach to earth, and proves to be a virtual no-show.

Apr 15 U.S. aircraft from bases in the United Kingdom and Navy carriers bomb Libyan bases.

Apr 16 Kohlberg Kravis Roberts buys Beatrice Cos. for $6.2 billion in cash and stock.

Apr 18 Federal Reserve cuts discount rate from 7 to 6.5%. (See Mar 7, Jul 10, Aug 20.)

Apr 18 Titan rocket, rumored to carry a spy satellite, blows up shortly after liftoff, repeating failure of previous launch in Aug 1985.

Apr 19 Bank of Japan cuts its discount rate from 4 to 3.5%.

Apr 21 Dollar falls to 171 Japanese yen, low since World War II. (Dollar hits 152 yen, low for the year, on Sep 19.)

Apr 21 Consumer price index declined in both Feb and Mar, first 2-month decline since 1965. (Third consecutive drop in Apr was unmatched since 1949.)

Apr 21 Prime rate falls from 9 to 8.5%.

Apr 25 GMAC cuts auto loan rate to 5.9%. (See Aug 28.)

Apr 26 Fire and explosion at Chernobyl USSR nuclear power plant spreads radioactive fallout over large area of central Europe.

Apr 29 Cleveland Electric merges with Toledo Edison, becomes Centerior Energy.

Apr 29 Exxon offers early retirement plan to reduce employment and cut costs. (One of many such announcements by large firms.)

Apr 29 Aancor Holdings buys National Gypsum for $1.6 billion in cash and debentures.

Apr 29 Federal Reserve Board approves merger of Wells Fargo and Crocker National, creating 10th largest commercial bank.

May 3 Delta rocket, carrying weather satellite, blows up shortly after lift-off.

May 7 Senate and House heavily reject Administration-proposed sale of arms to Saudi Arabia. (Reagan's veto of the resolution was upheld by one vote in Senate.)

May 9 Case-IH will close three farm equipment plants.

May 9 Mobil Oil freezes pay and hiring, plans staff cuts.

May 19 Federal Reserve Board announces new policy to deal with large discount window borrowings arising from computer and other operational problems.

May 21 U.S. and Canada begin negotiations on free trade agreement.

May 27 Supreme Court rejects appeal by Northern Indiana Public Service Co to recover cost of abandoned Bailly nuclear power plant.

Jun 1 AT&T strike begins. (Settled Jun 26.)

Jun 5 Dennis Levine, a director of the acquisitions division of Drexel Burnham Lambert, pleads guilty to perjury, tax evasion, and securities fraud, and agrees to make restitution. Four others plead guilty to similar charges. (See Nov 14.)

Jun 6 Capital Cities Communicatons buys ABC broadcasting for $3.5 billion in cash.

Jun 9 General Electric buys RCA for $6.4 billion in cash.

Jun 24 Hunt brothers sue 23 banks, charging a conspiracy against the family.

Jun 24 Hawkeye Bancorp, Des Moines, and creditors announce repayment agreement which includes sale of 17 banks.

Jun 27 U.S. trade deficit for May includes first agricultural deficit in 20 years.

Jun 30 New York Financial Control Board, set up to monitor New York City finances in 1975, ends its surveillance.

Jun 30 Ralston Purina buys battery division from Union Carbide for $1.4 billion in cash.

Jul 2 Supreme Court upholds affirmative action, 6-3, rebuffing Administration.

Jul 4 100th anniversary of the Statue of Liberty, restored and rebuilt, celebrated in massive ceremonies.

Jul 5 Alcoa strike ends after five weeks with wage freeze and benefit cuts.

Jul 7 United States Steel changes name to USX.

Jul 10 Federal Reserve reduces discount rate from 6.5 to 6%, lowest since Jan 1978. Prime rate falls to 8%. (See Mar 7, Apr 18, Aug 20.)

Jul 14 Comptroller of the Currency closes First National Bank and Trust Co. of Oklahoma City, second largest U.S. bank failure in history.

Jul 14 Hughes count of operating oil and gas rigs falls to 663, 43-year low and low for 1986, down from a peak of 4530 at the end of 1981.

Jul 17 Bank of America reports $640 million loss for second quarter.

Jul 17 LTV Corp, second largest steel company, files for bankruptcy, largest industrial company ever to do so.

Jul 18 Federal Reserve releases mid-year Humphrey-Hawkins report: M2 and M3 targets for 1986 retained; M1 above target "acceptable." (See Feb 19.)

Jul 26 Southeast suffers extensive drought damage to crops, livestock, and poultry.

Jul 27 Interstate Commerce Commission rejects merger of Santa Fe and Southern Pacific railroads.

Jul 30 U.S. Treasury announces all its new marketable securities will be in book entry form.

Aug 1 Manuel Johnson confirmed as Vice Chairman of Federal Reserve Board. (See Feb 7, Mar 21.)

Aug 1 Administration offers to subsidize wheat exports to USSR. (Offer was refused.)

Aug 1 United Steelworkers strike USX, first time since 1959. (No settlement by Dec 31.)

Aug 6 House upholds veto of bill to limit textile and shoe imports. (But new agreements to limit textile imports are soon negotiated with several Pacific-rim nations.)

Aug 7 LTV Corp announces steel plant shutdowns and layoffs.

Aug 8 Caterpillar-UAW strike begins. (Settled Aug 28.)

Aug 12 Northwest Airlines buys Republic Airlines for $0.9 billion in cash.

Aug 13 General Motors and Volvo White will combine heavy truck units.

Aug 16 House-Senate conferees approve draft of Tax Reform Act of 1986, cutting tax rates and curbing deductions. (Reagan signs bill Oct 22.)

Aug 19 Robert Heller sworn in as member of Federal Reserve Board.

Aug 20 Federal Reserve Board cuts discount rate from 6 to 5.5%, lowest in nine years. (See Mar 7, Apr 18, Jul 10.)

Aug 21 Federal debt ceiling raised from $2.08 trillion to $2.11 trillion. (See Oct 21.)

Aug 21 First Commodity Corp of Boston expelled from futures trading and fined for fraudulent activities at the Mid-America Commodity Exchange.

Aug 23 United Auto Workers strike three John Deere plants. (On Aug 25, Deere closes 10 additional plants in response to strike.)

Aug 26 Prime rate falls from 8 to 7.5%, lowest in almost nine years.

Aug 28 General Motors announces 2.9% auto financing and rebates to move excess inventories. (Other companies offer similar incentives.)

Aug 29 Yield on 20-year Treasury bonds falls to 7.12%, lowest since Oct 12, 1973, and low for 1986. (See Jan 13.)

Aug 29 Hunt brothers' Placid Oil Co files for bankruptcy.

Sep 4 Chicago & Northwestern and Illinois Central railroads will reduce staff.

Sep 7 Whirlpool will close plants in St. Joseph, MI.

Sep 11 Dow Jones industrial stock average drops a record 87 points to 1793. (Drop associated with program trading in stock futures and options.)

Sep 11 Government survey projects 2.5% decline in real capital spending by business for 1986. (See Dec 18.)

Sep 15 Government data show the U.S. ended 1985 a net international debtor, first time since 1919.

Sep 15 Heavy rains and flooding cause extensive crop losses in Michigan.

Sep 16 Burroughs buys Sperry for $4.8 billion in cash and stock in largest computer-electronics merger. (Consolidated company named Unisys.)

Sep 16 Textron buys EX-CELL-O machine tools for $1.0 billion in cash.

Sep 17 Senate approves William Rehnquist as Chief Justice and Antonin Scalia as Associate Justice of Supreme Court.

Sep 24 Farmers Home Administration moves to sell part of its loan portfolio, a first for a government agency.

Sep 25 Federal judge dismisses Senator John Melcher's suit challenging Federal Reserve Bank presidents' right to vote on Federal Open Market Committee.

Sep 29 Coca-Cola buys bottling companies from JTL for $1.2 billion in cash.

Sep 29 U.S. journalist Nicholas Daniloff freed in complex deal with USSR.

Sep 29 Wieboldt Department Stores files for bankruptcy.

Oct 1 Burroughs to move up to 300 executives from Michigan to Blue Bell, PA, following Sep 22 merger.

Oct 1 PepsiCo buys Kentucky Fried Chicken for $0.8 billion in cash.

Oct 2 Emmett Rice resigns from Federal Reserve Board, effective Dec 31.

Oct 2 Senate overrides Reagan's veto of bill to impose economic sanctions on South Africa to protest apartheid. (Follows similar House action.)

Oct 4 Flood waters crest after weeks of heavy rains in a band stretching from Oklahoma to Michigan.

Oct 6 May Department Stores buys Associated Dry Goods stores for $2.4 billion in stock.

Oct 6 NHTSA reduces CAFE (corporate average fuel economy) requirement from 27.5 to 26 miles per gallon for auto model years 1987 and 1988.

Oct 6 Sales of cars and trucks in model year 1986, domestic and foreign, totaled record 16 million.

Oct 8 Three-month Treasury bills yield 5.18% (coupon equivalent), low for the year and lowest since Jul 1, 1977. (See Jan 14.)

Oct 12 Iceland summit meeting between Reagan and Soviet Premier Gorbachev ends with failure to achieve arms agreement.

Oct 16 U.S. announces 15% tariff on Canadian construction lumber. (Later replaced by Canadian export tax.)

Oct 16 FDIC plans to sell to the public 30% of its 80% ownership of Continental Illinois Corp.

Oct 20 IBM and General Motors will pull out of South Africa. (See Dec 30.)

Oct 20 Union Pacific buys Overnite Transportation trucklines for $1.2 billion in cash.

Oct 21 Federal debt limit temporarily raised to $2.3 trillion through May 15, 1987. (See Aug 21.)

Oct 22 Budget Reconciliation Bill for 1987 permits Farm Credit System to amortize loan writeoffs over 20 years.

Oct 22 General Motors reports operating loss in third quarter, partly reflecting cost of sales incentives.

Oct 23 In fiscal 1986, federal outlays totaled $990 billion, revenues $769 billion with record $221 billion deficit. Farm programs hit record $26 billion.

Oct 27 Ahmed Yamani, long-time Saudi Arabian oil minister, removed from office.

Oct 27 London security markets deregulated in the "Big Bang."

Oct 29 J. Henry Schroder Bank, subsidiary of Industrial Bank of Japan, buys Aubrey G. Lanston & Co.

Oct 30 St. Louis Globe-Democrat ceases publication.

Oct 31 USDA reports soybean prices lowest in 10 years, corn lowest in 14 years.

Nov 1 Minimum rate on EE Savings Bonds held five years falls from 7.5 to 6%.

Nov 1 Fire at Swiss warehouse results in spill of chemicals into the Rhine River causing massive fish kill.

Nov 3 U.S. agricultural exports in fiscal 1986 were lowest in 9 years, 40% below 1981 peak.

Nov 4 Election transfers control of Senate to the Democrats, 55-45. Democratic majority in House increases to 259-176. GOP gains eight governorships.

Nov 6 Amoco begins to phase out leaded gas completely.

Nov 6 General Motors plans to close 11 plants in the Midwest, 7 in Michigan.

Nov 6 Immigration Reform Act imposes heavy fines on those who hire illegal aliens.

Nov 7 Canada imposes duty on "heavily-subsidized" U.S. corn.

Nov 10 International Paper buys Hammermill Paper for $1.1 billion in cash.

Nov 11 IBM will close Greencastle, IN, parts distribution center.

Nov 13 Reagan reports on controversial arms sales to Iran. (On Nov 25 he states he was not fully informed.) (See Dec 4.)

Nov 14 Ford ends COLAs for salaried workers, following GM and Chrysler.

Nov 14 Ivan Boesky pleads guilty to SEC charges of insider trading, agrees to pay $100 million in fines. (See Jun 5.)

Nov 17 Omnibus Water Resources Development Act increases user fees and cost sharing with state and local governments.

Nov 18 House Majority Leader Jim Wright predicts comprehensive trade legislation in 1987.

Nov 20 Japan agrees to limit exports of machine tools to the U.S. to its 1981 market share.

Nov 24 VA reduces home mortgage rate from 9.5 to 9%, lowest since June 1978.

Nov 24 Kohlberg Kravis Roberts buys Safeway Stores for $4.3 billion in cash, debentures, and stock.

Nov 30 Goodyear halts Sir James Goldsmith's takeover threat by paying him $619 million for his shares.

Dec 1 U.S. imposes 0.22% "user fee" on all imports.

Dec 1 H. Ross Perot agrees to sell back holdings of General Motors stock and resigns from its board.

Dec 1 Chesebrough-Pond's agrees to purchase offer by Unilever N.V. of $3.1 billion.

Dec 2 Dow Jones industrial stock average closes at 1956, high for the year, up 30% from Jan 22 low. (See Jan 22.)

Dec 3 MCI Communications will reduce labor force by 15%.

Dec 4 Baxter Travenol, following merger with American Hospital Supply, will cut 5,000 jobs, mainly in northern Illinois.

Dec 4 House and Senate create separate committees to investigate Iran arms deal. (See Nov 13.)

Dec 5 Unisys will close plants in Tennessee and Wisconsin. (See Sep 16.)

Dec 5 GM's Electro-Motive Division halts locomotive output in McCook, IL, because of low orders.

Dec 10 Trade deficit hit record $37.7 billion in third quarter.

Dec 11 Federal Reserve Bank of New York adds five U.S. government securities firms, including two owned by Japanese banks, to its list of primary dealers.

Dec 15 Chemical New York Corp plans to acquire Texas Commerce Bancshares of Houston for $1.2 billion, to become 4th largest commercial bank.

Dec 15 Henry Wallich resigns from Federal Reserve Board due to ill health, effective immediately.

Dec 16 RepublicBank of Dallas plans to acquire Interfirst of Dallas, to become 11th largest commercial bank.

Dec 18 Commerce Department survey projects business plant and equipment spending in 1987 to equal 1986. (See Sep 11.)

Dec 18 AT&T announces $3.2 billion pre-tax charge for fourth quarter.

Dec 18 Delta Air Lines buys Western Air Lines for $0.9 billion in cash and stock.

Dec 21 OPEC nations agree to cut oil output and sell at $18 per barrel.

Dec 22 Interstate Oil Compact Commission (29 states) urges tariff on crude oil and products.

Dec 22 USDA reports hog inventory lowest in 10 years, cattle inventory lowest in 22 years.

Dec 23 Fruehauf Holdings, investor group, buys Fruehauf truck trailers for $1.1 billion in cash and stock.

Dec 23 Federal Appeals Court rules that commercial paper operation of Bankers Trust is lawful, overruling district court which held such activities constitute security underwriting.

Dec 23 Honeywell buys Sperry Aerospace from Unisys for $1.0 billion in cash.

Dec 24 UAL Inc will buy Hilton International hotel chain for 1 billion.

Dec 30 Exxon sells Reliance Electric for $1.4 billion in cash.

Dec 30 Auto sales surge late in 1986 to beat loss of sales tax deductions and slower depreciation starting Jan 1.

Dec 30 New York State Banking Dept rules that state-chartered banks can underwrite corporate securities.

Dec 30 Exxon becomes 81st U.S. company to pull out of South Africa since 1984. (See Oct 20.)

Dec 30 Administration will impose heavy tariffs on EEC luxury exports if U.S. is not compensated for grain export loss resulting from Spain and Portugal entering EEC. (See Jan 1.)

Dec 31 Campeau buys Allied Stores for $3.5 billion in cash.

Dec 31 Fire at DuPont Plaza Hotel in San Juan, PR, causes 96 deaths.

Dec 31 Dollar falls to low for year against the German mark.

NOTE: These events were gathered from many sources including: *Fortune* magazine, *The Wall Street Journal*, *World Almanac*, *Information Please Almanac* and other newspapers and trade journals.

The minimum wage: No minor matter for teens

Donna C. Vandenbrink

"One of the Nation's most serious and longstanding problems is providing adequate employment for our young people. ...The restricted job opportunities for youth, especially minority youth, due to the minimum wage have contributed to the growing consensus on the value of a lower minimum wage for youths as a means of expanding their employment."

Presidential Message to Congress, May 17, 1984

"The record does not justify the establishment of a youth differential [minimum wage]."

Minimum Wage Study Commission, Report of the Commission, 1980.

Whether teenagers should receive special treatment under the federal minimum wage law has been a matter of controversy for some years. Bills to introduce a special lower minimum wage for teenagers have been proposed in the last two sessions of Congress. Advocates contend that the minimum wage has a significant negative impact on job opportunities of low-skilled youth. But some research suggests that the employment gains from a differential minimum wage might be quite modest. The 1980 Congressional Minimum Wage Study Commission concluded that a differential of 25 percent less than the adult minimum wage would likely increase youth employment by at most 5 percent.

In this paper, I look at the effects of such special treatment on teenage employment in the states of the Seventh Federal Reserve District. I find a much larger effect on youth employment than earlier time-series studies based on aggregate data. This study analyzes individual wages and personal characteristics rather than the average wages and population characteristics. Another study using data on individual adults finds similar results. The research also shows that the positive employment effect of a lower youth minimum wage is roughly the same across racial groups and geographic areas.

Minimum wage legislation

A federal minimum wage, intended to ensure all workers a "living wage," was established in 1938 by the Fair Labor Standards Act (FLSA). The minimum has been raised over the years from the original level of $0.25 per hour to $3.35 in 1981. Initially, the federal minimum covered 43 percent of all nonsupervisory and salaried workers. Today, the coverage rate is over 80 per cent. Currently, the FLSA exempts low-volume retail establishments, trade and service establishments, seasonal amusement establishments, and certain other establishments from paying the minimum wage. There were about 22 million exempt workers in the private sector in 1980. (This included 13 million executive, administrative, and professional workers who already earn well above the minimum wage.)

The employment effects of wage regulation

A teenage minimum wage differential is intended to ease a problem created when government sets a legal minimum on wages. Economic theory suggests that a minimum wage reduces the demand for low-skilled labor.[1] In a competitive market, with no regulation, the wage a worker is paid reflects the value of his time in the marketplace. Other things equal, the more skilled or productive a worker, the higher the market wage he can command. When a minimum wage is introduced, it raises the cost of employing workers whose market wage is below the legal floor.

Faced with a minimum wage, employers have several options. They can bring workers previously paid below the minimum up to the minimum, offsetting the added cost by reducing

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nonwage compensation or requiring greater effort. Or, they can choose to employ only those workers whose hourly contribution to output exceeds the minimum wage. When employers choose the latter course, the institution of a minimum wage (or an increase in the level of the minimum) reduces employment. This outcome has been substantiated in a number of empirical studies of the effects of the federal minimum wage.[2]

The side effects of minimum wage regulation may be felt particularly by teenagers who, because of inexperience and lack of skills, tend to have low market wages. If the minimum wage set by the FLSA were higher than the market value of most teenage workers, the regulation would make teens too costly to hire and thereby foster teenage unemployment. A survey of empirical research on the minimum wage concluded that the federal minimum wage has indeed reduced teenage employment, in the range of 1 to 3 percent for a 10 percent increase in the minimum.[3]

Youth joblessness is of considerable concern to policymakers. Whether induced by the minimum wage or caused by other factors, youth joblessness may have long-range consequences for individuals and society. Research has shown that although early periods of unemployment are not associated with later recurring periods of unemployment, the effect of lost work experience on a young worker's wage level persists as he gets older.[4] Furthermore, teenage joblessness may be associated with crime and other antisocial behavior.[5]

Permitting employers to pay teens less than the adult minimum wage would make more teenagers more employable. Minimum wage differentials—lower minimums that apply to certain types of workers—have been used in the past. For example, the FLSA permits authorized employers to pay below-minimum wages to some students and entry-level workers. Until recently, such differentials were not an important feature of federal minimum wage policy. However, since 1972 Congress has considered a number of proposals for a youth differential minimum wage. And, while failing to pass such a broad-based differential, it has greatly expanded the full-time student subminimum program.[6]

Proponents of a minimum wage differential for youth believe that by increasing teenage employment such a policy would encourage the development of positive work attitudes and the accumulation of job-related skills among youth. Critics of a differential object to singling out teenagers for special treatment. A minimum wage, they point out, makes employment of any low-skilled worker less attractive, regardless of age. According to Linneman (1982) almost 10 percent of the U.S. *adult* population did not have the characteristics to earn a wage above the minimum wage in 1974. Moreover, a subminimum wage for teenagers would encourage employers to substitute the cheaper teens for very low-skilled adult workers, increasing the unemployment problem in the adult population. These important issues are beyond the scope of this study.

Overview

The purpose of this study is to estimate the effect of a special minimum wage for teenagers on the level of teenage employment in the Seventh Federal Reserve District. Two alternative youth minimum wages are analyzed—one 25 percent below and one 15 percent below the adult minimum wage level. These translate into teenage minimum wage levels of $2.33 and $2.64, respectively, given the adult minimum wage of $3.10 in 1980, the year for which employment estimates are made.

A lower minimum wage for youth is expected to increase teenage employment, but the size of the increase depends on the distribution of market wages among teenagers and on individual teens' employment decisions. The wage distribution indicates how many teens have market wages between the existing adult minimum and the new youth minimum, and hence, how many teens would be available for hire as the legal minimum wage is lowered. However, not all of these teens would be willing to work even when employers were permitted to offer them their market wage. For some, employment at their market wage is not as attractive as alternative uses of their time. How many teens would choose to work depends on each individual's employment decision.

This study develops expected market wage distributions specifically for the population of teenagers in the Seventh District States and predicts aggregate employment using individual survey data. If there is significant individual variance in the distribution of

wages or in employment rates, then this approach will be more accurate in measuring the total change in employment than one based on aggregate data and population averages.

The distribution of market wages

As a starting point, it is useful to look at the distribution of wages for teenagers in the Seventh Federal Reserve District. The coefficients of a wage equation estimated on data from a national survey of youth (see Box), together with socio-demographic data for individual teenagers from the Public-Use Micro Samples (PUMS) of the 1980 Census of Population, were used to calculate expected market wages for individual teenagers in each of the five District states. The resulting wage distribution is shown in Figure 1. According to this measure, just under half of the teens in the five states could expect market wages below the 1980 federal minimum wage level of $3.10.

The characteristics of the teens in the District with expected wages above the $3.10 minimum differ considerably from those of the teens with expected wages below the minimum. The above-minimum teens are older, averaging just under 18 years of age. They have about one and one-half more years of education. Only slightly more than one-fourth of the above-minimum group is female, but young women comprise over three-fourths of the below-minimum group. Overwhelmingly, the below-minimum group is still enrolled in school. All five states exhibit similar above- and below- minimum differences by race, marital status, and motherhood status, but the average level of these characteristics differs among the states.

A youth differential would have its greatest effect on teens whose expected wage was between the youth minimum and the current minimum. In order to estimate the size of this group, I compared the proportion of teens having expected wages under $3.10 with the proportions below the alternative minimum wage levels of $2.33 and $2.64.[7]

These proportions are given in Table 1. According to the table, setting a teen minimum at $2.33 would reduce the proportion of teens below the minimum from approximately 47 percent to about 20 percent. Under this scenario, roughly 27 percent of teenagers would become newly eligible for employment. With a teenage minimum at $2.64, slightly under one-third of teens would remain in the below-minimum group. Under this scenario only 16 percent would become newly eligible for employment.

Employment probabilities

In order to measure the employment effect of lowering the minimum wage we also need to understand what determines whether a teen will decide to work if he is given the opportunity to earn his market wage. After we have developed a model of the probability of employment given an expected market wage and the level of the minimum wage, we can calculate how the rate of teenage employment would change under different minimum wage levels.

The employment decision

An individual will choose to work if the value of his wage income exceeds the value of time spent in school, homemaking, or other activities. But, when a minimum wage is in place, some individuals—those with market wages below the minimum—will not be able to work even if they choose to. So whether or not a person works depends not simply on his market wage, but on the relation of the market wage to the level of the minimum wage.

Thus, in a teenager's employment decision, the probability of his employment depends on opportunities for work in the locale where he resides, the nonmarket activities he engages in, and the probability of his market wage lying below the minimum wage. This latter probability captures the effect of the minimum wage on his ability to find work as well as the effect of his market wage on his decision to seek work. It varies with individual characteristics as well as with the level of the minimum wage.

Table 2 shows the specific variables used to predict employment along with the coefficients generated by the analysis. The sample was composed of all 16-to-19-year-olds in the five District states. Conventional statistical techniques are not appropriate for predicting "yes/no" decisions. The employment decision is an example of this, since people either have a job or they don't. A special statistical technique known as probit analysis was used to

The wage equation

The distribution of wages for teenagers in the Seventh District used in this analysis was based on imputed hourly wage rates. I describe here the rationale for that imputation and the details of its derivation.

Gaps in employment information make hourly wage rates constructed from the Census of Population unreliable. Rather than use the Census data to measure wage rates, we derived wage rates for the teenagers in the Seventh District census samples by estimating a wage equation on another data set and applying those coefficients to the personal characteristics reported in the Census samples. The other source of data was the 1980 interview wave of the Second Youth Cohort of the National Longitudinal Survey (NLS). The questions on this survey were designed specially to provide information on the labor market behavior of youth in the general population.*

The wage rate of interest is one which indicates the true market value of an individual worker. However, minimum wage regulation may distort actual observed wages from this true market wage when it does not cover all workers in the economy. If workers excluded from employment in the covered sector seek work in the uncovered sector, the additional supply of labor will push wages there below their value in an unregulated labor market. As a practical matter, this means that when a teenager on the NLS survey reports a wage less than the federal minimum, we cannot be sure what his true market wage would be. On the other hand, actual wages which are higher than the federal minimum should be relatively unaffected by the regulation and should indeed represent unconstrained market wages. Consequently, I used only those NLS observations with reported wages above $3.10 (the federal adult minimum wage in 1980) as the sample for the wage equation.

Having thus excluded from the wage equation teens who were not employed and those who were employed but with below-minimum wages, I needed to adopt an appropriate estimating technique. Standard ordinary least squares (OLS) estimates of the wage equation would be biased if the chance of inclusion in the sample (here, the chance of employment at an above-minimum wage) were systematically correlated with the personal characteristics that determine the market wage. I adopted Heckman's solution, controlling for the potential bias by adding to the wage equation a variable (lambda) whose value depends on the probability of being included in the sample (here, the probability of being employed at a wage above the minimum).**

Table A reports the estimates of the wage equation. The explanatory power of the equation is reasonable, with an R^2 of .15. The wage structure is consistent with our expectations about the relationship of various personal characteristics and their market value. More education, greater age (and presumably more experience), and married family status all garner higher wages while being female, being black, and being enrolled in school reduce an individual's wage, other things equal.

The second column of Table A shows the OLS estimates of the wage equation without controlling for the probability of employment with a higher than minimum wage. Comparing these results with those in the first column we can see that including lambda in the wage equation shifts the intercept without having much effect on the coefficients of the other variables. This suggests that average wage levels differ with the probability of employment, although the slope of the wage structure

Table A
Wage and employment analysis of NLS youth sample

	Adjusted OLS wage	OLS wage	Employment probit
Intercept	0.52 (.323)	0.77 (.059)	−8.68 (1.103)
Highest grade	0.02 (.005)	0.02 (.003)	—
Education 9-12 years	—	—	0.49 (.058)
Education over 12	—	—	0.60 (.073)
Female	−0.18 (.021)	−0.17 (.011)	−0.29 (.028)
Age	0.04 (.008)	0.03 (.004)	0.75 (.117)
Age ^{2}	—	—	−0.02 (.003)
Enrolled	−0.11 (.039)	−0.80 (.013)	−0.57 (.036)
Black	−0.05 (.025)	−0.03 (.013)	−0.37 (.033)
Married	0.02 (.026)	0.04 (0.17)	−0.31 (.050)
Lambda	0.24 (.316)	—	—
F	91,061	106.121	—
$R^2/\bar{R}^2$	.1491/.1475	.1475	—
log likelihood ratio	—		−5477.99
n	3645	3645	9819
Standard error	.3553	.3094	

with respect to personal characteristics does not. In any case, this NLS youth sample does not suffer from conventional selection bias, since the coefficient on lambda is not significant.

Table B compares the distribution of wages actually reported on the NLS with the distribution constructed from the parameters of the wage equation in Table A. The predicted distribution is constructed by taking into account not only

Table B
Comparison of actual and predicted wage distribution NLS sample

	Actual (workers only)	Predicted (workers + nonworkers)
$0.01 - 2.32	8.9%	15.9%
2.33 - 3.09	14.0	23.2
3.10 - 4.11	43.7	27.9
4.12 - 5.00	12.5	15.4
5.01 - 8.00	16.3	15.9
8.01 and over	4.6	1.7

each individual's expected wage level derived from the wage equation but also the variance in this predicted value. (The variance arises because a person's wage is influenced by many unobserved factors and by variables not included in the wage equation.) The actual distribution in Table B is more concentrated above $3.10 than the predicted distribution. Of course, this is as it should be since the minimum wage law prohibits many employers from paying wages under $3.10.

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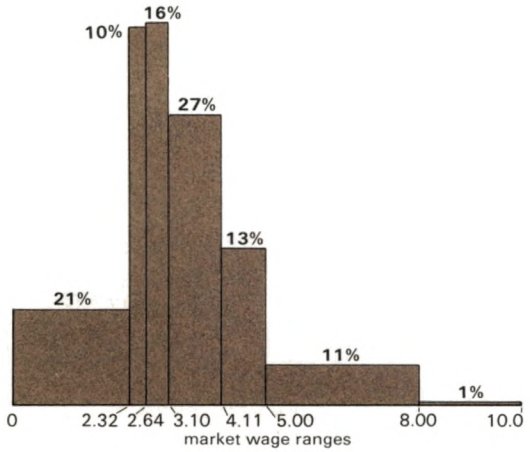
*The NLS Youth Cohort is a sample of 5,700 young men and 5,700 young women who were interviewed annually between 1979 and 1984. At the time of the 1980 interview they ranged in age from 15 to 23 years old.

**The value of lambda is computed from a probit estimate of employment status. The employment states were: "employed with a wage higher than the minimum wage" and "other." The results of this probit are shown in the third column of Table A. This lambda differs slightly from the conventional "Heckman lambda" which controls only for potential bias due to censoring the sample by employment probability. These results also are consistent with expectations. Being female, enrolled in school, black, or married makes one less likely to be employed. Greater age increases the probability of employment, with a diminishing effect as one gets older (age-squared is negative). Individuals with a high school education are more likely to be employed than those completing eighth grade or less (the omitted category) and those with education beyond high school are even more likely to be employed.

Figure 1
Distribution of expected market wages of 15-19 year olds in Seventh District states



predict employment status. The dependent variable is individual employment status. The variable PROBSUB is the probability that the individual's expected wage is below the minimum wage of $3.10. The other explanatory variables include four state dummies, two indicators of local labor market opportunities—a local unemployment rate for teens and local per capita income—and three measures of nonmarket alternatives—school enrollment and marital and motherhood status.

According to the coefficients on the state dummies, the average probability of employment, other things equal, is higher in Indiana, Iowa, Michigan, and Wisconsin than in Illinois (the omitted category). The difference between Illinois and Indiana is not statistically significant, however. Teens living in counties with a higher per capita income are more likely to be employed while those in areas with a higher proportion of unemployed teens are themselves less likely to be employed. Being enrolled in school, being married, or being a mother all reduce the probability of being employed, although the effect of marital status is not statistically significant. As expected, the higher the probability of having a market wage below the minimum wage, the lower the probability of being employed.[8]

Figure 2 demonstrates the relative importance of each of the independent variables by showing the change in employment probability that results from a 10 percent increase in the mean value of each explanatory variable. In these terms, the below-minimum status—PROBSUB—is the most important determinant of employment probability.

Table 1
Effect of alternative minimum wages on the proportion of teenagers with below-minimum wages

Proportion of teens with wages below	
$3.10	47.40%
$2.33	20.80
$2.64	31.36

Figure 3 illustrates how changes in the probability of earning a subminimum wage affect the probability of employment. As the figure shows, lowering the minimum wage has its biggest impact on individuals who already have a 50-50 chance of being employed. The impact on individuals with extremely high or extremely low probabilities of employment will be much smaller.

Increase in employment with teenage differential

We can calculate the effect of a youth minimum wage on teenage employment in the Seventh District by combining our understanding of the determinants of individuals' market wages with our analysis of the determinants of employment. From the wage equation we can determine the probability of a teen's

Table 2
Employment equation for 7G States

	Probit coefficient	Standard errors per probit
Intercept	0.8316145	.037
Indiana	0.00579456	.012
Iowa	0.04991053	.014
Michigan	0.12036113	.010
Wisconsin	0.09386675	.012
Enrolled	−0.36047791	.010
Married	−.0.00818144	.018
Mother	−0.72281929	.021
Teen unemployment rate	−0.03103838	.001
PROBSUB	−1.37434363	.032
Per capita income	.02998966	.003
log likelihood ratio	−83,903.2	
n	129,623	

market wage lying below the alternative minimum wages of $2.33 and $2.64.

These new values of PROBSUB can be used to recompute each individual's probability of employment using the employment model from Table 2. These in turn can be used to generate an aggregate employment rate for teenagers. Comparing these new employment rates with the baseline rate gives the effect of the new policy.

Table 3 shows the employment rates calculated in this way for the five states of the Seventh District. The expected baseline employment rates with the minimum at $3.10 range from 39.3 per cent in Indiana to 46.7 percent in Wisconsin. Under a $2.33 minimum wage, estimated teenage employment rates stand above 50 percent in all five states, and with a $2.64 minimum, estimated employment rates range between 47 and 55 percent.

These predicted employment rates suggest that reducing the minimum wage by 25 percent (to $2.33) would raise the teenage employment rate by fourteen percentage points. In the District states this would translate into a 30 to 36 percent increase. Lowering the minimum by 15 percent would increase employment by 18 to 21 percent. By comparison, the Minimum Wage Study Commission determined from a review of previous research that we might expect a 2.5 to 5 percent increase in teenage employment for a 25 percent youth minimum wage differential.

Figure 2
Change in probability of employment with a 10 percent increase in independent variables

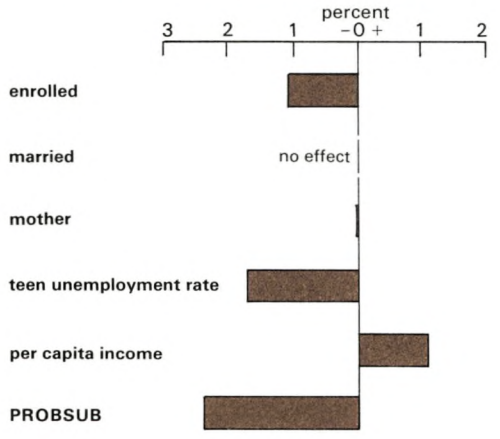
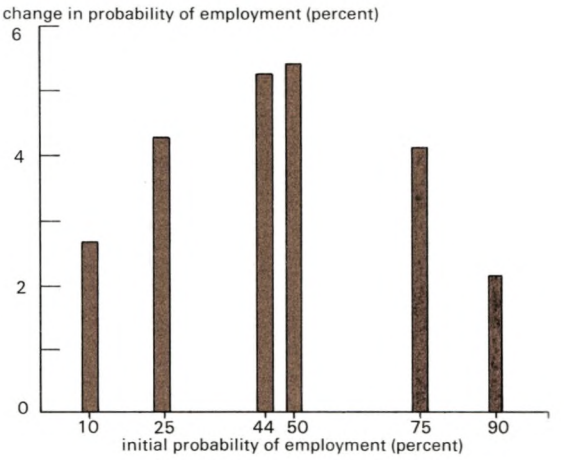


Figure 3
When the probability of having a subminimum wage decreases by 10 percentage points, the probability of actually having a job increases. The effect is greatest when the probability of employment is nearly even



Some insight into the greater employment responsiveness of our results can be gained by looking back at Figure 3. In that figure, which is based on our employment probability model, reductions in the minimum wage have their greatest effect on employment when initial employment rates are between 25 and 50 percent. This is exactly the range of teen employment rates obtained for the District states under the baseline, $3.10, minimum wage assumption (see Table 3).

Our estimates of the responsiveness of employment to changes in the minimum wage are consistent with the results of one other study. Linneman investigated changes in adult employment following the 1974 increase in the minimum wage from $1.60 to $2.00. He calculated employment rates of 64 percent and 51

Table 3
Expected employment rates among District teenagers under alternative minimum wage levels

Percent employed with a minimum wage of:	Illinois	Indiana	Iowa	Michigan	Wisconsin
$3.10	42.6	39.3	46.6	39.6	46.7
$2.64	50.8	47.4	55.1	47.8	55.1
$2.33	56.4	53.0	60.6	53.3	60.6

Table 4
Predicted increase in teenage employment under alternative minimum wage differentials

By age, sex, race, employment status, and location for Seventh District states
(Percentage point difference from predicted employment rate with $3.10 minimum wage)

Change in employment rate when minimum lowered to:	Illinois		Indiana		Iowa		Michigan		Wisconsin	
	$2.33	$2.64	$2.33	$2.64	$2.33	$2.64	$2.33	$2.64	$2.33	$2.64
All 15 to 19 yr. olds	13.8	8.2	13.7	8.1	14.0	8.5	13.7	8.2	13.9	8.4
By age										
15 yr. olds	15.5	8.7	15.2	8.5	16.0	9.1	15.1	8.4	16.0	9.1
16 yr. olds	15.3	8.9	15.1	8.7	15.6	9.2	14.9	8.6	15.6	9.2
17 yr. olds	14.5	8.7	14.3	8.6	14.8	9.0	14.3	8.6	14.6	8.8
18 yr. olds	12.7	7.9	12.8	7.9	13.0	8.1	12.7	7.9	12.8	8.0
19 yr. olds	11.0	7.1	11.1	7.1	10.8	6.9	11.2	7.2	10.7	7.0
By sex										
Males	12.6	7.9	12.6	7.9	12.6	7.9	12.6	7.8	12.5	7.9
Females	15.0	8.6	14.7	8.5	15.4	8.9	14.6	8.4	15.3	8.8
By race										
Black	13.9	8.1	13.6	7.8	14.8	8.7	13.3	7.7	14.5	8.5
Other	13.7	8.3	13.7	8.2	14.0	8.5	13.7	8.2	13.9	8.4
By employment										
Unemployed	12.3	7.7	12.2	7.6	11.9	7.5	12.3	7.6	12.0	7.5
Not in labor force	14.2	8.5	14.1	8.4	14.4	8.1	13.9	8.3	14.4	8.7
By location										
Center city	13.8	8.2	13.0	7.6	13.9	8.4	15.0	9.6	16.6	8.3
SMSA outside center city	13.8	8.3	13.9	8.3	13.8	8.4	13.9	8.4	14.0	8.4
Non SMSA	13.6	8.1	13.5	8.0	14.1	8.5	13.5	8.0	13.9	8.4

percent before and after the change in policy, respectively, for those adults who had below-minimum wages in 1974. In other words, Linneman found that the 25 percent increase in the minimum wage resulted in a thirteen percentage point decline in the employment rate for this group. This result is quite close to our own estimate of a fourteen percentage point change for teenagers. Significantly, Linneman's work, like ours, is based on the analysis of data on individuals, not on aggregate employment statistics such as were used in most other studies.

The distribution of employment benefits

By using the employment equation in Table 2 to predict unemployment rates for different demographic groups, we can get a better idea of who will benefit most from a lowering of the teenage minimum wage. Table 4 shows the percentage point increase over the predicted baseline employment rate by age, sex, race, current employment status, and residential location.

Lowering the minimum wage generates larger increases in employment rates for younger than for older youth, for females than for males, and for those currently not in the labor force than for the unemployed.

Noteworthy is the fact that the increment to the employment rate for nonblacks is as large as it is for blacks. Also, the gain in the employment rate of teens living in suburban areas is on a par with that of center city teens. Thus, a youth differential would not appear to benefit primarily blacks or primarily center city youth. Its benefits would be felt across all racial groups and geographic areas.

Conclusion

This study used survey data on individual teenagers to investigate the effect of a youth minimum wage differential on teenage employment in the Seventh Federal Reserve District. The study found that allowing employers to pay teenagers a minimum wage 25 percent below the adult level would likely increase teenage employment rates by about one third. This is a substantially greater increase in youth employment than many observers, including the Minimum Wage Study Commission, have predicted. This study also showed that the

youth differential would draw new teen workers from outside the labor force as well as from the unemployed, from all racial groups, and from all geographic locations. Thus, a youth differential minimum wage should not be considered a job program for the inner city, minority, hardcore-unemployed youth. Rather, it would be a broadbased youth employment program.

[1]See George J. Stigler (1948) for the classic analysis of the economic impact of minimum wage legislation.

[2]See Brown, Gilroy and Kohen, (1982), for a review of this literature.

[3]Brown, Gilroy and Kohen (1982), p. 505.

[4] See Ellwood (1982) and Meyer and Wise (1982).

[5]See Albert Rees (1986) for discussion of the problem of youth joblessness and public policy.

[6]Before 1975 student employment under the program never exceeded 79,000 but it has fluctuated between 250,000 and 500,000 thousand annually since the changes initiated in 1974. Richard B. Freeman, Wayne Gray and Casey E. Ichniowski. "Low-Cost Student Labor: The Use and Effects of the Subminimum Wage Provisions for Full-Time Students," Vol. 5. Minimum Wage Study Commission. 1981, Table 3.

[7]I first calculate the probability that each individual's expected market wage is below-minimum under the three assumptions about the minimum wage level. The mean of this probability for each state sample indicates the expected proportion of teens in the state with a wage below the assumed minimum.

[8]The following table shows the results of ordinary least squares (OLS) estimates of an employment status equation similar to the one in Table 2. The regression on the left includes the variable PROBSUB, while the one on the right does not. Comparing these results, we can see that including the probability of a below-minimum wage increases the explanatory power of the model.

OLS employment results

	Model 1		Model 2	
	Coefficients	Standard errors	Coefficients	Standard errors
Intercept	.685833	.014	.801869	.014
Indiana	.000115832	.005	.00194259	.005
Iowa	.016953*	.005	.019478*	.005
Michigan	.050854*	.004	.043907*	.004
Wisconsin	.034730*	.004	.035551*	.004
Enrolled	−.225064*	.003	−0.138086*	.004
Married	.001073928	.007	−.0077382	.007
Mother	−0.308383*	.007	−.252184*	.007
Teen unemployment rate	−0.012438*	.000	−.011211*	.000
PROBSUB	—		−0.512270*	.012
Per capita income	.008595258*	.001	.011697*	.001
n	129,623		129,623	
R^2	.0620		.0756	
F	952.2		1061.0	

*Significant at 1%.

However, even the OLS version of the model with PROBSUB accounts for less than 8 percent of the variation in employment among the sample of Seventh District teens. The remaining variation must be explained by other factors not included in the model and their influence on individual employment decisions. (One of the factors omitted from the employment model is the existence of programs, like the full-time student certification program, which do permit some employers to pay below-minimum wages.) Since the employment model accounts for only a small percentage of variation in employment, it does not predict accurately whether a particular individual will be employed. But, since the coefficient on PROBSUB is significant, as long as factors omitted from the model are not correlated with PROBSUB, the model captures fully the effect of a change in the probability of below-minimum market wages on the probability of employment.

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Technical correction: The inflation-adjusted index of the dollar

The article, "The international value of the dollar: An inflation-adjusted index" in the January/February 1987 issue of *Economic Perspectives*[1] contained an error in the formulation of the equation that specified the inflation-adjusted aggregate exchange rate of the dollar. As formula (1) is specified on page 21, the relative prices term is inverted. The correction is as follows: The ratio of the CPI for the United States to the CPI for country i is used to measure the relative movement of prices in the United States as compared with the movement of prices in country i. The corrected equation (1) for the calculation of the Chicago real trade-weighted dollar follows:

$$(1) \qquad 7\text{-}Gr_t = 100 \left[\prod_{i=1}^{16} \left(\frac{CPI_{U.S.,t}}{CPI_{i,t}} \frac{XR_{i,t}}{XR_{i,0}} \right)^{\overline{W}_{i,t}} \right]$$

where
$7\text{-}Gr_t$ = the Chicago real trade-weighted dollar in quarter t.

An equivalent formulation for applying the deflator to nominal exchange rates is:

$$(2) \qquad 7\text{-}Gr_t = 100 \left[\prod_{i=1}^{16} \left(\frac{XR_{i,t}}{XR_{i,0}} \div \frac{CPI_{i,t}}{CPI_{U.S.,t}} \right)^{\overline{W}_{i,t}} \right]$$

In the example at the bottom of page 19 the real DM/$ exchange rate in t_1 should be 2.47 DM/$ with the real appreciation between t_0 and t_1 being 23.4 percent as compared with the 20 percent nominal appreciation. The third sentence of the final paragraph of that example should read: "However, the dollar cost in terms of the claim on U.S. real resources necessary to acquire that product at a real exchange rate of 2.47 mark/dollar would be $42.51—less than in time t_0 and less than indicated by the nominal exchange rate. The relative increase in U.S. prices contributed to a boost in the real appreciation of the dollar above that of the nominal appreciation."

Recall that during the period of inquiry, 1971-1986, U.S. prices *relative* to price trends in the countries included in the 7-G indexes performed as follows: During 1971-1977, U.S. prices declined; during 1978-1980, U.S. prices increased; during 1981-1983, U.S. prices declined; and during 1984-1986 U.S. prices remained stable. The relative price movements in conjunction with nominal dollar exchange rate trends exerted the following modifying influences during the 16-year period under study:

(1) During 1971-1977 the nominal value of the dollar declined. Falling relative U.S. prices exacerbated the decline. Thus, the relative-price adjusted exchange rate declined more than the nominal exchange rate. The real competitive position of the dollar improved more during that period than is reflected by a nominal measure of the aggregate value of the dollar.

(2) During 1978-1980 the nominal value of the dollar continued to decline. However, the trend in U.S. relative prices turned upward in 1978. As a result, the impact of U.S. inflation began to offset the continued decline in the nominal aggregate value of the dollar. Consequently, in real terms the competitive position of the dollar began to deteriorate in the first-quarter of 1979. This was well before the turn-around indicated by the nominal indexes, which indicate that the competitive position of the dollar began to deteriorate in the fourth quarter of 1980.

(3) During 1981 to mid-1983 the nominal value of the dollar increased. U.S. relative prices declined. Thus, the real deterioration in the dollar's competitive position during this period was somewhat less than indicated by the nominal index.

(4) From mid-1983 into 1986 there was virtually no change in U.S. relative prices, consequently, during this period the nominal aggregate index is a near

perfect proxy for the relative-price adjusted index.

Due to the correction in the relative price term we will restate, with some modification, our initial conclusions.

First, the trend of the 7-Gr real dollar index, as corrected here, was negative during the 1970s (rather than positive as initially reported). (The 7-Gr index, of course, remained unchanged.) Indeed, because U.S. prices were declining during this period, relative to other index-country prices, the real dollar index declined more (the dollar became more competitive in international markets) than the nominal index.

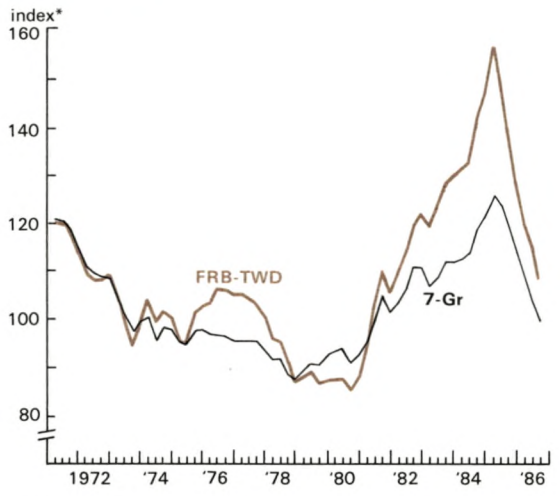
However, the turn-around in the trend, and thus the beginning of the deterioration in the competitive position of the dollar, commenced substantially earlier than indicated by nominal indexes. The 7-Gr index, as corrected here, "bottomed out" in the fourth quarter of 1978 and had increased 8 percent by the time the nominal indexes—the 7-Gn and the FRB-TWD—reached their low points in the third quarter of 1980.

Second, the initial formulation of the real index indicated a somewhat surprising convergence of the index level during three periods of current account balance—1971, 1974, and 1979-1980. Evidence of such a convergence disappears in the corrected index. Index levels during 1971, when fixed exchange rates remained in force during much of the year, were far outside the index range in 1974 and 1979-1980 (this is also true for the nominal indexes). Indeed, this is less surprising than was the initial finding, given the apparent overvaluation of the dollar that led to its devaluation at the end of 1971, again in 1973, and the subsequent floating of the dollar. Evidence of convergence is also much weaker in the latter two periods. While the range of the 7-Gr index as corrected here (98.0 for the year 1974 and 90.4 for the two years 1979-1980) remains narrower than the range observed for the FRB-TWD we do not consider this to be an especially interesting property of the index.

Third, the conclusion concerning the magnitude in the decline of the dollar and its longer term "recovery ratio" remains fully supported, indeed, is strengthened. The decline in the dollar since early 1985, as measured by the more broadly based 7-G nominal and price-adjusted indexes, has been more moderate than suggested by the more narrowly based indexes such as the FRB-TWD. Both 7-G indexes indicated a depreciation of about 23.5 percent between the first quarter of 1985 and the third quarter of 1986. By comparison, both the FRB-TWD index and a FRB-TWD index modified to account for relative price changes indicated a depreciation of about 37 percent.

However, placed in a longer term perspective the recovery ratio, which sets the

The 7-Gr and the FRB trade-weighted dollar indexes



*The 7-Gr index is constructed to have a common base with the Federal Reserve Board's trade-weighted dollar as of the first quarter of 1973, which equals 104.8.

7-Gr real trade-weighted dollar*

Year	Q1	Q2	Q3	Q4	Annual average
1971	120.9	120.2	118.8	114.6	118.6
1972	110.9	109.5	108.7	108.7	109.5
1973	104.8	100.4	97.9	99.2	100.6
1974	100.0	95.9	98.2	97.8	98.0
1975	95.0	94.6	97.9	98.0	96.4
1976	97.0	96.7	96.4	95.8	96.5
1977	95.9	95.4	95.0	93.4	94.9
1978	91.4	91.1	88.2	87.9	89.7
1979	89.3	90.9	90.4	92.3	90.7
1980	93.3	93.4	90.7	92.5	92.5
1981	95.1	99.7	104.9	101.2	100.2
1982	103.4	106.2	110.3	110.3	107.6
1983	106.9	108.7	111.8	111.7	109.8
1984	112.2	113.4	118.9	120.9	116.4
1985	125.9	123.3	119.1	113.1	120.4
1986	108.4	103.2	99.7	—	—

*The 7-Gr index is constructed to have a common base with the Federal Reserve Board's trade-weighted dollar as of the first quarter of 1973.

magnitude of the dollar's depreciation since the first quarter of 1985 in relation to the magnitude of the dollar's appreciation (since the late 1970s when the real indexes turned up and 1980 when the nominal indexes turned up), indicates that the decline in the dollar relative to its earlier appreciation for the nominal and real comparisons and for the 7-G and FRB comparisons are virtually identical. As of the third quarter of 1986 the recovery ratios for the corrected 7-Gr index and the relative-price adjusted formulation of the FRB-TWD were 0.69 and 0.70, respectively. The recovery ratios for the nominal indexes were nearly identical to those of the relative-price adjusted indexes. The 7-Gn index and the FRB-TWD index both recorded recovery ratios of 0.68.

——— Jack L. Hervey and William A. Strauss

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