Competition through Innovation: ATMs in Italian Banks

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Abstract

This paper reports results from a study of location, ownership, and acquisitions of automated teller machines (ATMs) by a sample of large Italian banks between 1991 and 1995. The sample banks have 85% of Italian banking assets. Data are collected at the provincial level for each bank. The underlying model is recursive; a bank is presumed to make branching decisions (analyzed in a separate paper) and then, conditional on branching decisions, decisions about ATMs. Several sets of cross-sectional data are studied using OLS and Tobit models yielding the following results: 1) The logarithm of ATMs in a province is related positively to the logarithms of interest-bearing deposits and GDP and negatively to the logarithm of population, as might be predicted from the Baumol/Tobin transactions demand models; 2) The number of a bank's ATMs in a province is related positively to the numbers of its branches and deposit accounts, a province's per capita GDP, the bank's deposits, and the bank's number of employees per branch in the province and negatively to the bank's share of a province's branches; 3) Changes in a bank's ATMs in a province are positively related to changes in the number of its branches and those of competitors; and 4) Concentration indices of ATMs, branches, deposits, and loans decreased at the provincial level between 1991 and 1995.

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I Introduction

Since about 1988, the Italian banking system has been undergoing a substantial restructuring. This was necessary because of required privatization, changing regulations, reduced restrictions on branching, and the continuing high rate of technical progress in data processing. Italian bank profitability has decreased; newly privatized banks are merging and establishing shareholding interlinkages. There has been an explosive expansion in branches and automated teller machines (ATMs) throughout Italy. Between 1993 and 1998, the number of ATMs in Italy has risen from 15,227 to 27,766. Banking market concentration measures at the national level have risen, but Herfindahl indices describing branches and deposits in Italian provinces have mainly fallen [De Bonis et al., 1998].

This paper analyzes one aspect of this competitive restructuring, the introduction and increased use of ATMs. In another paper we are analyzing the rapid expansion of branches, which is a parallel mechanism for delivering banking services. The two channels are complementary components of an evolving integrated

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system. The banking industry is far from an equilibrium in Italy and in all modern economies. Indeed, as a recent publication of the European Central Bank [1999b] argues, the likely emergence of internet banking will transform the markets for banking services radically. In part, our motivation for studying branch expansion and the introduction of ATMs separately is the belief that this dual approach yields insights about how new technologies are assimilated in a competitive setting. With few exceptions decisions to branch precede decisions to locate ATMs in some market; our approach captures this inherent recursivity.

ATMs differ from branches in several important respects. First, they are less labor intensive than branches. This is critical for Italian banks, which have high staff expenses relative to other European Union (EU) and G-10 countries [European Central Bank, 1999a]. Second, in Italy there is only one national ATM network, Bancomat, which allows depositors at all banks in the system to realize the convenience of a unitary system. Because of their geographic specificity, branches are more focused on serving customers in an adjacent area. Third, relative to other EU countries, Italy has a low ratio of banking assets to GDP [Barth, et al., 1997]; convenient access to accounts when branches are closed is an excellent market attraction for present and potential clients in such circumstances. Fourth, branches and ATMs are likely to permit profitable price discrimination by distinguishing among classes of clients. Thus, income can come to a bank from providing ATM services to clients of other banks on terms that differ from prices offered directly through a branch. Fifth, in Italy and countries such as the U.S. [Saloner and Shepard, 1995], a majority of ATMs are physically in or adjacent to branches. However, geographic remoteness from branches is likely to increase, which again facilitates price discrimination.

The introduction of ATMs and the related analysis of the economics of networks has generated an extensive literature. Nicholas Economides has put a large bibliography about networks

on the web.[2] A useful summary of the economics of networks appears in Katz and Shapiro [1986, 1994], who emphasize that markets with networks are unlikely to be welfare maximizing and are likely to have equilibria that are especially vulnerable to technical innovations. Discussions of networks in the context of ATMs have been provided by Matutes and Padilla [1994], McAndrews [1991, 1997], and Baglioni [1998]. They all emphasize the market structure dimensions of ATMs and the importance of compatibility of different ATM networks.

Empirical studies by Hannan and McDowell [1984, 1987, and 1990] and Saloner and Shepard [1995] have primarily focused on the decision to adopt ATMs by banks, using two FDIC surveys of U.S. banks that were conducted in 1976 and 1979. The samples of banks were large - more than 3500 observations. Hannan and McDowell [1990] studied the effects of adoption on concentration ratios in banking markets. They concluded that introducing ATMs did attract customers from competitors in the short run, but there was no evidence of permanent effects in this disequilibrium market. In their earlier papers, Hannan and McDowell used an exponential model to estimate the probability that banks would adopt ATMs. They reported that large banks in more concentrated banking markets are more likely to adopt ATMs. Saloner and Shepard studied the same question using Weibull and nonparametric models. Their principal conclusion was "that banks with many branches adopt ATMs earlier than banks with fewer branches, adjusting for the number of depositors" (p. 499), which they interpret as evidence that a network effect was present.

In another empirical paper, Humphrey [1994] examined costs and increments to profits from adopting ATMs, using a sample of 161 U.S. banks in 1991 and 1992. While reporting that labor costs of maintaining ATMs are lower than the cost of offering a similar amount of services with human tellers, he found that the volume of services demanded from ATMs was much higher than from tellers.

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[2] See: http://www.stern.nyu.edu/networks/biblio.html

He suggested that the added convenience of ATMs effectively reduced transactions costs, so that clients described by the Baumol [1952] inventory-theoretic model of the demand for money would make many more transactions and save by holding smaller cash balances. As a result average operating costs of banks - increased slightly when ATMs were introduced, but average profits also rose. He attributed this to economies of scope because the volume of both teller and ATM transactions was higher when ATMs were present.

As a first approximation the empirical models just discussed are based on an assumption that banks are attempting to maximize expected profits. This assumption is arguable in the case of Italian banks examined in this paper. We study a sample of about 200 large banks that control about 85% of Italian banking assets over the years 1991-95. During this period most banks were owned or closely controlled by governments or foundations. Privatization was being initiated, but ownership had not been transferred to private investors in most cases. Nonetheless, a maintained hypothesis in this paper is that Italian banks were acting as if they were maximizing the discounted value of expected future profits. It can be justified using the argument that managers who wish to survive after privatization should be interested in having a bank's market value high when ownership is transferred.

Italy and other large countries in the Group of 10 have very different histories in the adoption of electronic media for effecting transactions, as can be seen in Tables 1 and 2, which are constructed from a document prepared by the Bank for International Settlements [1998]. The tables convey an impression of extraordinary international heterogeneity in the use of transactions media and in their annual flows relative to GDP.[3] With the possible exception of Japan, the incidence of automated transac-

[3] Notes in the underlying BIS document attest strongly to this heterogeneity, but also suggest that respondents differed in the quality of available information and had trouble fitting national data into a standardized request for information.

tions media relative to population and GDP rose rapidly between 1993 and 1997. Italy, starting from a low base, had an exceptionally high rate of growth. With the exceptions of Italy and the U.S., checks written per resident fell between these years as the new technologies were adopted.

The next section proposes a set of hypotheses about the determinants of the distribution and changes in the distribution of ATMs. Data resources and descriptive statistics are reported in the third section. Econometric results from testing hypotheses about ATMs and banking market structure are reported in section four, and section five concludes.

II Hypotheses about the Distribution of ATMs

At the outset it is important to acknowledge the inevitable ambiguity in empirical representations of markets. For the most part in this discussion, a market is interpreted to be one of Italy's 95 provinces.[4] Banks choose to compete in some provinces, but they no doubt have larger playing fields that guide strategy - regions, the nation, Euroland, and beyond. By modelling behavior at the provincial level, we implicitly assume that nothing is lost by ignoring market struggles in other provinces, a specification error of unknown severity. In networks, when banks make an investment in ATMs, clients of all branches benefit, whether or not they have accounts at branches in a province.

A second difficulty in modelling markets results from mergers, which are occurring at a rapid rate in Italy. We have a balanced panel of banks that were not involved in a substantive merger and a second unbalanced panel of banks that merged during the period we study. Merging is an alternative path to investing

[4] The number of Italian provinces is 103 as of this writing, but the older classification of 95 provinces has been uniformly employed in this paper.

in new branches and ATMs.[5] Decisions to acquire ATMs by banks involved in mergers may differ from those by nonmerging banks. We hypothesize that banks that merged had rational expectations and envisioned their merger trajectory thoughout the period we study. This allows us to construct a balanced panel of "pseudo banks", which are summations of all component banks that agree to merge with one another during the period we study. Tests of the validity of the hypothesis that pseudo banks and nonmerging banks are described by the same behavioral equations are reported below.

We assume that banks view provinces opportunistically as locations in which to site branches and ATMs as they attempt to maximize the expected value of future net income. Provinces vary greatly in terms of their profit potential to different banks. For a bank to have much chance for profits in a province, it must be recognized as a reliable supplier of services. A plausible way to achieve such recognition is to have a good reputation through past performance. ATMs are mechanisms for reliably delivering services when branches are closed. Thus, one should expect banks to place ATMs in provinces where they have many branches to extract rents from their reservoir of good will.

New branches and ATMs are investments that are intended to earn future profits. Other things equal, branches and ATMs should be located in provinces that are expected to experience high rates of growth. Because the banking system is in profound disequilibrium, it may also be true that investments in areas where income is currently high (or low) are promising. Many provinces are contestable and potential profits cannot be easily or accurately estimated. In such circumstances banks inevitably make mistakes that will be costly to correct. Mistakes in locating ATMs are likely to be easier to correct than branching mistakes.

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[5] In related work we have found that banks that merge have a higher probability of opening new branches than nonmerging banks. Merging and opening new branches are activities that resemble complements, not substitutes.

A bank with many branches in a province has much to lose and a strong incentive to deter entry. Within limits, such banks are predicted to saturate markets with branches and ATMs, when the probability of entry by rivals is high, whether or not through miscalculation. On the other hand, each of a large number of potential entrants has relatively little to lose by establishing a branch in a market. It is unclear whether market concentration in individual provinces, as measured by Herfindahl indices, should be expected to rise or fall. A simple Cournot argument suggests that, with low fixed costs of entry, market concentration should tend to decrease as an equilibrium is approached. In fact, Herfindahl indexes of branches and deposits in provinces have tended to fall, as was reported above. A prediction is that concentration measures of ATM distribution should be decreasing as well, other things equal. This prediction is strengthened if there are, in fact, economies of scale from network effects.

Because there is only one ATM network in Italy, introducing ATMs does not necessarily help a bank improve its competitive position in a market. Clients of rival banks can use a bank's ATMs, so competitor banks may reasonably choose to "free ride." Banks can deter rival clients by imposing user fees, as they do in the U.S.[6] In Italy there are no service charges when a customer uses a debit card issued by the bank owning an ATM, except possibly on weekends where a charge of 500 lire (about 0.26 of a U.S. dollar or Euro) may be imposed. Individuals using cards issued by other banks are charged up to 3000 lire. Under transparency laws, banks are required to disclose all fees. Some banks charge other banks an "interchange" fee of 2500 lire when an "alien" customer uses a machine.

To formalize this discussion, we propose and briefly defend a number of hypotheses about the introduction of ATMs at the level of both an individual bank and a market (province). All hypotheses should be interpreted as conditional, after eliminat-

[6] For a description of U. S. pricing, see McAndrews [1998].

ing the effects of other variables in each subsection.

1. Bank hypotheses: The number of a bank's ATMs in a province is expected to be an increasing function of a) the number of branches the bank has in the province, b) the bank's percentage of all banks' branches in the province, c) per capita real GDP in the province, d) the expected change in real GDP in the province, e) the number of deposit accounts the bank has in the province, f) the value of its deposits in the province, and g) the bank's profitability relative to other banks. The number of a bank's ATMs in a province is expected to be negatively related to a bank's operating costs relative to other banks and h) the number of workers per branch of the bank in the province. Finally, there may well be some nonlinear interaction effects among the variables just mentioned when describing variations in a bank's ATMs. These interaction effects are difficult to specify in advance. Specifically we predict that:

a. More ATMs should be present when banks have more branches because the network value of a machine is higher and because they are a relatively inexpensive way to deter entry in a market where a bank has a substantial commitment.

b. Banks with a high percentage of a province's branches are especially able to exploit the advantages from network effects. This is a complementary and stronger form of the preceding argument.

c. Provinces with high per capita real GDP are markets where profit potential and the opportunity costs of transactions by individuals are especially high. They are likely to be highly contested and ATMs are an attractive weapon.

d. Provinces with a high expected growth rate of real GDP are likely to have especially high present and future profit potential. Expectations are assumed to be rational; in empirical work it is assumed that expectations can be estimated by actual real GDP growth between 1990 and 1995.

e. Banks with a large number of accounts in a province can expect to serve more of their clients and to have ATMs more fully and beneficially utilized. At the margin they will have more machines to exploit network externalities.

f. Banks with a larger volume of deposits in a province are similarly able to exploit network externalities. It is plausible that both number of accounts and amount of depos its should enter, drawing on the Baumol/Tobin inventory theoretic model.

g. Banks that are unusually profitable or cost efficient are likely to take advantage of leading-edge technology like ATMs. To test this hypothesis, five-year average residuals from a statistical cost accounting analysis of banks were employed to test this prediction. Cf. Calcagnini and Hester [1997].

h. Banks with fewer workers per branch are likely to be using ATM machines; ATM machines require fewer workers to deliver a given amount of teller services.

Changes in the number of ATMs in a province are expected to be a function of the difference between a bank's desired number of ATMs and its actual number in the preceding year. Further, in an environment of imperfect information, changes in the numbers of branches and ATMs in a market in the preceding year are likely to induce a bank to add more ATMs. This specification implies that banks attempt to learn from the unobserved information that guides competitors' actions which may lead to destabilizing overshooting.

2. Market hypotheses: It is expected that Herfindahl indices of ATMs in a province will decrease over time, because smaller banks will increasingly be willing to incur the setup costs associated with offering services through this proven technology. In part this is also a consequence of the fact that Herfindahl indices of branches in a province are declining and that new branches are likely to include an ATM. Because of disequilibrium and the importance of provincial heterogeneity, the rate of decrease is expected to vary across provinces.

3. Recursivity: The foregoing hypotheses are premised on the notion that banks operate ATMs from branches that they have in a province. A maintained hypothesis is that banks site branches in provinces and then determine how many ATMs to purchase. It rarely occurs in our sample that a province is observed with an ATM, but

no branch. Branch location decisions are examined in a forthcoming paper [Calcagnini et al., 1999].

III Data Resources and Descriptive Statistics

The data studied have largely been collected by the Bank of Italy and measure the activities of banks in each of the 95 provinces where they have branches, over the years 1991 - 1995. The data set includes information about the numbers of branches, ATMs, deposit accounts, and employees, as well as the values of deposits and loans a bank had in each province. The data set was constructed from several independent files that recorded information on large banks. One set contained information on deposits, loans, and branches for 268 banks (hereafter referred to as core banks) between 1990 and 1996. Information on ATMs was collected from 249 banks between 1991 and 1995. There were 84 banks in the core of 268 that merged with other core banks between 1991 and 1995; they were aggregated into 34 pseudo banks as described above. Some mergers also occurred between core banks and other small noncore banks, but details about the small banks are not conveniently available and these mergers are ignored in this study. After eliminating banks with incomplete information and constructing pseudo banks to replace merging banks, there is a balanced panel of 214 banks, before taking ATM data into account. Data were reviewed for consistency with other information and for large percentage changes. With the exception of loan data, which were redefined in 1995 for a small number of banks to account for mergers between long-term banks and their parent short-term banks, information seemed to be clean.

Information about ATMs was less complete and required some editing. Editing was particularly concentrated in 1993 because a number of banks were reported to have all of their ATMs in one province (presumably where the head office was) or to have no ATMs at all. Using data from 1992 and 1994, it was possible to assign ATMs for these banks to provinces through interpolation in a manner that added up to the reported total for a bank (if a

total was reported). Errors in other years were relatively minor; corrections were made in about 5% of the observations. In the cases of 21 banks, the history of ATMs was unclear and these banks have been excluded. The resulting sample consists of 193 banks that were operating in some of the 95 provinces. There are 1817 bank/province pairs where a bank is reported to have had a branch in a province in at least one of the years, 1991 - 1996. In empirical work, observations consist of bank/province observations where a bank had a branch actually operating in a province.

Information about economic activity in provinces was collected from a volume published by Confindustria [1996] and an internet site provided by Istituto Guglielmo Tagliacarne [1998].

Table 3 reports means of selected measures for a bank in a province; it was calculated from the sample of 1817 bank/province observations when banks were present in a province. A bank doing business in a province increased its number of branches by about 50% and about doubled its number of ATMs between 1991 and 1995. Deposits and the number of deposit accounts increased at much slower rates and the number of employees at branches in a province was essentially unchanging. Loans expanded rapidly in 1991 and 1992, but then stagnated. The picture conveyed by this table is an intensifying competitive struggle - sharply decreasing deposits, loans, and accounts per branch or ATM.

Table 4 provides some perspective on ATM data editing and on the extent to which the sample describes ATMs in Italy. There are two points to note. First, the edited sample share of the population of ATMs in Italy decreases over time, because smaller banks not in the sample were acquiring machines with a lag relative to large sample banks. Second, because of imputations for a few large banks in 1993, the total number of ATMs in the edited sample is about 5% larger than in the unedited sample that year. The edited sample contains at least 90% of all ATMs in Italy in every year.

IV Empirical Results;

1 Preliminary studies: Because this analysis focuses on markets in disequilbrium, we emphasize behavior by individual banks at the level of a province. Nevertheless, it is instructive to start by examining cross-sectionally the behavior of the aggregate of all banks as observed in each of the 95 provinces and the behavior of each bank summed over all provinces. They are respectively called "province" and "bank" relations.

a. Province relations: Italian provinces differ considerably in income, population, and banking services. Although no formal claim of identification can be established when markets are in disequilibrium, it seems reasonable to argue in these circumstances that shock terms are larger for the supply of than the demand for banking services. Following an argument of Working [1927], a relation estimated from a cross section of provinces will resemble a demand function for banking services. It is helpful to begin with the Baumol/Tobin [1952, 1956] transactions demand for money model, which predicts that cash holdings will be positively related to transactions costs and per capita GDP. Transactions costs are believed to be negatively related to the stock of ATMs in a province. We propose that the logarithm of the number of ATMs in a province should be an increasing function of the logarithms of per capita GDP, interest-bearing deposits, and the number of deposit accounts in a province. To control for differences in market structure, a Herfindahl index on the distribution of branches in a province is included.

Results from estimating this model at the beginning and end of the sample period are reported in Table 5. Signs of parameter estimates on population, nominal GDP, and deposits conform with predictions from the Baumol/Tobin model; coefficients on the number of accounts and the Herfindahl index are not significantly different from zero. There are three further points to note when interpreting Table 5. First, the absolute values of coefficients on GDP and population differ significantly in 1995, but not in 1991. ATMs are demanded in high income provinces even more than is attributed to high per capita income by the model in 1995.

Second, the positive coefficient on deposits is plausible because most bank deposits in Italy pay interest. Third, all significant parameter estimates had smaller absolute values in 1995 than in 1991. The Working argument's validity is less persuasive when disequilibrium in the market for ATM services is less severe, as might be expected in 1995.

b. Bank relations: Irrespective of where bank branches are sited, it is plausible that there are substantial economies from using modern ATM technology; this is especially true for banks with many deposit accounts and deposits. Two specifications are considered in this subsection; each is tested using data on ATMs owned by banks in 1991 and 1995. The first naive model is an attempt to explain the number of ATMs owned by banks with lagged values of a bank's deposits, number of deposit accounts, employees per branch and "adjusted" gross operating expenses and net current operating income. The adjustments were made by eliminating the effects of bank portfolio composition, both assets and liabilities, by taking residuals from a statistical cost accounting analysis reported by Calcagnini and Hester [1997].[7] The second naive model adds detail about the number of bank branches, including interactions between branches and income in a province where branches are sited. Because the statistical cost accounting study used a different sample of banks and because bank mergers made comparisons of some banks meaningless, only 165 banks could be analyzed in 1991 and 147 in 1995.

The regression results are reported in Table 6. In all cases coefficients on the previous period's number of deposit accounts are highly significant and in three cases the coefficient on the level of deposits was significant at the .01 level. The number of

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[7] Specifically, a positive gross operating expense (net current operating income) residual implies that the ratio of a bank's actual gross operating expenses (net current operating income) in a year to total assets is greater than is predicted by a regression of the respective ratio on an exhaustive set of noncash assets and liabilities, each deflated by a bank's total assets.

employees per branch and both residuals variables yielded no significant coefficients. Because hypotheses about the residuals variables are rejected, they are not considered in the remainder of this paper. The three branch variables in the second model all had coefficients that were significantly different from zero in 1991, but negative coefficients are difficult to rationalize. The coefficients on the number of branches in a province times per capita GDP suggest how banks were allocating ATMs across markets; individuals whose time was more valuable were likely to be served first. Finally, there was remarkably little gain in explained variance by adding three variables when moving from model 1 to model 2 although in both cases the improvement was statistically significant at the .01 level.

2 Bank ATMs in provinces: ATMs are pieces of physical capital; changes in the number of ATMS represent net investment. In section II it was argued that a bank's desired stock of ATMs in a province should be a function of several characteristics of the bank and a province. While the desired number of ATMs is unobservable, data are available about the actual number in a province. If banks are optimizing, the actual and desired number should have similar determinants. Further, trends in the relations between the actual number and determinants may be informative. The approach in this subsection is to estimate equations for the actual stock of a bank's ATMs in a province in each of five years. Then, acquisitions of ATMs are modelled using the difference between the number of ATMs a bank had at the end of the preceding year and a measure of desired machines, constructed with the set of variables used to describe the actual stock, and recent changes in branches by the bank and its rivals in a province.[8]

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[8] As explained above, some sample banks merged with other sample banks and disappeared. To avoid discarding them, all component banks to a merger among sample banks were summed to create pseudo banks. To examine the validity of pooling pseudo and nonmerging banks, OLS equations were estimated separately for

Table 7 reports results for the stock of ATMs. They are obtained by applying a limited dependent variable ("Tobit") estimation procedure to samples of bank/province pairs in which a bank had at least one branch in a province. Because many pairs had no ATM, as is reported in the table, the Tobit method is needed. The number of limit (zero ATM) observations decreases steadily with the passage of time, presumably as banks move toward equilibrium. The total number of observations rises over time as banks open first branches in provinces. All variables but the average percentage change in a province's GDP and the number of employees per branch have several coefficients that are significantly different from zero at the .01 level. The trend in a province's GDP is a very crude measure of a province's expected future profitability for a bank; its failure is not too surprising. The positive relation between employees per branch and ATMs was unexpected; an interpretation is that ATMs tend to be located in larger cities where more services are offered at a branch. A positive relation might occur if there are economies of scope with having an ATM, as was argued by Humphrey [1994].

As expected, the number of a bank's ATMs in a province is an increasing function of the numbers of its branches and deposit accounts, per capita GDP, and the amount of its deposits. More interesting are the trends in parameter estimates. With the passage of time, variations of both deposits and number of branches across provinces are increasingly important in describing variations in ATMs; variations in per capita GDP and number of accounts are weakening as predictors. An interpretation is that, as the market moved toward equilibrium, banks first sought out high income areas where they had many clients. As these

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pseudo banks and nonmerging banks in 1991 and 1995. An analysis of covariance was performed using OLS counterparts to equations reported in Tables 7 and 8. A null hypothesis that no information was lost through pooling was rejected in three of the four tests. Nevertheless, to conserve space, only pooled results are reported in this paper. Disaggregated OLS and Tobit results are available from the authors.

"river bottoms" were exhausted, competition shifted increasingly to provinces where they had large lodes of deposits which needed to be protected. Further, they increasingly blanketed their branches with ATMs to provide clients with maximum network gains. The competitive struggle is especially evident in the steady downtrend in coefficients on own branches as a fraction of sample branches in a province. Banks were pushing ATMs hard where their share of branches in a province was small and where their share of branches was falling. An interpretation is that they were attempting to deter clients from opening accounts with dominant local and new marauding banks in a province. Such markets were likely to be in large cities where the number of potential rivals was large and growing.

Changes in the number of a bank's ATMs in a province also have a large number of zero values, roughly 50% of all observations, so again a Tobit estimator seems appropriate. However, a further wrinkle is that about three percent of observed changes are negative.[9] There are several awkward ways to proceed: 1) simply ignore this anomaly in which case conventional Tobit computer programs replace the negative values with zero, 2) discard the observations with negative values, or 3) abandon the Tobit model and apply ordinary least squares. The first and second approaches give essentially identical results; only the first is reported in this paper, as Table 8. OLS results reported in Table 8a have the advantage that no information is discarded; they are generally similar to those in Table 8, and are not discussed in detail.

In both tables the first eight variable are the same as in Table 7, but parameter estimates have a different interpretation.

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[9] Several interpretations are possible: 1) a data coding error, 2) a bank erred in siting an ATM in a province, 3) branches are resited in a province with a temporary loss of ATM availability, etc. Conditional on a bank having a negative change in some province, the decrease in ATMs was about three. Inspection of the original data did not reveal conspicuous outliers or that negative values were concentrated in any year.

The product of the estimates times values of bank and province variables is a representation of a bank's desired stock of ATMs in a province. When combined with the lagged stock of ATMs, this construct can be interpreted as the stock-adjustment model common in macroeconometrics. Parameter estimates associated with the first eight variables in Tables 7 and 8 are generally positive for number of branches and amount of deposits in a province. In Table 8, a bank's share of branches in the province is associated with an increase in ATMs, but in Table 7 the share of branches is increasingly negatively related to the stock of ATMs. This difference can be accounted for by the higher growth rate in the number of branches of rival banks in a province, which is reported below. The downtrends in coefficients on per capita GDP and number of deposit accounts in Table 7 are consistent with the pattern of coefficients in Table 8.

The ninth variable is the lagged or "beginning of year" stock of ATMs. One minus its coefficient measures the fraction of the discrepancy between the desired and actual stock of ATMs that a bank wishes to close in a year. The estimates reported in Table 8 (or 8a) imply that changes in ATMs in a year are essentially unrelated to the stock of machines at the beginning of the year. An interpretation is that ATM investment decisions are fulfilled within a year in Italy. The magnitude of the gap between the estimated desired stock and beginning stock of ATMs is not informative.

The tenth variable is intended to represent the changing state of the art in providing banking services. As banks establish new branches, it is believed to be increasingly likely that they will have one or more associated ATMs. Consequently, banks with more new branches will have a greater change in ATMs, other things being equal. This hypothesis is strongly supported by estimates in both tables.

The eleventh variable, the number of new branches opened by competitors, is intended to represent the effects of asymmetric information and, perhaps, the intensity of the struggle among

competitors in a province. The first interpretation reflects the possibility that competitors have private information about future economic activity in a province. A bank that observes rapid expansion may read this information to mean that they too can benefit by expanding. The second interpretation is that there are recognizably underserved clients in a disequilibrium situation who are "up for grabs". In this situation, all banks are likely to expand in a competitive frenzy. Either interpretation will induce banks to add relatively inexpensive ATMs and, perhaps, to overshoot. This hypothesis is not supported by results from 1992, but was increasingly supported by results for subsequent years.

The twelfth variable in Table 8a allows for the possibility that bank/province pairs with negative changes are distinctive from other observations when described by the preceding variables in the equation. If they are not distinctive, its coefficient measures the mean negative change in ATMs for banks that have a negative change.

3 Changes in market concentration: The distributions of ATMs, branches, deposits, and loans in provinces became less concentrated between 1991 and 1995 as the system evolved. In Table 9 this can be seen in the first four columns where correlations between a bank's market shares at the end of 1991 and subsequent changes are reported for the ten provinces where thirty or more sample banks were operating, and for all other provinces. Thirty-nine out of forty-four correlations are negative and more than half are more than two standard deviations below zero. Correlations tended to be most negative for ATMs and branches.

In the case of branches, Herfindahl indices were about four times as likely to have fallen as risen in the 95 provinces. For the sample banks, the mean Herfindahl indices for ATMs, branches, deposits, and loans fell every year, with percentage declines ranked in the same order. Sample banks with small market shares were expanding more rapidly than their larger counterparts,

especially in numbers of ATMs and branches. As concentration eroded, competition is likely to have strengthened, even though banks were merging at an increasing rate.

V CONCLUSION:

There are great differences in the ways and rates of change of ways with which more developed countries effect transactions, as shown in Tables 1 and 2. These variations and trends suggest that interpretations of monetary aggregates in different countries and in the EMU should be changing. It is our belief that much can be learned by analyzing the adoptions of new technologies in different countries. Italy and other countries in the European Union are distinctive in that they are combining very high rates of privatization, regulatory change, and technical progress.

Branches and ATMs are tools that banks employ when competing in Italian provincial markets; both may become obsolete when internet banking and other technical innovations are more fully developed. This paper has analyzed the spread of ATMs using a recursive modelling approach in which banks first establish branches in a province and then provide ATMs. Decisions to open branches are analyzed in Calcagnini, et al. [1999].

ATMs reduce transactions costs for clients of banks and, therefore, reduce the demand for noninterest-bearing currency. Evidence supporting this interpretation appears in Table 5 where it is reported that, in cross sections of Italian provinces, the logarithm of number of ATMs in a province is positively related to the logarithms of interest-bearing deposits and nominal GDP and negatively related to the logarithm of population. Such results are consistent with predictions from the Baumol/Tobin transactions demand for money models, and we argue that the reported results can roughly be interpreted as describing demand.

A reason for banks to acquire ATMs is that they reduce costs of supplying transactions services. In Table 6 we analyze cross sections of banks and show that ATMs owned are positively related

to a bank's lagged deposits and number of deposit accounts. ATMs are positively related to the product of its branches and GDP in a province, but the general relation between ATMs and branches is difficult to interpret in markets that are in disequilibrium.

Disequilibrium is studied more directly by examining the levels and changes in the stock of ATMs that banks have in a province. In Tables 7 and 8 annual cross-sectional relations are reported for samples of banks that had at least one branch in a province, as is appropriate in our recursive specification. A 'Tobit' regression technique was employed because of the presence of large numbers of zero values of the dependent variable.

Table 7 should be interpreted as a sequence of still photographs of the motion of a dynamic system, presumably moving toward an (transitory?) equilibrium. On average, the number of a bank's ATMs in a province was positively related to the numbers of its branches, employees per branch, and deposit accounts; per capita GDP in a province; and the value of its deposits in a province. ATMs were usually negatively related to a bank's share of all branches in a province. However, the relations between numbers of ATMs and these variables were changing in a manner that suggests the nature of an eventual equilibrium. In particular, the coefficients on branches and deposits were increasing and coefficients on a bank's share of branches, per capita GDP, and number of deposit accounts were decreasing with the passage of time. This pattern can be summarized as describing a bank that first secured markets where it had a large share of branches and deposit accounts, and where per capita income was high. It then increasingly invaded markets where its deposits were large and where its share of branches was small.

Table 8 reports results of an attempt to describe changes in a bank's ATMs in provinces where it had branches. Using the explanatory variables from Table 7 to characterize equilibrium, a simple adaptive adjustment mechanism was postulated to describe changes in ATMs, but it was not successful. The coefficient on the lagged stock of ATMs is typically positive and/or insignifi-

cant, which implies that there was no lagged adjustment mechanism when acquiring ATMs. Year-to-year variations in parameter estimates are sizable, but on average coefficients are positive between changes in ATMs and the number of a bank's branches, its share of branches in a province, and the value of its deposits. In addition changes in a bank's ATMs are increasingly positively related to changes in its own branches and to changes in branches of rival banks in a province. The former suggests that banks were increasingly equipping all new branches with ATMs; the latter suggests an accelerating competitive struggle where banks respond to expansion with alacrity. Such behavior may reflect information asymmetries, but is likely to result in overshooting and a temporary glut in the supply of banking services.

This competitive struggle led to significant decreases in market concentration in ATMs, branches, deposits, and loans in large provinces and on average in all other provinces, as shown in Table 9. Unreported Herfindahl indices for each variable, averaged across provinces, fell monotonically; the largest decreases were for ATMs and then branches.

Madison, Wisconsin September 2, 1999

SELECTED BIBLIOGRAPHY

Baglioni, Angelo, [1998], "Sistemi di Pagamento e Tutela della Concorrenza: Aspetti Teorici e Istituzionali," processed, Dicembre.

Banca D'Italia, Bollettino Statistico, various issues.

Bank for International Settlements, [1998], Statistics on Payment Systems in the Group of Ten Countries: Figures for 1997, Basle, December.

Barth, James R., Daniel E. Nolle, and Tara N. Rice, [1997], "Commercial Banking Structure, Regulation, and Performance: An International Comparison," Comptroller of the Currency Economics Working Paper 97-6.

Baumol, William J., [1952], "The Transactions Demand for Cash: an Inventory-Theoretic Approach," Quarterly Journal of Economics, 66, pp. 545-56.

Calcagnini, Giorgio and Donald D. Hester, [1997], "Cambiamento istituzionale e redditivita delle banche in Italia," Rivista di Politica Economica, 87, 1, pp. 3-42.

Calcagnini, Giorgio, Riccardo De Bonis, and Donald D. Hester, [1999], "Determinants of Bank Branch Expansion in Italy," manuscript.

Calem, Paul S. and Leonard I. Nakamura, [1998], "Branch Banking and the Geography of Bank Pricing," Review of Economics and Statistics, 80, 4, pp. 600-10.

Confindustria Centro Studi, [1996], Indicatori Economici Provinciali, a cura di Giuseppe Rosa and Michele Esposto, Roma: SIPI.

De Bonis, Riccardo, Fabio Farabullini, and Fabio Fornari, [1998], "L'Apertura di Sportelli Bancari dopo la Liberalizzazione: Andamento e Determinanti," Rivista Economica del Mezzogiorno, pp. 69-104.

European Central Bank, [1999a], Possible Effects of EMU on the EU Banking Systems in the Medium to Long Term, February.

_____, [1999b], The Effects of Technology on the EU Banking Systems, July.

Hannan, Timothy H. and John M. McDowell, [1984], "The Determinants of Technology Adoption: the Case of the Banking Firm," RAND Journal of Economics, 15, 3 (Autumn), pp. 328-35.

_____, [1987], "Rival Precedence and the Dynamics of Technology Adoption: an Empirical Analysis," Economica, 54, May,

pp.155-71.

_____, [1990], "The Impact of Technology Adoption on Market Structure," Review of Economics and Statistics, 72, 1, pp. 164-8.

Humphrey, David B., [1994], "Delivering Deposit Services: ATMs versus Branches," Federal Reserve Bank of Richmond Economic Quarterly, 80, Spring 1994, pp. 59-81.

Istituto Guglielmo Tagliacarne,[1998], http://www.tagliacarne.it.

Katz, Michael L. and Carl Shapiro, "Technology Adoption in the Presence of Network Externalities," Journal of Political Economy, 94,4 pp. 822-41.

_____, [1994], "Systems Competition and Network Effects," Journal of Economic Perspectives, 8, 2, pp. 93-115.

Matutes, Carmen and A. Jorge Padilla, [1994], "Shared ATM Networks and Banking Competition," European Economic Review, 38, 5, pp. 1113-38.

McAndrews, James J., [1991], "The Evolution of Shared ATM Networks," Federal Reserve Bank of Philadelphia Business Review, May/June, 3-16.

_____, [1997], "Network Issues and Payment Systems," Federal Reserve Bank of Philadelphia Business Review, November/December, pp. 15-25.

_____, [1998], "ATM Surcharges," Federal Reserve Bank of New York Current Issues in Economics and Finance, 4, 4 (April).

Saloner, Garth and Andrea Shepard, [1995], "Adoption of Technologies with Network Effects: An Empirical Examination of the Adoption of Automated Teller Machines," RAND Journal of Economics, 26, 3 (Autumn), pp. 479-501.

Tobin, James, [1956], "The Interest-Elasticity of Transactions Demand for Cash," Review of Economics and Statistics, 38, pp. 241-7.

Working, Elmer J., [1927], "What Do Statistical 'Demand Curves' Show?", Quarterly Journal of Economics, 41, pp. 212-35.

Table 1

TRENDS IN THE USE OF TRANSACTIONS MEDIA - VOLUMES

	ATMs/mil. residents		POS terms./ mil. residents		ATM cards/ thous. resids.		Ann. ATM trans per resident		Annual checks written per res.	
	1993	1997	1993	1997	1993	1997	1993	1997	1993	1997
Belgium	279.	492.	5251.	8421.	836.	1116.	11.	16.	13.786	9.411
Canada	556.	649.	2142.	10945.	476.	581.	38.	53.	73.000	59.461
France	325.	461.	9185.	9540.	372.	472.	13.	20.	85.076	83.911
Germany	308.	504.	345.	1981.	552.	1037.	NA	NA	11.501	8.870
Italy	268.	443.	1360.	4891.	287.	426.	4.	7.	10.947	11.411
Japan	936.	1115.	168.	155.	1769.	1945.	3.	5.	2.628	2.247
Netherlands	291.	409.	1600.	7692.	82.	162.	20.	33.	14.274	5.174
Sweden	256.	268.	3064.	7774.	1313.	691.	28.	35.	8.398	2.034
Switzerland	439.	678.	1433.	5852.	716.	978.	7.	11.	2.210	1.312
United Kingdom	328.	393.	4639.	8983.	888.	1271.	21.	30.	49.591	43.764
United States	367.	616.	600.	4853.	2059.	2628.	30.	41.	233.528	246.707

Source: Bank for International Settlements, 1998.

Table 2

TRENDS IN THE USE OF TRANSACTIONS MEDIA - VALUES DEFLATED BY GDP
(Annual flows x 1000/GDP)

	ATM transactions		POS transactions		Checks written		Debit & credit card transactions		Total transactions	
	1993	1997	1993	1997	1993	1997	1993	1997	1993	1997
Belgium	63.	78.	47.	75.	1811.	1347.	53.	78.	41684.	46733.
Canada	80.	93.	5.	52.	33543.	22383.	107.	189.	33951.	23055.
France	47.	58.	72.	86.	2159.	1821.	72.	86.	46639.	41583.
Germany	NA	NA	2.	8.	1691.	1108.	15.	23.	73348.	70590.
Italy	41.	66.	7.	24.	1400.	1311.	10.	24.	30407.	40413.
Japan	38.	44.	0.	0.	6862.	3126.	NA	NA	NA	NA
Netherlands	96.	126.	12.	65.	53.	18.	12.	66.	36767.	43082.
Sweden	135.	143.	26.	48.	NA	NA	37.	73.	4212.	4374.
Switzerland[1]	51.	59.	7.	28.	106.	53.	30.	55.	97695.	124686.
United Kingdom	95.	115.	NA	NA	2368.	2102.	81.	131.	43651.	50498.
United States	80.	92.	2.	6.	10546.	9593.	98.	152.	83452.	91280.

Source: Bank for International Settlements, 1998.

[1] Excludes PTT debits.

Table 3

MEAN VALUES FOR PROVINCES WHERE BANKS HAVE A PRESENCE

	Branches	Deposits	Loans	ATMs	Employees	Accounts
1990	7.21	350	265	NA	117	11,430
1991	8.01	382	304	5.70	118	12,148
1992	8.65	396	342	7.12	119	12,563
1993	9.22	416	336	8.30	117	12,752
1994	9.82	434	352	9.57	119	13,001
1995	10.21	446	NA	10.54	116	13,178

Note: Deposits and loans are expressed in miliardi (billions) of lire per bank per province; all others are expressed as integers per bank per province. Loan data for 1995 are not shown because of a discontinuity that resulted from merging data from long-term credit institutions with those of parent public sector banks.

Table 4

SAMPLE AND POPULATION OF ATMS IN ITALY: 1991 - 1998
(in thousands of machines)

year	population[1]	unedited sample	edited sample
1991	NA	11.04	10.36
1992	NA	13.41	12.94
1993	15.23	14.37	15.08
1994	18.67	18.06	17.39
1995	21.67	20.27	19.15
1996	24.22	NA	NA
1997	25.50	NA	NA
1998	27.77	NA	NA

[1] Data on population comes from Bank for International Settlements [1998] and from the Bank of Italy's Bollettino Statistico, March 1999.

Table 5

PROVINCE RELATIONS AND THE DEMAND FOR ATM SERVICES
(Dependent variable is ln of number of ATMs in a province)

	1991	1995
Intercept	-9.652**	- 8.672**
	(1.344)	(0.937)
Ln of a province's population in the year	-1.361**	-0.792**
	(.137)	(.087)
Ln of province's nominal GDP in the year	1.542**	1.202**
	(.215)	(.137)
Herfindahl index on distribution of branches among sample banks	.208	-.591
	(.484)	(.369)
Ln of a province's aggregate deposits in year	.882**	.599**
	(.136)	(.110)
Ln of number of deposit accounts in the year	-.064	-.064
	(.107)	(.080)
Mean	4.0469	4.8061
Standard error of estimate	.3196	.2214
Multiple correlation coefficient	.927	.950
F - ratio	188.6**	284.0**
Number of observations	95	95

Note: In this and subsequent tables, * implies that a null hypothesis is rejected at the .05 level and ** implies that a null hypothesis is rejected at the .01 level in a two-tailed test. Standard errors are in parentheses.

Table 6

BANK RELATIONS AND THE PROVISION OF ATM SERVICES
(dependent variable is the number of a bank's ATMs at year end)

	naive model one		naive model two	
	1991	1995	1991	1995
Intercept	2.954	7.157*	-0.226	1.929
	(2.104)	(3.424)	(1.878)	(3.575)
Previous year's deposits in trillions of lire	1.030	17.504**	7.558**	10.566**
	(1.504)	(1.357)	(1.930)	(2.492)
Previous year's employees/branch	-0.013	-0.046	-0.006	-0.008
	(0.036)	(0.063)	(0.029)	(0.060)
Lagged net income SCA residuals as percentage of total bank assets	0.267	4.025	-1.078	3.519
	(3.437)	(4.373)	(2.811)	(4.107)
Lagged operating expense SCA res. as percentage of total bank assets	-2.976	-0.568	-0.614	-0.219
	(2.053)	(-2.429)	(1.699)	(2.289)
Previous year's number of deposit accounts (in thousands)	0.435**	0.162**	0.236**	0.149**
	(.044)	(.043)	(.049)	(.053)
Number of branches in current year			-0.776**	-0.049
			(.088)	(.119)
Number of branches x nominal GDP in a province (quintillion of lire)			-2.933**	-0.293
			(1.139)	(1.018)
Number of branches x per capita GDP in a province (100 trillion of lire)			3.994**	1.451**
			(.476)	(.497)
Mean	33.424	99.014	33.424	99.014
Standard error of estimate	21.657	34.022	17.569	31.903
Multiple correlation coefficient	.924	.969	.951	.974
F - ratio	323.5**	746.0**	337.2**	568.1**
Number of observations	165	147	165	147

Table 7

TOBIT REGRESSIONS OF STOCK OF ATMS OF BANKS IN PROVINCES
(Dependent variable is number of ATMs a bank has in a province)

variable	1991	1992	1993	1994	1995
Intercept	-5.930	-5.244	-5.263	-3.522	-3.246
	(1.168)	(1.187)	(0.722)	(1.233)	(1.319)
Branches	.124**	.171**	.347**	.399**	.494**
	(.032)	(.030)	(.029)	(.030)	(.034)
Bank's share of all branches in a province [1]	7.315**	-.350	-9.837**	-10.872**	-14.093**
	(2.659)	(3.290)	(3.353)	(3.459)	(3.862)
Per capita GDP (millions of lire)	.280**	.252**	.207**	.158**	.148**
	(.029)	(.028)	(.026)	(.025)	(.026)
Average % change in GDP	-.247	-.199	-1.916	-.146	-.133
	(.158)	(.163)	(2.157)	(.171)	(.184)
Number of deposit accounts (thousands of accounts)	.343**	.288**	.269**	.253**	.240**
	(.014)	(.014)	(.015)	(.015)	(.017)
Deposits (trillions of lire)	-.793	3.424**	3.193**	4.431**	4.363**
	(.556)	(.561)	(.555)	(.610)	(.657)
Employees/branch	.023*	.008	.008	.035*	.027
	(.011)	(.009)	(.010)	(.015)	(.017)
Number of observations	1600	1665	1700	1739	1744
Number of limit observations	285	232	189	147	114
Disturbance standard deviation	5.98	6.31	6.56	6.83	7.42
Log likelihood function	-4416.8	-4842.0	-5130.6	-5431.3	-5666.0

[1] In 1991 the number of branches in a province was estimated from the number of branches owned by sample banks; it was not all branches in a province as in other years.

Table 8

TOBIT REGRESSIONS OF CHANGES IN ATMS OF BANKS IN PROVINCES
(Dependent variable is first difference of ATMs a bank has in a province)

variable	1991-2	1992-3	1993-4	1994-5
Intercept	-5.434	-2.052	-2.077	-4.397
	(1.046)	(0.761)	(0.882)	(0.869)
Branches at end of period	0.053*	0.106**	0.126**	0.098**
	(.027)	(.017)	(.019)	(.019)
Bank's share of all branches	7.208**	4.011**	0.768	5.945**
in a province at end of per.	(2.129)	(1.524)	(1.861)	(1.712)
Per capita GDP in second	0.099**	-0.006	-0.034	-0.008
year (hundred mils. of lire)	(0.026)	(0.017)	(0.020)	(0.019)
Average % change in GDP	-0.009	-0.072	-0.049	0.152
	(0.143)	(0.105)	(0.120)	(0.116)
End of period number of	-0.021	-0.019	-0.033**	-0.048**
deposit accounts (10,000s)	(0.013)	(0.010)	(0.011)	(0.010)
End of period deposits	3.645**	0.855**	1.409**	-0.209
(trillions of lire)	(0.443)	(0.318)	(0.426)	(0.359)
End of period employees	0.005	0.011	0.018	0.014
per branch	(0.008)	(0.007)	(0.010)	(0.011)
ATMs at end of first year	-0.059**	0.024	0.018	0.066**
	(0.023)	(0.016)	(0.017)	(0.015)
Change in bank's own	0.431**	0.433**	0.224**	1.238**
branches over time span	(0.086)	(0.075)	(0.038)	(0.107)
Change in branches of rival	-0.002	0.006	0.016**	0.018**
banks over time span	(0.008)	(0.004)	(0.006)	(0.007)
Number of observations	1616	1655	1703	1695
Disturbance standard deviation	4.822	3.583	4.148	3.745
Log likelihood function	-2721.7	-2514.3	-2652.1	-2106.2

Table 8a

OLS REGRESSIONS OF CHANGES IN ATMS OF BANKS IN PROVINCES
(Dependent variable is first difference of ATMs a bank has in a province)

variable	1991-2	1992-3	1993-4	1994-5
Intercept	-1.131	.063	.256	.038
	(.591)	(.412)	(.513)	(.362)
Branches at end of period	0.029	0.097**	0.072**	0.053**
	(.017)	(.010)	(.013)	(.010)
Bank's share of all branches	-2.179	-2.032*	0.194	0.421
in a province at end of per.	(1.345)	(.923)	(1.156)	(.833)
Per capita GDP in second	0.069**	0.009	-0.012	-0.009
year (hundred mils. of lire)	(.015)	(0.009)	(.012)	(.008)
Average % change in GDP	0.013	-0.021	0.049	0.037
	(.081)	(.057)	(.070)	(.049)
End of period number of	-0.011	-0.035**	0.034**	-0.025**
deposit accounts (10,000s)	(.009)	(.006)	(.007)	(.005)
End of period deposits	3.802**	1.560**	-0.279	-0.060
(trillions of lire)	(.292)	(.197)	(.259)	(.184)
End of period employees	-0.000	0.002	0.003	0.003
per branch	(.004)	(.003)	(.006)	(.005)
ATMs at end of first year	-0.082**	-0.005	-0.021	0.054**
	(.015)	(.010)	(.011)	(.008)
Change in bank's own	0.290**	0.245**	0.242**	0.605**
branches over time span	(.056)	(.046)	(.026)	(.053)
Change in branches of rival	-0.017**	-0.002	0.006	0.006*
banks over time span	(.005)	(.002)	(.004)	(.003)
Binary variable; = 1 if change	-4.022**	-2.802**	-3.728**	-2.686**
in ATMs negative, else = 0	(.470)	(.349)	(.482)	(.295)

Table 9

CHANGES IN CONCENTRATION OF SAMPLE BANK MARKET SHARES

province	correlation coefficients for				number of	provincial	
	ATMs	branches	deposits	loans	observations	branch Herfindahl index	
						1991	1996
Bologna	.36*	-.76*	-.28	.33*	41	.11	.14
Brescia	-.15	-.45*	-.43*	-.36	31	.11	.10
Firenze	-.27	-.71*	-.06	-.24	30	.15	.13
Milano	-.37*	-.53*	.35*	-.27*	67	.05	.05
Modena	-.20	-.60*	-.29	-.10	30	.11	.11
Roma	-.62*	-.87*	-.58*	-.27	59	.10	.10
Torino	-.11	-.16	.23	.11	38	.15	.15
Treviso	-.06	-.02	-.84*	-.27	33	.09	.10
Verona	-.59*	-.82*	-.66*	-.60*	30	.20	.18
Vicenza	-.55*	-.52*	-.46*	.12	31	.14	.12
All other provinces	-.43*	-.38*	-.26*	-.26*	1427	NA	NA
All provinces	-.41*	-.38*	-.25*	-.25*	1817	NA	NA

Note: An * indicates that a correlation coefficient is significantly different from zero at the .05 level in a two-tailed test using the Fisher - z transformation. For ATMs, branches, and deposits, correlations are between a bank's market share at the end of 1991 and the change in that share between 1991 and the end of 1995. For loans changes were to the end of 1994.

Mean	1.544	1.253	1.316	1.009
Standard error of estimate	3.229	2.287	2.826	2.014
Multiple correlation coef.	.574	.557	.421	.472
F - ratio	185.6**	176.8**	104.9**	128.9**
Number of observations	1665	1700	1739	1744