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RETAIL PRICING OF ATM NETWORK SERVICES

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RETAIL PRICING OF ATM NETWORK SERVICES

ABSTRACT

In this paper a model of wholesale and retail fee-setting for automated teller machine (ATM) network services is developed, and comparative statics results are derived. Retail ATM fees are shown to be dependent on the demand-side network effect and economies of scale in production of network services. These, in turn, are functions of the size of the ATM network. Survey data on bank fees are linked with the bank's probable ATM network membership, and the retail ATM fees are regressed on ATM network size and other variables in a reduced-form estimation. The results suggest that both network effects in demand and economies of scale influence retail ATM network service fees, with economies of scale becoming dominant for the largest ATM networks.

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I. INTRODUCTION

Over the course of the last 20 years banks and their customers have embraced automated teller machines (ATMs) as an excellent way to deliver basic banking services, including withdrawals, deposits, balance inquiries, and transfers among accounts. As Saloner and Shepard (1992) point out, many banks began providing ATM services to their customers in a proprietary system--only customers of the bank could access their accounts at an ATM owned by that bank. In the early 1980s banks began to share their ATMs with the customers of other banks through shared ATM networks.

Since the mid-1980s, ATM networks have consolidated considerably, and ATM usage has grown. McAndrews (1991) documents this trend. Matutes and Padilla (1994) present a model in which ATM network sharing and consolidation is predicted based on network effects in the demand for access to one's bank accounts. These network effects are the result of uncertainty about the location at which a consumer might desire access to her bank account. Alternatively, economies of scale in production of network services may explain the consolidation of ATM networks. Network services are provided by electronically relaying (through a central computerized switch) the information needed to complete transactions from the cardholder's bank to the bank that owns the machine.

This paper seeks to determine the relative importance of demand-side network effects and economies of scale in production of ATM network services by examining the effect of network size on retail prices of ATM network services. If larger networks are significantly more efficient than smaller networks, all else equal, then larger networks should have lower prices than small networks.

Of course, small networks may face more competition than do large networks, so the estimation will control for the presence of network competition. It may also be the case that one network provides its services in a more concentrated retail banking market, which could distort the basic test, and so the estimation will control for retail market competition as well. On the other hand, if larger networks enjoy a significant, positive network effect in demand, then, all else equal, larger networks will charge higher prices for retail services.[1]

Determining the importance of the two explanations for network consolidation is of considerable importance for public policy. If no support can be found for either explanation, or if the network demand effects and economies of scale appear to be exhausted at some network size, then that result would cast doubt on the public benefits of ATM network mergers beyond that size. Alternatively, if either or both of the forces continue to operate at all observed network sizes, then further consolidation would be expected and could be welfare enhancing.

The rest of the paper is organized as follows. Section II presents a model of wholesale and retail price setting in an ATM network, and derives the comparative statics results on retail prices as networks expand. Section III describes the data and estimation procedure and presents the results of the estimation. Section IV concludes the paper with suggestions for further research.

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[1] Larger networks can charge higher prices to the extent that they can capture the network effect. To the extent that the network effect is external to any party in the network, prices would not reflect the network demand effect. However, the network organization itself, i.e., the organization that controls access to the network switch is seemingly in a position to capture the benefits of network size through its pricing decisions, perhaps through membership fees. Alternatively, the member banks may be able to capture the effect through their pricing of consumers' access to network machines.

II. THE MODEL

ATM network services are provided through ATM networks, which sell switching services in the wholesale market to banks that then sell the end product of remote and timely access to bank accounts to retail customers. In this section ATM networks will be modeled as monopolists; in an appendix available from the author they are modeled as duopolists. Both models have the same comparative statics properties regarding pricing. ATM networks charge a switch fee to their bank customers and set an interchange fee, which all banks must pay to the bank that owns the machine whenever one of the bank's cardholders accesses her account at a network-affiliated ATM owned by a different bank.

At the wholesale level, then, there is one "network switch," and at the retail level there are n network-affiliated "banks." The banks, which are identical, take the switch price as given and compete in quantities, i.e., the number of transactions. The network switch acts as a monopolist and maximizes profit given the demand of the network-affiliated banks. The banks have constant marginal costs of production, assumed, without loss of generality, to be zero. The network switch, on the other hand, has a cost function whose marginal cost can exhibit economies or diseconomies of scale. One unit of wholesale switching is required to produce one unit of retail ATM network services.

As in McAndrews and Rob (1994), the retail demand for ATM network services will be modeled as in Katz and Shapiro (1985). Let n be the number of member banks in the network. Demand is modeled as linear with a common additive network effect.

$$P(n) = A - Q + v(n); \tag{1}$$

where P is the retail price of the service when n banks participate, A is an aggregate of individual demands (given an underlying uniform distribution of a taste for the product by consumers), Q is the quantity supplied of the service by the n banks, and v(n) is the network component of demand, assumed to be common across banks. It is assumed that $v' > 0$, and that $v'' \leq 0$ (additional banks in a network yield more convenience to a given bank's customers, but this effect diminishes as more banks join a network). Bank profit is given by

$$\pi(n) = P(n)q(n) - s(n)q(n) = [A - Q + v(n) - s(n)]q(n); \tag{2}$$

q(n) is the output of an individual bank (since banks are identical, there is no subscript), and s(n) is the wholesale price of the switched transaction.

Under Cournot competition the first order condition results in an output level and retail price, which are given by the following expressions.

$$q^*(n) = [A + v(n) - s(n)][1/(n + 1)]. \tag{3}$$

$$P^*(n) = [A + v(n) + ns(n)][1/(n + 1)]. \tag{4}$$

The derived demand for the network switch is then given by the following demand relationship:

$$s(n) = A + v(n) - (n + 1)q^*(n). \tag{5}$$

Profits at the switch level are

$$\pi^s = n\, q^*(n)s(n) - c(nq^*(n)); \tag{6}$$

c(nq(n)) is the total cost function of switching nq(n) units of switching services. Substituting (5) into (6) and solving for the level of output by the switch using the first order conditions yields the equilibrium output of the monopoly switch (alternatively, one could substitute (3) into (6) and solve for $Q^{*}(n)$ and $s(n)$).[2]

$$(7) \qquad Q^{*}(n) = nq(n) = [n/(2(n+1))][A + v(n) - c'(Q^{*}(n))].$$

The level of output found in equation (7) results in the following switch price:

$$(8) \qquad s^{*}(n) = (½)[A + v(n) + c'(Q^{*}(n))].$$

Equation (8) is the familiar pricing rule for a monopolist facing a linear demand curve. The retail price is found by substituting the expression in equation (8) into (4):

$$(9) \qquad P^{*}(n) = \{(2+n)/(2(n+1))\}[A + v(n) + c'(Q^{*}(n))].$$

Treating n as a continuous variable and differentiating the retail price with respect to n yields the following comparative statics result.:

$$(10) \qquad \frac{dP^{*}(n)}{dn} = \frac{1}{2}\left[\frac{(2+n)}{(1+n)}v'(n) + \frac{1}{(n+1)^{2}}c'(nq(n)) + \frac{n}{(n+1)}c''(nq(n))(q(n) + nq'(n)) + \frac{1}{(n+1)^{2}}(A+v(n))\right]$$

Examination of the expression in (10) shows that it is of indeterminate sign. Depending on the strength of the network effects in demand, i.e., the size of $v'(n)$, which is assumed to be positive, and the strength of any possible scale economies in production, i.e., the sizes and signs of $c'(q(n))$ and $c''(q(n))$ (about whose signs no assumptions have been made, other than those implicit in footnote 2, which ensure that the second order conditions for profit maximization hold), the expression in (10) could be positive or negative. It is useful to point out that while (10) includes n, v(n), c(n), and q(n) as arguments, one can substitute for q(n) and obtain an expression dependent on n alone, which is

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[2] The second order conditions are assumed to be satisfied: $-2n(n + 1) - nc''(nq(n)) - n^{2}c'(nq(n)) < 0$. With n fixed, it is correct for the differentiation of (6) to be with respect to q(n) to find the profit maximum for the monopolist; see McAndrews and Rob for a proof of this.

the strategy I will adopt empirically.

This result suggests that retail prices for ATM network services could either increase or decrease as the size of the network grows. The prices would increase if the network demand effects predominate, and they would decrease if the economies of scale in wholesale network services predominate. This result holds true even for a monopolist wholesale switch operator.

The same result holds under duopoly provision of network services. This result is derived in an appendix, available from the author, for the case of duopoly switches of equal size.

III. DATA AND ESTIMATION

The model suggests the basic hypothesis that will be tested: retail prices for ATM network services are influenced by the size of the network. The variable n in the model represented the number of identical bank members of the ATM network, each of which provided a single ATM. In the empirical estimation we measure n by the number of ATMs in the network. We also measure the network's level of output by the number of ATMs, since the correlation between the number of transactions in a network and the number of ATMs in the network is 0.94. As a result, the number of ATMs in the network will be our primary measure of the network's size.[3] We will also control for the size of the bank. Hence our empirical implementation of the model takes n as the number of ATMs in the network, with individual banks owning different numbers of ATMs.

In addition to testing the effect of network size on prices for retail ATM network services, the effects of network competition on retail pricing will also be tested. Competition at the network

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[3] The results of estimations using the number of transactions rather than the number of ATMs are very similar to the results using ATMs.

level has several influences on retail pricing. First, competing networks will split the market in some way. This can have two effects on prices: the network effect on demand may be less than fully exploited, which would tend to lower retail prices, and the economies of scale may be less than fully exploited, which would tend to raise retail prices. Of course, both of these effects should be fully captured by a measure of the networks' level of output, because they are both determined by the network's size. Next, if there is active price competition between the networks, the networks' markups over marginal cost will be less than in the case of a monopoly network, which should work to lower prices independently of the level of a network's output. Finally, there may be significant costs of changing networks for consumers (they would have to establish a different bank account in some cases) and so price competition may be weak; if so, the presence of competition may have little effect on network pricing.

The hypothesis that the presence of network competition has no effect on retail pricing will be tested by including in the regressions two proxies for the presence of competitive networks. The markets for network services will be approximated by the states in which a bank operates. The first proxy is the variable OVERLAP. OVERLAP is a dummy variable that takes the value 1 when there is more than one network operating in a given state. A second variable, called NONMANDATORY, is a dummy variable that takes the value 1 for all states that did not pass laws (during the 1980s) that mandated sharing of ATM network facilities. Laderman (1990) documents that those states that passed such laws suffered slower development of ATMs and ATM cards than other states. NONMANDATORY is taken from Laderman's paper.

Another hypothesis concerning the behavior of networks is that networks whose ownership and governance are widely dispersed are less inclined to price in an anticompetitive manner. Charles Rule (1985), then the acting Assistant Attorney General for Antitrust, clearly articulated this view. More recently, McAndrews and Rob (1994) investigate this claim in a model in which the downstream retail banks own the upstream wholesale network switch. They find, contrary to Rule's claims, that the jointly owned and operated switch is more likely to achieve large scale than a solely owned network switch and, having achieved it, is as likely to extract monopoly rents from the downstream retail customers as is a solely owned network switch.

The three networks in the sample that most clearly satisfy Rule's criteria for determining whether a network's governance is widely distributed are the Star, PULSE, and Yankee 24 networks. As documented in McAndrews and Rob (1994), these three networks operated as not-for-profit in 1994 (Yankee 24 was merged into the InfiNet network late in 1994); they were the only networks among the 10 largest that operated as not-for-profit. A dummy variable, called NETWORK DUMMY, that takes on the value 1 for banks judged to be affiliated with those networks is included in the regressions to test the hypothesis that retail prices of jointly owned and operated networks are lower than those of networks whose ownership is concentrated.

The price data used in the basic estimations are from a survey of retail bank fees conducted by Moebs Services of Lake Bluff, Illinois, under contract with the Board of Governors of the Federal Reserve System. The data for 1994 are used. The survey sampled 415 banks in the 50 states, stratified into five asset-size categories; the survey gathered no data on the network affiliation of the bank.

The dependent variable in the estimations is the fee charged by these banks to their customers for withdrawing cash from an ATM owned by another bank. This fee forms a part of the fees associated with a deposit account at the bank. The fee chosen was for the standard checking account at the banks. Such a fee is typically called a "foreign fee," or an "on-others" fee. A transaction that triggers the imposition of an on-others fee necessarily involves a switch and interchange fee at the wholesale level. In a purely competitive single product downstream industry with zero marginal costs of production, the retail fee would equal the sum of the switch and the interchange fee.

The raw data do not identify the bank from which the price data are drawn; only the state in which the bank is located and the asset-size category of the bank are known. To form a data set of retail fees at ATM networks, I linked to each of the 28 largest ATM networks a set of states in which they operate, according to the *Bank Network News Data Book 1994*. The smallest network in the sample is less than 1 percent of the size of the largest network in the sample, as measured by the number of network-affiliated ATMs. Each bank in a state was assigned "membership" in every network that operated in the state. In that way each price observation was linked to an ATM network. As a result of single price observations being identified with more than one network, the final data set has 1190 observations. One can think of the procedure as assigning to a network an average of retail prices observed in the region in which the network operates. Table 1 lists the states and the networks assigned to each state.[4]

I will also use the median household income of a state in 1990, obtained from the census, as a demand side variable, and the statewide CR4 banking market concentration ratio for 1994, obtained from the Summary of Deposits report, to proxy for the degree of retail banking competition

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[4] I also carried out three other procedures for linking banks to networks to test the robustness of the preferred assignment. These will be discussed later in the paper.

in the various states. Table 2 presents the sample statistics and names of the variables.

The basic ordinary least squares regression that I will estimate is

$$\mathbf{FEE}_i = \alpha + \beta_1\mathbf{SIZE\ 1}_i + \beta_2\mathbf{SIZE\ 2}_i + \beta_3\mathbf{SIZE\ 3}_i + \beta_4\mathbf{SIZE\ 4}_i + \beta_5\mathbf{ATMS}_i + \beta_6\mathbf{ATMS2}_i + \beta_7\mathbf{CR4}_i + \beta_8\mathbf{MEDIAN\ INCOME}_i + \epsilon_i .$$

The equation includes both the linear term, ATMS, and the squared term, ATMS2, to determine if the network effect or economies of scale effect vary across networks of different sizes. The error term accounts for measurement error in observing prices accurately and in assigning banks to networks.

Table 3 presents the results of the basic regression as well as regressions that successively include NONMANDATORY, OVERLAP, and NETWORK DUMMY. The coefficient estimates in the various equations all have the same sign and levels of significance. The levels of the adjusted R-squared for the estimations are low--roughly 5 percent. I conjecture this is because the data are clustered around the levels of 0, 25, 50, and 75 cents, etc., on out to \$2.00, and not because the estimates are not explanatory in both a statistical and economic sense. To control for any bias introduced into the estimates because the fees are censored at 0, a Tobit estimation was conducted. The final column presents the results of the Tobit estimation. Because its estimates suggest very little if any bias in the OLS estimates, we will report most results using the OLS estimates.

As one can see in Figure 1, which shows the effect of network size on retail fees at banks in the largest size category, holding all other variables constant, retail fees at ATM networks display a humped-shaped pattern (the dots on the horizontal axis show the observed sized of the ATM networks in the sample). The fee increases as the size of the network in which the bank participates grows to about 6000 ATMs, then decreases as the network grows larger. This result is economically significant: banks in the largest networks are predicted to have a fee about 60 percent of the level of banks in the average size network and about three-fourths the level of banks in the smallest networks.

These results are consistent with a pattern of increased marginal value of networks because of network effects in demand out to about 6000 - 10,000 ATMs, with the marginal network effect in demand decreasing thereafter. It is also consistent with continuing scale economies even in the largest ATM networks of 16,600 ATMs. The results suggest that consumers in the largest networks enjoy considerable consumer surplus, assuming that they have the same willingness to pay for the services as do those who participate in the mid-sized networks.

The estimate of the coefficient on the CR4 variable suggests that banking market competition has a significant effect on retail ATM network fees. However, while the effect is measurable, the economic significance is slight. The roughly 70-point difference between the states with the most and least concentrated banking markets makes about a quarter of a penny difference in expected price. Median income has a more economically significant effect. The expected difference in retail fees at banks between the highest and lowest income states is about 20 cents.

The effect of bank size is, perhaps surprisingly, quite dramatic. The large size category of banks, those with over $1 billion in assets, has an average price significantly higher than the two mid-size categories, SIZE 2 and SIZE 3. This may well reflect an effort of those large banks, which typically have a more extensive network of bank-owned ATMs than do the smaller banks, to discourage their customers from accessing their accounts at "foreign" ATMs.[5] Banks in the smallest

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[5] This conjecture is supported by the evidence that banks in the largest size category have significantly lower "on-us" ATM retail fees. On-us fees are those charged to a customer who accesses her account through one of the bank's own ATMs.

size category and those in the SIZE 4 category charge fees not significantly different from those of the largest banks.

The results of the tests of the effects of competition on retail pricing for ATM services suggest that the presence of competitive networks does not tend to lower prices. Both the OVERLAP variable, which is a dummy indicating the presence of competing networks in the state, and the NONMANDATORY variable, which has a 0.15 correlation with OVERLAP, have positive signs. The NONMANDATORY variable is marginally significant. One interpretation of this result is that, even after accounting for the effects of network size on ATM network retail fees, competition is a weak force in reducing the fees for ATM network services. One possible reason for this is that there may be significant costs of changing networks by retail customers and, hence, only weak pressures on banks to price those services competitively.

The sign of the coefficient on NETWORK DUMMY tests the hypothesis of Charles Rule that those networks operated as a cooperative of the members are less likely to price in an anticompetitive manner. The sign of the coefficient is positive, but insignificant. Hence, after accounting for the effect of the size of the network and other features of the market, it appears that the organization of the network has little influence in the retail prices charged to the ultimate customers. This result accords with the prediction of McAndrews and Rob, whose model suggests that cooperative networks exploit monopoly power at the retail level to the same degree that a solely owned monopoly network would at the wholesale level.

The results of the Tobit estimation result in the same conclusions as those of the OLS estimation. The marginal effects calculated using the Tobit procedure (the listed values are the marginal effects of the independent variables on the FEE, given that the fee is nonzero) are strikingly similar to the OLS estimates. This suggests that the effect of the FEE variable being censored at zero does not introduce a significant bias into the OLS estimates.

To further test the robustness of the assignment of banks to networks, I've created five alternative assignments as follows. As the smallest network in the sample is less than 1 percent of the size of the largest network in the sample, as measured by the number of network-affiliated ATMs, one may conjecture that the basic assignment is flawed in ascribing too much influence to small networks. Alternative 1 is a nonrandom (or deterministic) assignment in which all banks in each state are assigned to one network, using only the largest 19 networks in the sample. So Alternative 1 places emphasis on the largest regional networks in an area. Alternatives 2 and 2A are probabilistic assignments in which each state is assigned a unique network from among the full sample of 28 networks. In Alternative 2 any network linked to a state in Table 1 has equal probability of being assigned to that state. In Alternative 2A, the probability with which a network is assigned to a state is greater the larger the network. The odds that a network is chosen is equal to the network's share of total transactions of all the networks that serve that state. Alternatives 3 and 3A are probabilistic assignments that assign to each bank in each state a network. The probabilities with which banks are assigned are as in Alternatives 2 and 2A: in the first case there is equal probability assigned to each network, in the latter case the network is assigned with weighted odds that are equal to the network's share of total transactions of all the networks that serve that state according to Table 1 (the same weights as in Alternative 2A).

Table 4 reports the results of running the basic regression on Alternative 1. The results using the other assignments are broadly similar: in particular, the size of the measures of network size are all quite close to one another and to the results in Table 3. Table 5 shows the sign and level of significance of the coefficients on ATMS and ATMS2 for 5 regressions (i.e., 5 draws of the probabilistic assignments of banks to networks) using Alternatives 2, 2A, 3, and 3A. When using the weighted odds assignments, i.e., Alternatives 2A and 3A, the levels of significance on ATMS and ATMS2 are consistently high (significant at the one percent level). Using assignment with equal odds (Alternatives 2 and 3), the significance levels are not as consistently high. I conjecture that this is because the equal probability assignment introduces too much noise in the linking of banks to networks. These results tend to confirm the results reported in Table 3, and show that they are robust with respect to the specific assignment used.

One question that naturally arises is how much of the variation in retail pricing of ATM network services, which the estimates reveal, is due to differences in wholesale prices. It is possible to provide a preliminary answer to this question by considering some switch and interchange fee data reported in the March 28, 1994, issue of the *Bank Network News*. These data report the maximum and minimum switch and interchange fees for some of the largest 30 ATM networks. This includes 26 out of 28 of the networks in the main retail fee data set in this paper. The following regression of wholesale fees on network size was estimated to determine how wholesale fees at networks vary with the size of the network.

$$\begin{array}{lccccc} (\text{WHOLESALE FEE})_I = & \alpha & + & \beta_1\textbf{ATMS}_i & + & \beta_2\textbf{ATMS2}_i + \epsilon \\ & .50^{***} & + & (2.2\text{E-}06)\textbf{ATMS}_i & & -\ (5.6\text{E-}10)^{***}\textbf{ATMS2}_i \\ & (73.2) & & (0.97) & & (-4.26) \end{array}$$

These estimates suggest that much of the systematic variation in retail fees across ATM networks of different sizes may be generated by differences in wholesale fees (in this regression, I do not control for some of the same factors used in the retail fee regressions). The above estimates suggest that a network of 16,500 ATMs has wholesale fees (the sum of the minimum switch and interchange fee) 15 cents lower than those of the smallest network--very close to the estimated retail fee differences between banks in the largest networks and the smallest networks of 13.5 cents.

A significant difference between the behavior in wholesale and retail pricing for ATM networks appears to be that retail prices rise as network size rises, up to network sizes of approximately 6000 ATMs, while this is not so for wholesale prices. It may be that the networks are unable to capture the network effect in the transaction fees; this does not preclude the possibility that they can capture the effect in their fixed membership fees. This result also suggests that to the extent that network effects in demand exist at ATM networks, member banks seem to be able to capture at least some of the network benefits through their on-others fees.

IV. CONCLUSION

This paper reveals that bank fees for retail ATM services vary systematically with the size of the network in which the bank participates. Survey data on bank fees were linked with the network in which the survey respondents were likely to participate. These data were supplemented with information on state income and banking market concentration, as well as other variables that influence supply or demand. Fees for on-others ATM transactions were then regressed on the network size and other variables in a reduced-form estimation consistent with a model of network and bank fee-setting behavior.

The results are interpreted within the model as reflecting first an economically significant demand-side network effect. This effect allows banks in larger networks to charge a premium of (at its largest) 5.5 cents per transaction. As network size increases further, however, economies of scale in production of network services continue to affect pricing, while the demand-side network effect diminishes, resulting in bank fees, in the largest networks, that are as much as 15 cents below those in the smallest networks.

Surprisingly, given that the industry tends toward large scale, pressures from competitive networks do not result in lower prices for retail services. Competition is proxied here by a dummy that records the presence of competitors and a dummy variable that indicates states that did not impose mandatory sharing on ATM networks. This feature of competition is consistent with consumer-borne costs of changing networks, which tends to reduce incentives to engage in price competition.

The results lend little support for the hypothesis, first advanced by Charles Rule, that widely dispersed governance and ownership within a network result in lower prices for retail consumers. Instead, consistent with the model of McAndrews and Rob, the results suggest that consumers fare no better or worse under widely dispersed governance and ownership of ATM networks, holding fixed the size of the network. This result does not preclude the possibility that small banks may fare better under widely dispersed governance and ownership of ATM networks, nor that (as is possible in the model of McAndrews and Rob) consumers can be better off in such networks as a result of their larger equilibrium size than in solely owned networks. The dispersion of ownership was proxied by the three networks that are nonprofit and have widely inclusive governance.

The fact that the largest banks charge significantly higher prices than banks of smaller size suggests that they may be attempting to encourage their customers to use the bank's own network of ATM machines.

More research is needed to address the interaction between pricing and growth of networks and between pricing for different sizes of banks and the type of organization by which the network governs itself. Another issue raised in this paper is the disparity between the premium transactions prices achieved by retail sellers of network services as network sizes increase, while the wholesale prices do not reflect the premium. Are retail banks able to capture the network demand effect, while the wholesale network itself cannot? Or can the network capture some of the demand effect through fixed fees?

Finally, this paper shows that it is likely that network sizes will continue to increase, either through growth or continued industry consolidation. The significantly lower fees associated with the largest networks suggest that substantial efficiencies are yet to be exploited by many ATM networks.

TABLE 1
NETWORKS BY STATE

State	Networks	State	Networks	State	Networks
Alabama	Alert Honor Money Belt	Illinois	Bankmate Cash Station EFT Illinois Shazam	Montana	The Exchange FastBank
Alaska	Alaska Option The Exchange	Indiana	EFT Illinois Jeannie MAC Money Station	Nebraska	NetWorks
Arizona	Shazam Pulse	Iowa	Shazam	Nevada	The Co-op Star
Arkansas	Pulse	Kansas	Bankmate Shazam	New Hampshire	MAC XPress 24 Yankee 24
California	The Co-op Pulse Star	Kentucky	Bankmate Jeannie MAC Money Station	New Jersey	MAC NYCE
Colorado	FastBank Pulse Star	Louisiana	Gulfnet Honor Money Maker Pulse	New Mexico	The Co-op Pulse
Connecticut	NYCE XPress 24 Yankee 24	Maine	Yankee 24	New York	MAC NYCE Yankee 24
Delaware	MAC Most 24 Hour Teller	Maryland	Honor Most	North Carolina	Honor Jeannie
D.C.	Honor Most	Massachusetts	NYCE XPress 24 Yankee 24	North Dakota	FastBank
Florida	Honor Jeannie Presto	Michigan	Cash Station EFT Illinois MAC Magic Line Money Station TYME	Ohio	Jeannie MAC Money Station
Georgia	Honor Presto	Minnesota	FastBank Instant Teller	Oklahoma	Bankmate Money Maker Pulse
Hawaii	Bank of Hawaii Star	Mississippi	Gulfnet Honor Money Maker Pulse	Oregon	The Exchange Star
Idaho	The Exchange	Missouri	Bankmate	Pennsylvania	MAC

State	Networks
Rhode Island	XPress 24 Yankee 24
Tennessee	Bankmate Gulfnet Honor Jeannie Most
Texas	Gulfnet Money Maker Pulse
Utah	Star
Vermont	Yankee 24
Virginia	Honor Most
Washington	The Exchange Star
West Virginia	Jeannie MAC Money Station Most
Wisconsin	EFT Illinois TYME
Wyoming	NetWorks

TABLE 2

Sample Statistics
number of observations = 1190

	mean and standard deviation	minimum	maximum
FEE: on-other's fee charged by bank (in dollars)	.79 (.46)	0	2.0
ATMS: number of ATMs in the network	5704 (5262)	156	16604
ATMS2: square of **ATMS**	60E06 (90E06)	24,336	275E07
CR4: Four-bank state concentration ratio	44.42 (12.9)	20.1	90.8
MEDIAN INCOME: State median household income	32736 (4944)	23492	47655
OVERLAP: 1 if state has more than one network	.95 (.2)	0	1
NONMANDATORY: 1 if state did not mandate sharing of ATM network facilities	.5 (.5)	0	1
SIZE 1:bank asset is below $100 million	.03 (.18)	0	1
SIZE 2:bank asset is between $100 million and $250 million	.34 (.47)	0	1
SIZE 3:bank asset is between $250 million and $500 million	.22 (.41)	0	1
SIZE 4:bank asset is between $500 million and $1 billion	.19 (.39)	0	1
SIZE 5:bank asset is over $1 billion	.19 (.39)	0	1
NETWORK DUMMY: 1 if member of PULSE, Star, or Yankee 24	.14 (.35)	0	1

TABLE 3[6]

	COEFFICIENT ESTIMATES AND T-STATISTICS				TOBIT
CONSTANT	0.46*** (3.98)	0.41*** (3.82)	.47*** (3.30)	.47*** (4.08)	.35** (2.51)
SIZE 1	-0.08 (-1.27)	-0.075 (-0.95)	-0.078 (-0.99)	-0.079 (-1.01)	-0.093 (-0.98)
SIZE 2	-0.17*** (-4.56)	-0.17*** (-4.47)	-0.17*** (-4.53)	-0.17*** (-4.53)	-0.21*** (-4.54)
SIZE 3	-0.17*** (-4.13)	-0.16*** (-4.09)	-0.17*** (-4.13)	-0.16*** (-4.09)	-0.20*** (-4.10)
SIZE 4	-0.056 (-1.33)	-0.056 (-1.33)	-0.056 (-1.32)	-0.056 (-1.32)	-0.07 (-1.37)
ATMS	0.24E-04** (2.43)	0.22E-04** (2.21)	0.23E04** (2.34)	.21E-04** (2.01)	0.32E-04*** (2.60)
ATMS2	-0.20E-08*** (-3.37)	-0.19E-08*** (-3.30)	-0.19E-08*** (-3.30)	-0.18E-08*** (-3.06)	-0.25E-08*** (-3.51)
CR4	0.36E-02*** (3.47)	0.29E-02*** (2.59)	0.34E-02*** (3.22)	-0.35E-02*** (3.41)	0.39E-02*** (3.09)
MEDIAN INCOME	0.79E-.05*** (2.77)	0.88E-05*** (3.04)	0.75E-05*** (2.65)	0.76E-05*** (2.69)	0.95E-05*** (2.75)
NONMANDATORY		0.03* (1.75)			
OVERLAP			0.07 (1.18)		
NETWORK DUMMY				0.059 (1.49)	
ADJ. R-SQUARED LOG-LIKELIHOOD (TOBIT)	.048	.05	.048	.049	-1052.1

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[6] The asterisks indicate levels of significance; * indicates significance at the 10 percent level, ** indicates significance at the 5 percent level, and *** indicates significance at the 1 percent level.

TABLE 4[7]

	COEFFICIENT ESTIMATES AND T-STATISTICS
BASIC MODEL	Exclusive territories: 19 networks, nonrandom assignment
CONSTANT	0.08 (0.43)
SIZE 1	0.07 (0.68)
SIZE 2	0.0 (0.01)
SIZE 3	0.10* (1.75)
SIZE 4	0.15 ** (2.36)
ATMS	0.92E-04*** (5.44)
ATMS2	-0.57E-08*** (-6.09)
CR4	0.59E-02*** (3.67)
MEDIAN INCOME	0.11E-.04 (0.93)
ADJ. R-SQUARED	0.10

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[7] The asterisks indicate levels of significance; * indicates significance at the 10 percent level, ** indicates significance at the 5 percent level, and *** indicates significance at the 1 percent level.

TABLE 5[8]
Sign and Level of Significance on ATMS and ATMS2 for 5 Draws of Random Assignments of Banks to Networks

	Alternative 2: All Banks in One Network, Equal Probability	Alternative 2A: All Banks in One Network, Weighted Odds	Alternative 3: Each Bank Assigned to a Network, Equal Probability	Alternative 3A: Each Bank Assigned to a Network, Weighted Odds
ATMS ATMS2	+ $-^{**}$	$+^{***}$ $-^{***}$	+ -	$+^{***}$ $-^{***}$
ATMS ATMS2	+ -	$+^{***}$ $-^{***}$	$+^{***}$ $-^{***}$	$+^{***}$ $-^{***}$
ATMS ATMS2	+ $-^{**}$	$+^{***}$ $-^{***}$	$+^{***}$ $-^{***}$	$+^{***}$ $-^{***}$
ATMS ATMS2	$+^{**}$ $-^{***}$	$+^{***}$ $-^{***}$	+ $-^{*}$	$+^{***}$ $-^{***}$
ATMS ATMS2	+ -	$+^{***}$ $-^{***}$	$+^{*}$ $-^{**}$	$+^{***}$ $-^{***}$

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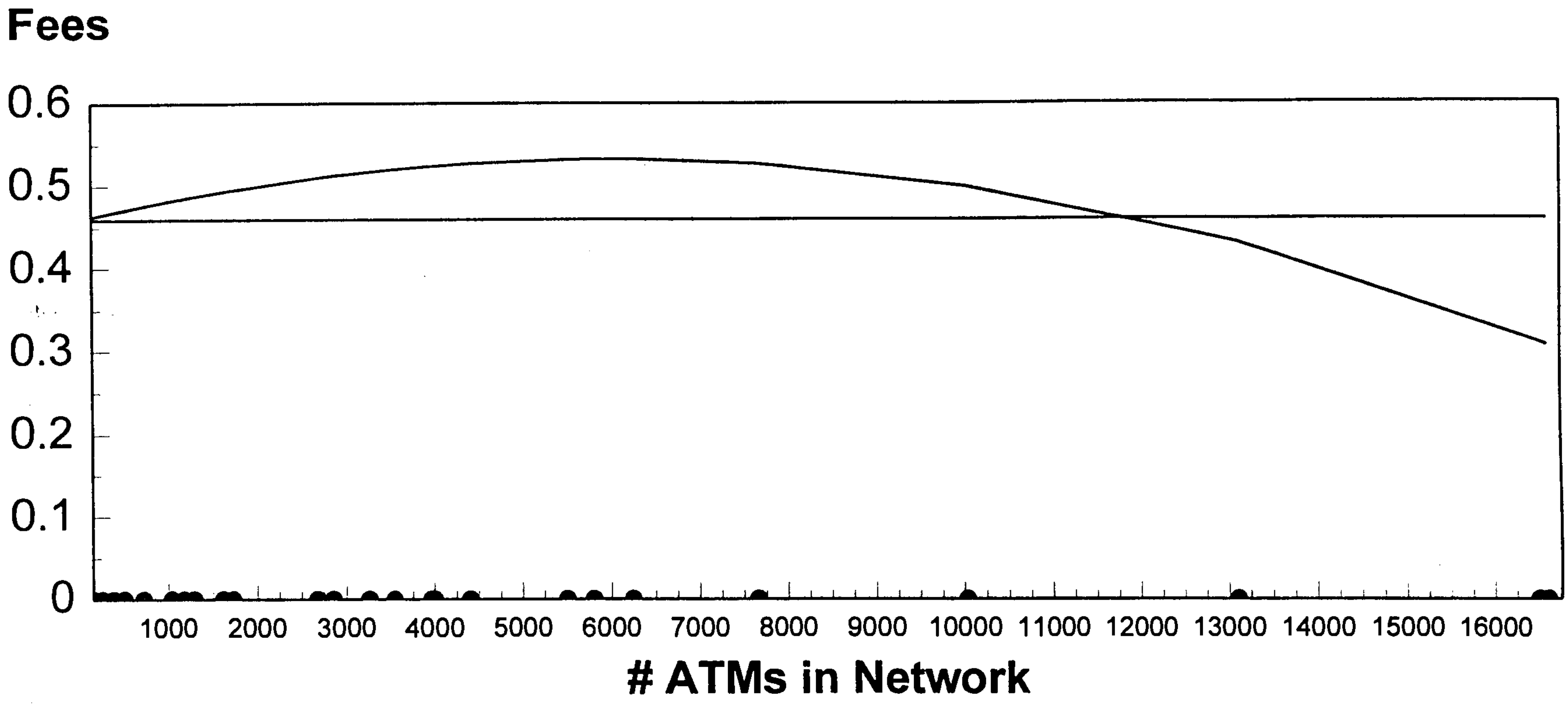
[8] The asterisks indicate levels of significance; * indicates significance at the 10 percent level, ** indicates significance at the 5 percent level, and *** indicates significance at the 1 percent level.

Figure 1

ATM FEES BY NETWORK SIZE



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