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The Productivity Impact of IT Deployment: An Empirical Evaluation of ATM Introduction

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and

Steve Thompson**

ABSTRACT
The service industries in general and financial services in particular have been disproportionately large investors in information technology. However, critics have suggested that the productivity effects of this investment have been negligible, a serious outcome given the importance of the service sector in the modern economy. This issue is part of a wider failure of many empirical studies to find a robust empirical association between increasing inputs of information technology capital and measured output, the so-called "IT productivity paradox". While a number of possible explanations have been advanced for this, it is clear that measurement difficulties attaching to IT inputs are particularly problematic. This paper seeks to circumvent some of these problems by an examination of the impact of a single homogeneous embodied IT application, the automatic teller machine (ATM), on productivity. It uses an unbalanced panel of UK building societies over the years 1981-93, a period corresponding to the diffusion of the ATM across the sector. The dataset is restricted to the societies' core financial intermediation activities and hence avoids contamination from irrelevant diversifying activities. The results suggest that ATMs have strong productivity consequences. This appears inconsistent with existing evidence for an "IT paradox".

JEL Codes: D24, G21, L80, O33.

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I. INTRODUCTION: THE "IT PARODOX"

This short paper presents some results from an empirical investigation of the productivity effects of IT adoption. In so doing it contributes to the current debate over the so-called "IT paradox": that is the apparent failure of so much economic research to reveal a productivity impact proportionate to the quantitative and qualitative importance of IT investment in modern economies. The paper uses an augmented production function approach to isolate the productivity effects of introducing the automatic teller machine (ATM) across an unbalanced panel of UK building societies. It suggests that the ATM has characteristics that make it representative of many embodied IT applications. Similarly, the choice of a single industry with a highly restricted product range generates a data set of unusual homogeneity, permitting the circumvention of those measurement difficulties – see below – which plague much empirical work in the area. The paper finds no support for the "IT paradox" view and reports large, robust and statistically significant productivity gains associated with ATM introduction.

It is self-evident that IT investment is important. It is the major element of new capital formation in many industries[1], particularly in financial and other services, whilst the technology itself is widely considered to be one of those "generic" technologies [Bresnahan and Trajtenberg (1995), Lehr and Lichtenberg (1998)] whose diffusion supports a spurt of growth across many user industries[2]. However, a series of econometric studies have produced the somewhat counter-intuitive result that the productive contribution of IT investment is disappointingly small: Wilson (1995), for example, surveys 20 empirical papers published in the 1980s and early 1990s, of which 13 report insignificant or even negative returns to IT. Similarly, the IT usage of some individual industries has generated adverse comments, especially the financial services industry – e.g. Roach (1991).

The disappointing empirical work discussed above has stimulated considerable discussion on the nature and causes of this "IT paradox" [Berndt and Malone (1995), Brynjolfsson and

[1] For example, in the USA approximately 20% of all new capital investment is IT-related, with a considerably higher proportion in the service industries - see Brynjolfsson and Yang (1996) pp 185-185.

[2] Historians consider technologies such as water and steam power in the eighteenth and nineteenth centuries, respectively, and electrification in the inter-war period to have been both novel and sufficiently wide in their applicability to stimulate major growth spurts - see David (1990).

Yang (1996), Wilson (1995)]. A series of possible explanations has been advanced: first, it is clear that IT investment is overwhelmingly concentrated in what Griliches has termed the "unmeasurable" sectors of the economy, where output determination is difficult and where productivity effects are correspondingly harder to find. Second, the output measurement problem is intensified since most IT applications are both process and product innovations: that is they impact on both the quantity and quality of any good or service being produced strictly requiring that hedonic output measures be used[3]. Third, it has been suggested that radically new technologies require an unusually long lag for full implementation, perhaps requiring complementary investments in human and physical capital and even organisational and contractual changes [David (1990)]. Finally, some critics have alleged that much IT investment may be unproductive because of inappropriate deployment [Landauer (1995), Wilson (1995)].

It is notable that some recent studies, using more carefully delineated samples and more precisely defined IT input measures, have reported significant and substantial positive returns to IT investment by both large US firms [Brynjolfsson and Hitt (1996), Lichtenberg (1995), Lee and Barua (1999)] and in the American public sector [Lehr and Lichtenberg (1998)]. As far as we are aware, no comparable work has been undertaken outside the US. The current paper aims to circumvent measurement difficulties by concentrating upon a single IT application in the context of a remarkably homogeneous sample of potential adopters. The data are described in Section II and the model is outlined in Section III. Section IV presents the results and a brief Conclusion follows.

II THE INNOVATION, THE SAMPLE AND THE DATA

II.i The ATM as an Innovation

The ATM clearly has both process and product innovation characteristics. As a process innovation, it substitutes the automated delivery of services for those previously offered at a

[3] See Griliches (1999), for a discussion. Of course, the use of hedonic output measures should strictly be matched by comparable input measures which allow for both the very rapid real fall in the price of IT inputs and the related phenomenon of high depreciation rates for IT assets.

bank counter[4]. However, the ATM additionally offers services not previously available; for example 24 hours-a-day access, foreign currency provision abroad and cash provision in locations remote from bank branches. As a consequence the ATM is also a product innovation, with implications for consumer demand. For example, as Griliches (1994) points out, improved access generates unmeasured but presumably not unvalued time savings for the users.

The ATM shares another important characteristic of many IT applications in that it exhibits strong network externalities [Salop (1990)]. The more locations are available to the user, the more valuable is access to the system. As a consequence, independent financial institutions have co-ordinated their introduction of ATMs into a series of joint networks, some of which have themselves developed mutual access arrangements. The result is that once individual institutions have joined a network, the demand-side effects may be no more than loosely related to the extent of their individual ATM provision.

Finally, it is the case that the ATM is employed by a *service* industry with the usual characteristics that use occurs at the point of delivery. This implies that the actual utilisation of an ATM system depends upon customer action. By contrast, the utilisation of IT applications in, say, manufacturing typically depends in the first instance on scheduling decisions by the operator. The result is that during the diffusion stage of the ATM there may be a corresponding learning process among potential users. During this period we might expect that installed capacity may exceed substantially the level of actual utilisation.

II.ii The Sample and Data

The sample consists of an unbalanced panel of 93 UK building societies over the period 1981-1993, inclusive. This period contains the years of rapid ATM diffusion across the sample, as shown in Table 1. The criteria used in sample selection were as follows: one, that at least five years of continuous data were available; and two, that at least two years of data related to the post-deregulation regime which commenced in 1987. These requirements had the effect of excluding some (generally small) societies that were taken over during the

[4] Furthermore, work in the USA [Hannan and McDowell (1984)] and the UK [Ingham and Thompson (1993)] suggests that the speed of adoption of the ATM is a function of the wage rate, as would be expected for a labour saving process innovation.

period. The industry population fell from approximately 200, at the start of the period, to about 80 at the end, so that our sample was very close to the entire population towards the latter part of the study period.

ATM adoption data were obtained from "Banking World" annual surveys and from the Building Societies' Association Yearbook. Other data were obtained from industry sources, including the BSA and Franey and Co, London and Manchester Central Reference Library and the Loughborough University Banking Centre Library. A particular advantage of the data set was its concentration on core activities. Most firm-level data has to contend with multiple outputs, making productivity analysis problematic. In this case, regulation limited the societies to core financial intermediation activities until 1987 and thereafter imposed the requirements that such non-core activities as were permitted be administered through separately accountable subsidiaries [Ingham and Thompson (1995)]. This has allowed us to restrict attention to the core activities, even in the post-deregulation regime. In consequence, it seems reasonable to assume homogenous output across the sample.

Table 1 shows the intra-sample diffusions of the ATM. This indicates that 23 of the 93 sample societies adopted the innovations over the period. The adopters displayed considerable variety in the extent of their deployment – from a maximum of 1600 units to a minimum of two. However, the intra-firm diffusion pattern appears similar in most cases with most adopters reaching their (within period) maximum number of installed ATMs within a few years of the initial adoption. Thus, for example, 11 adopters reached 90 percent of their maximum within four years, whilst another 8 have reached 50 percent by the same time.

The variables used in the analysis were as follows:

Output [Qit] We have followed a substantial literature in financial intermediation – see Section III below – in taking the banking firm's output as its level of earning assets. Accordingly, output is measured as the balance sheet value of society *i*'s commercial assets at time *t*, expressed in constant 1985 prices.

Total Employment [Lit] is measured as the total number of full-time equivalent employees of society *i* at time *t*, where part-time employees are given a weight of one half.

Total Fixed Assets [K1it] is the balance sheet value of fixed assets of society *i* at time *t* in 1985 prices.

Liquid Assets [K2it] is the balance sheet value of liquid assets (cash and deposits) of society *i* at time *t* again in 1985 prices.

ATM Adoption [ATMit] is measured as a binary variable equal to 1 in the year in which an ATM system was installed and 0 otherwise. Additional binary variables were defined equal to 1 for years one to four subsequent to adoption and 0 otherwise. Also, a binary variable ***[ATMDUM]*** equal to 1 for any year post-adoption, and 0 otherwise was measured.

The summary statistics for the continuous variables above are given in Table 2.

III. MODELLING STRATEGY

Some previous investigations of the productivity impact of IT have disaggregated capital inputs into IT capital and non-IT capital series and entered both as separate elements in the production function, which is typically assumed to be Cobb-Douglas [e.g. Lichtenberg (1995), Lehr and Lichtenberg (1998)]. However, this approach becomes problematic when dealing with firm level data and with a single discrete innovation, since by definition substitution is not observable unless and until adoption occurs. Therefore the basic approach adopted in this paper is to utilise an augmented production function in which the innovation is treated as a shift factor whose impact is captured using contemporaneous and lagged binary variables. Such an approach has been widely employed in investigations of firm or plant-level productivity change: for example, following the introduction of profit-sharing and similar schemes [e.g. Cable and Wilson (1989)] and unionisation [e.g. Clark (1980)]. Here it is precisely because the innovation under consideration represents such a completely new technology, that it is treated in a manner analogous to a disembodied shift in the production function.

Using dichotomous ATM variables, rather than a continuous variable representing the number of installed machines, has two additional advantages in the present case. First, any output effects resulting from the existence of network externalities will presumably commence once the society's depositors are able to access the network, and are partially independent of the extent of the society's own installed capacity. Second, the data on ATM system adoption was checked with industry sources and thus appeared more reliable than the time series on machine numbers.

There is an extensive literature on estimating banking production functions – see Berger and Humphrey (1996) for a review – but there is no clear consensus on the appropriate choice of functional form. Therefore, in the absence of any strong priors in this regard, our initial approach was to evaluate the three most commonly used alternatives, the Cobb-Douglas (C-D), the translog and Kmenta's (1967) linear approximation to the constant elasticity of substitution (CES) case. Since the C-D is nested in both the translog and the CES and the CES is itself nested in the translog, a data-driven design seemed appropriate. Furthermore, the alternative specifications of the augmented production function offered a check on the robustness of the productivity effects. Therefore, taking the C-D case as illustrative of the rest, the basic approach was to assume a production function, which before augmentation was:

$$Q_{it} = A_i L_{it}^{b1} K1_{it}^{b2} K2_{it}^{b3} e^{b4t} \quad \ldots (1)$$

Where Q_{it}, L_{it} and K_{it} are the output, labour input and capital input, respectively, and e^{b4t} represents an exponential time trend.

Following Murray and White (1980) and subsequent researchers in bank productivity analysis, output is measured as the *level* of commercial (i.e. earning) assets[5].

The labour input was measured using the number of full-time equivalent employees (L)[6].

[5] The translog had the additional difficulty that its higher order and cross product terms introduced multicollinearity into the production function estimates.

[6] Earlier versions of the paper used the wage bill as an alternative measure of labour input to capture any quality of labour changes following ATM introduction. In the event this variable yielded very similar results to those obtained with the number of employees as the labour input variable. The alternative results are available from the authors.

Capital inputs were measured using fixed assets (K1) and liquid assets (K2). The former variable is intended to capture productive capital inputs in the normal way. The latter is included to control for any changes in the depositors' and societies respective cash holding brought about by changes in the process of intermediation.

After augmenting with ATM binary variables, our basic estimating equation became.

$$LnQ_{it} = a_i + b_1 LnL_{it} + b_2 LnK1_{it} + b_3 LnK2_{it} + b_4 t + b_5 ATM_{it}$$
$$+ b_6 ATM1_{it} + \ldots + b_9 ATM4_{it} + \varepsilon_{it} \qquad \ldots (2)$$

Where: a_i represents the firm-specific, fixed effects, arising for example from differential location advantages etc.; b_4t is a time trend; and ε_{it} is a normally distributed error term.

Two principal variants to the basic specification in equation (2) were also considered. First, recognising that the number of individual observations on some of the lagged ATM variables was quite small, we considered a re-specification in which all the contemporaneous and lagged ATM variables were replaced with a single binary variable [ATMDUM] equal to one for any ATM deployment and zero otherwise. Second, to allow for the possible impact of macroeconomic fluctuations upon the output variable, the time trend was replaced by a set of year dummies.

Equation (2) and the equivalent translog and CES specifications were initially estimated by OLS, using both the full set of ATM binary variables and the single ATMDUM specifications and under the alternative time trend and time dummies variants. Then, following the arguments of Cable and Wilson (1989) and others on the likelihood of endogeneity in the labour input variables, each specification was re-estimated by instrumental variables (IV), after instrumenting the labour variable. In addition, since the banking literature in general and that on building societies in particular, [see Berger and Humphrey (1996) and Drake and Weyman-Jones (1992), respectively] has yielded ambiguous results with respect to returns to scale, both unrestricted and constant-returns cases of the C-D, our ultimately preferred alternative, were estimated.

IV. RESULTS

The three alternative functional forms of the augmented production function were initially estimated on the full sample using OLS. It was immediately apparent that it was possible to reject unambiguously the translog in favour of either the C-D or the CES[7]. The choice between the latter pair was rather more difficult, with an F-test giving a somewhat ambiguous result[8]. However, Kmenta (1967)'s approximation of the CES strictly requires the elasticity of substitution to be in the neighbourhood of unity, while our results implied substantially higher (typically 1.5-1.6) values. In acknowledgement of this and for reasons of space, we report only the C-D results, although the different functional forms turned out to give very similar results with respect to the ATM variables[9]. Similarly, we were able to reject the imposition of constant returns in the C-D case in favour of the unrestricted form. Table 3 reports the unrestricted C-D results, both OLS and IV, under alternative specifications.

In each version the basic production function was well determined with positive and generally highly significant input elasticities. However, it was clear that the labour and liquid assets (K2) variables performed substantially better than fixed assets (K1), probably because the latter, as a balance sheet item, was recorded with some measurement error, especially during periods of rapid inflation. The TIME trend variable was highly significant in all cases and was suggestive of annual industry-wide productivity growth of approximately three-to-four percent[10].

Turning to the variables of interest, it was apparent that the ATM dummies were jointly and individually significant whichever functional form was employed. It had been anticipated

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[7] The translog had the additional difficulty that its higher order and cross product terms introduced multicollinearity into the production function estimates.

[8] Employing an F-test to discriminate between the C-D and CES alternatives typically produced a somewhat inconclusive result. For example, in the OLS estimation with the full set of dummy variables, an F-test on rejecting the C-D null yielded F=2.50 [p=0.11].

[9] An earlier version of the paper reported, in full, the estimations of the augmented production function under alternative assumptions about the underlying functional form. In the absence of any strong priors on the appropriate functional form for this industry, this had the advantage of showing the robustness of the ATM effect. For space reasons these results are no longer reported but are available from the authors.

[10] This is likely to be an upper bound estimate because of the existence of some survivor bias in the sample. Over the period of investigation, 1981-93, the membership of the sample tends to converge towards that of the population, principally because of the disappearance by acquisition of smaller societies. If the latter have productivity lower than the mean – either because of scale effects or technical inefficiency – there will be an apparent increase associated with their demise.

that the coefficients for successive years following adoption would display a pattern of increasing magnitude as ATM utilisation increased. This effect was not consistently observed, however, and the largest individual yearly effects were normally for YRATM2 or YRATM3: i.e. two or three years after the post-adoption year. Replacing the set of adoption dummies with a single binary variable for any adopter-year [ATMDUM] yielded a highly significant effect that was robust to all changes in specification and to sub-period estimation. The magnitude of the ATMDUM coefficient varied a little when the time trend was replaced by a set of year dummies, but it remained within the .07 to .09 range: i.e. equivalent to a productivity gain of approximately seven to nine percent over non-adoption.

Following extensive discussions in the augmented production function literature on the likely endogeneity of labour – see, for example, Cable and Wilson (1989) - Table 3 also reports the results of re-estimating the basic C-D model by IV, with labour treated as endogenous. This resulted in a slightly shorter panel, through the use of lagged labour variable as an instrument, so direct comparisons with the OLS results in Table 3 need some qualification. In the event, however, the IV results were extremely similar to their OLS counterparts and neither an expanded regression test nor a mis-specification test was able to reject the exogeneity of labour[11]. Again the ATM effects were positive and significant, whether assessed on individual post-adoption years or using the all-adopter [ATMDUM] binary variable[12].

The introduction of year dummies in place of the time trend left the principal results largely unaffected and the all-adopter [ATMDUM] binary variable continued to be highly significant and equivalent to a seven percent productivity advantage for users over non-users for the period. However, individual year dummies were now less precisely estimated because of the bunching of adoptions within the middle of the sample period and the decline in adoption thereafter. Column (6) reports the re-estimation of the equation for the sub-period 1981-1989, when all the adoption in the sample occurred[13]. Again the results are materially unaffected,

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[11] For example, using comparable estimation periods for the OLS and IV estimations, i.e. taking account of the loss of one year's data when lagged labour is employed as an instrument, the expanded regression test statistics for the full dummy variables and single ATMDUM models, respectively, were $F(1, 840) = 1.601$ and $F(1,844) = 0.857$. The corresponding chi-squared statistics for mis-specification tests were 1.48 and 0.75.

[12] A Sargan test was used to confirm the validity of the instruments. Using the lagged ATM and ATMDUM specifications, as outlined in footnote 10 above, the chi-squared statistics were 1.271 and 0.762, respectively.

[13]There was some subsequent adoption in the 1990s but, unfortunately, it was not possible to lengthen our panel in any meaningful way without introducing potentially serious biases. In the mid-1990s demutualisation and/or acquisition led to the disappearance of many of the leading societies. The loss of these, many of them ATM users, would inevitably introduce survivor bias into the sample. Their continued inclusion would be

but both the coefficient estimates and the standard errors tend to increase on the longer-lagged ATM terms. When labour productivity was substituted for output there remained an ATM effect of around seven percent.[14]

It can be seen that our empirical investigation suggests that the introduction of an ATM system was rapidly followed by productivity gains, such that adopters enjoyed a reasonably large productivity advantage over non-adopters by the end of the 1980s. Furthermore, experimentation with different generic functional forms and alternative specifications of each suggests that this result is extremely robust. However, in common with other studies on the *consequences* of innovation, there are two caveats with respect to the adoption decision that need to be recognised in generalising from the results. These concern the possible endogeneity of adoption and the issue of necessarily omitted variables.

It has long been recognised in the diffusion of innovation literature that the adoption decision is itself a function of the expected benefit from adopting. This inevitably implies that the gains to early adopters may outstrip those of the laggards and hence that they may exaggerate the potential benefits of more general diffusion. It also means that there is a potential endogeneity problem if adoption occurs in anticipation of output growth. Given the data at our disposal it was not possible to construct a formal endogenisation of adoption. However, this did not appear to be particularly problematic. The data did not suggest that productivity increased substantially immediately *prior* to adoption. Furthermore, a binary variable distinguishing adopters from non-adopters is less vulnerable in this regard than a continuous variable on the *extent* of adoption.

A related perennial difficulty faced by those who try to evaluate the performance impact of an innovation during its diffusion period is that of unobservable differences in factor quality, in this case particularly in the quality of management, which may generate an omitted variables problem. It is possible that those managers who adopted earlier may have been superior to and/or more alert than those who lagged behind. If so, these managers may have

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problematic, since input and output data become available only at the group level and not for the core activities alone.

[14] For example, regressing Ln (Q/L) on capital inputs, ATMDUM and the firm and year dummies yielded ,with absolute t-statistics in parentheses: Ln (Q/L) = -0.032Ln K1(3.055)+0.18Ln K2(7.793)+0.071ATMDUM(3.473), although the overall fit was considerably poorer [adjusted R^2 =0.827, F=47.09] and there was a sign reversal for the fixed assets variable.

affected performance in ways not directly related to the adoption decision[15]. The present research, however, does have the advantages of an unusually homogeneous sample and a fixed effects panel design to control for persistent firm level productivity differences[16].

V. CONCLUSION

The debate over the apparently illusive productive contribution of IT investment now centres on the service sector - and on financial services in particular - where so much IT investment is normally concentrated. However, as Griliches (1994) and others have pointed out, service sector data is particularly suspect, raising the possibility that an absence of observed productivity gains is attributable to measurement problems. This paper has tried to circumvent many of the usual problems encountered in using service output and IT capital input data by concentrating upon the deployment of a homogeneous embodied IT application in a narrowly defined financial market. The paper has adopted the financial intermediation view of banking output as the level of real earning assets.

This paper has used an augmented production function approach to explore the productivity effects of ATM adoption by financial intermediaries, using a panel of UK building societies, over the period 1981-1993. It has been seen that the results are suggestive of significant productivity gains to adopters following the introduction of an ATM system and subsequently. Since the banking productivity literature has reached no general consensus on the appropriate choice of functional form for the production function, this research adopted a data-driven approach. It became clear, however, that the productivity gains were robust to changes in specification. Using the preferred and reported C-D form the adopters showed a consistent seven to nine percent productivity advantage over the non-adopters.

These results do not support to the "IT productivity paradox" view and tend to confirm the most recent findings of Lichtenberg (1995) and Brynjolfsson and Hitt (1996), using US

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[15] Geroski *et al* (1993) have found that "innovative" firms have higher profitability than "non-innovative" rivals, even prior to the very innovation which they use to make the characterisation.

[16] The fixed effects will capture differences attributable to constantly superior management. Of course, if the managerial quality changes substantially before or during the introduction of the innovation the observed coefficient magnitude remains a conflation of the two effects.

manufacturing data that, at least in its later applications, IT investment may be associated with substantial productivity gains. Furthermore, the results have particular significance since the financial services sector has been among the most intensive investors in IT and has been subject to the greatest criticism in this regard [e.g. Roach (1991)]. To the extent that our results demonstrate productivity gains in a case where the definition of inputs and outputs is relatively straightforward, the results tend to support those, such as Griliches (1994 etc.), who argue that the *perceived* lack of productivity growth in services stems overwhelmingly from measurement difficulties.

Table 1. Diffusion of ATM Technology across the Sample

Year	Percentage of Adopters
1981	0%
1982	0%
1983	1%
1984	2%
1985	5%
1986	14%
1987	19%
1988	22%
1989	26%
1990	26%
1991	27%
1992	28%
1993	27%

Table 2. Full Period Characteristics for Continuous Variables

Variable	Mean	S.D.	N
Output	1152.57	3160.40	1034
Employment	668.36	1727.61	1034
Fixed Assets (£m)	25.31	97.81	1034
Liquid Assets (£m)	258.76	704.72	1034
Number of firms = 93 Number of adopters = 23			

Table 3. Panel Estimates of Augmented Cobb-Douglas Production Function

	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	OLS (6)
Ln L	0.434 (14.190)	0.496 (11.024)	0.437 (14.481)	0.487 (10.936)	0.390 (13.270)	0.388 (10.175)
Ln K1	0.012 (1.256)	0.005 (0.518)	0.008 (0.874)	0.003 (0.275)	0.022 (2.514)	0.028 (2.156)
Ln K2	0.364 (16.857)	0.323 (13.415)	0.343 (15.675)	0.305 (12.621)	0.363 (17.260)	0.266 (9.568)
TIME	0.043 (20.976)	0.043 (18.362)	0.042 (20.702)	0.042 (18.143)		
YRATM	0.064 (2.369)	0.055 (2.130)				0.058 (2.131)
YRATM 1	0.059 (2.170)	0.051 (1.967)				0.064 (2.167)
YRATM 2	0.072 (2.629)	0.064 (2.441)				0.093 (2.939)
YRATM 3	0.067 (2.423)	0.058 (2.211)				0.081 (2.204)
YRATM 4	0.051 (1.853)	0.044 (1.671)				0.117 (2.034)
ATMDUM			0.096 (5.535)	0.091 (5.203)	0.070 (4.142)	
Firm Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	No	No	No	No	Yes	Yes
Adjusted R^2	0.996		0.996		0.997	0.997
F [d f]	2773.33 [101,931]		2940.39 [97,935]		2921.22 [108,924]	2008.85 [108,610]
Observations	1033	940	1033	940	1033	719

Notes: dependent variable equals log commercial assets
(t-statistics in parentheses)

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