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## *Emergence and Evolution of Proprietary ATM Networks in the UK, 1967-2000*

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## Abstract

Through archival research we investigate the impact of the introduction of Automated Teller Machines (ATM) in British retail banking. Contrary to the experience in the US, in the UK the ATM has been largely neglected by historians and management scholars. Technologically, cash dispensers preceded ATM and were originally a British innovation but U.S. (e.g. IBM and NCR) and German manufacturers (e.g. Siemens) took the lead as the ATM became a global technology. The evolution of the ATM illustrates how banks adopted on-line, real-time computing for the entire branch network and highlights the role of network externalities in financial markets. From a business history perspective, the ATM epitomises a shift in bank strategy, namely how applications of computer technology moved from being potential sources of competitive advantage to being a minimum requirement for effective competition in retail finance. Research in this article traces the origins of this process of competitive change in British retail financial markets, by looking at the emergence of proprietary networks and their evolution into a single national network at the same time that cash dispensers transformed into ATM.

## 1 Introduction

In today's global economy networks of automated teller machines (ATM) are ubiquitous. They facilitate travel and have helped to redefine urban and global space. The ATM is an expensive, industry specific piece of capital equipment who also embodies the first step in multi-channel delivery strategies for the provision of retail banking services. The ATM has been heralded as typical software application, 'on which a customer presses a sequence of buttons that causes the computer network to perform a complex set of operations correctly ... the customer is programming the bank's computer.' (Ceruzzi, 2003: 80). But as the research that follows illustrates, a number of things had to happen before the ATM achieved 'software status'.

Embracing an historical perspective, the research in this paper analyses the emergence, diffusion and transformation of stand-alone cash dispensers into ATM networks in the UK. This process goes hand in hand with the creation of databases and database management systems of customer records and more generally, protocols that enable electronic fund payments systems. The ATM represents a significant development in itself as a means of facilitating the payments mechanism and changing the structure of the money supply. But it is of even greater importance to this study because of its links to the external and internal environment of financial intermediaries, namely competition in retail bank markets and the automation of banking practice (including computerised management accounting systems).

The remainder of this paper proceeds as follows. Section 2 summarises systematical studies into ATM and information technology (IT) from an historical perspective. Section 3 presents the context of technological adoption in UK retail finance in the end of the 1960s. Section 4 offers evidence of ATM usage in the UK through the emergence of proprietary networks. Section 5 looks at the evolution of ATM networks and how greater interconnectivity amongst banks and building societies led to a single ATM network in Britain. Section 6 offers a discussion and tentative conclusions.

## 2 Research Context

A number of key contributions have pointed to the importance of mechanical, electro-mechanical and electro-magnetic aids to radically reduce the cost of processing and communicating information within organisations (Chandler *et al.*, 1988: ; Chandler,

1990: ; 2001: ; Yates, 2005). These contributions have pointed to a particular characteristic of the modern enterprise, namely the role of accounting information to articulate command and control procedures (Johnson and Kaplan, 1987: ; Chandler, 2001). The introduction of computer technology has been instrumental in the emergence of these processes and procedures (Johnson and Kaplan, 1987: ; Kee, 1993: ; Robb, 1996: ; Tyson, 1996). In this context, there is growing interest to document the impact of mechanisation and automation on the organization and business practices of retail financial intermediaries (e.g. Wardley, 2000: ; Booth, 2001: ; Bátiz-Lazo and Wood, 2002: ; Bátiz-Lazo and Boyns, 2003: ; Booth, 2004: ; Bátiz-Lazo and Billings, 2007: ; Bátiz-Lazo and Wardley, 2007).

For most of the twentieth century, financial intermediaries working in retail markets and particularly those active in loans and deposit taking were the main channel for monetary control. This as governments anticipated changes in the business cycle by introducing qualitative and quantitative criteria to allocate credit. Banks and other retail finance intermediaries became the back-bone of monetary and inflation control in the absence of organized markets for government debt. The process accelerated in the US and the UK in the decades that followed the Second World War to the extent that cheques rather than bills and coins became the predominant medium of retail payment.

A significant and sustained increase in the number (but not the value) of cheques to be cleared has been associated by a number of studies as one of the key motivations for banks on both sides of the Atlantic to automate (e.g. Yavitz, 1967: ; McKenney and Fisher, 1993: ; Bonin, 2004). The automation of internal processes during the late 1950s and the 1960s together with innovations in products and services (e.g. credit cards), eventually led to the creation of electronic fund transfer systems (EFTS) in the 1970s and 1980s as intermediaries brought retail branches 'on-line' at the same time that computers and computer networks were increasingly used for inter-bank payments (e.g. Richardson, 1970: ; Bátiz-Lazo and Wood, 2002).

A key element in the implementation and expansion of EFTS was the creation of networks of self-service cash withdrawal machines commonly known as cash dispensers and automated teller machines (ATM). The importance of ATM technology in US banking has not gone unnoticed. The pioneering contribution by Richardson (1970) has been followed by others including McAndrews (1991), Sienkiewicz (2002) and more recently by Cortada (2005). All of which offer a

systematic study of ATM and the evolution of ATM networks within the business and technological history of US banking. Others who have written on the emergence and diffusion of ATM in the US include doctoral dissertations by Hopkins (1986), Lozano (1987), Lane (1989), Peffers (1991) and Lee (2000).

In the UK, Hopton (1979), Kirkman (1987) and Howells & Hine (1993) summarise developments in British payment system. Coopey (2004) and Barrie (2006) touch on the emergence of ATM in the UK from an historical perspective. Coopey (2004) offers detailed evidence of the emergence of cash dispensers and its business and technological links with credit cards as the backbone of British EFTS. Some elements of this story are also found in Ackrill and Hannah's (2001) authoritative history of Barclays Bank. Meanwhile, Barrie (2006) aims to position the ATM within the overall process of technological change of UK banks. However, none of these contributions provide a detailed account of the evolution of ATM networks in the UK as their main topic.

Along side systematic studies from an historical perspective, there is an extensive body of cross-sectional analyses by management scholars who have explored marketing dimensions of ATM, industrial policy dimensions and the ATM as a computer network.

A recent survey by Vázquez-Alanís (2007), identified two broad areas that group of academic contributions in the broad areas of economics and management, namely performance effects and networks effects. Performance effects aims tell how investments in ATM relate to greater operational efficiency and this, in turn to changes in market share, interest and non-interest income. A central claim is that possibilities of informational asymmetries that can be exploited through early adoption of new information technologies, such as ATM networks, can result in first mover advantage.

Contributions dealing with network effects focus on changes in the number of locations from which users are able to access bank records using an ATM. It is claimed that there are location-specific costs and that fixed specific costs (i.e. sunk or irrecoverable costs) are not important to explain the growth of ATM networks. These contributions are further divided in two sub-categories or those dealing with the size of the network. Of particular importance are network externality, role of participants, role of 'switches', economies of scale or scope in the provision of services, density

(i.e. number of devices per capita or km<sup>2</sup>). A second sub-category deals with interchange fees, that is, sharing costs of proprietary networks. This involves competitive dynamics between financial intermediates, pricing of the fee itself and customers' willingness to pay for the fee. In the US, recommendations for public policy around concerns for interchange fees has received substantial attention by legal scholars and those versed in the economics of industrial networks (see further McAndrews, 2003).

Along side Vázquez-Alanís' (2007) performance and network effects, there might be two other areas of research. Both of these are in need of a greater number of empirical and analytical attention. Firstly, the effects of bank automation on the money supply and monetary control. This is an area that considers the interaction of banks' corporate strategy and bank regulators in the creation of network standards. Moreover, how decisions of banks' senior managers, changes in customer behaviour and preferences, and policy goals of monetary authorities influenced the development of EFTS. Secondly, the role of ATM within interpretative studies of organisational change and information technology (e.g. Coombs *et al.*, 1992). However, both of these alternative research agendas are beyond the scope of the present paper.

In summary, the use of standards and the creation of networks has been documented. These studies have placed too much emphasis on technology and market-based solutions than in the corporate strategy motivating investments in expensive and highly industry specific devices such as ATM. Archival-informed analysis of similar, but previously undocumented, developments on the part of UK banks and building societies, the emergence of EFTS and the creation and growth of ATM networks in Britain is the focus of the current research. A history of ATM networks in Britain offers an opportunity to explore both technological and strategic aspects of retail banking – an area comparatively neglected in the discussion of post-1945 British economic performance.

### 3 Technological Know How and Bank Strategy

As suggested by Revell (1983: 42) and McAndrews (1991: 4), the ATM is a technology used for banking services, which embodies a machine incorporating a video display, keyboard, printer (to provide a record of the transaction or a summary statement) and other software and hardware that enables individuals using debit cards, credit cards or certain tokens to make cash withdrawals and/or deposits, balance enquiries, balance transfers (between accounts of the same customer, the customer and the bank or the customer and a third party) as well as other services, for which users may be charged a transaction fee.

There are other interesting features of an ATM, for instance, machines must be fitted with a miniature strong room to enable it to store and supply cash. A stainless steel fascia mediates between user and hardware to protect electronic equipment from adverse weather, vandalism and theft. A full-service ATM would offer all these features already mentioned and therefore, provide practically all the straight forward services a customer needs from a retail bank. One important exception being that regular payments and credits have to be arranged separately. A second important distinction appears when deposit facilities are provided because these are rarely more than the conventional night safe, leaving the bank to verify the amount deposited when the machine is cleared. Automatic currency exchange devices at airport halls suggest it is technologically possible for the ATM to identify and count notes and coins. However, this feature has not been extended to machines in the high-street and thus enable cash to be counted when it is deposited or to read details of cheques inserted into the machine.

Coopey (2004) has questioned whether the ATM embodies a single technology. He considers that the 'ATM is best viewed as the consolidation of a series of technologies and systems, developing independently, and some in turn picking up impetus from the development of the ATM itself.' (p. 175). The availability of different technological solutions coexisting highlights the fact that senior managers of banks can (and do) choose amongst alternative technological configurations. Choice empowers individual banks to influence the evolution of these configurations rather than having to accept technological solutions determined by manufacturers.



A tendency has been to call a cash machine an ATM as long as it provides at least one additional service to that of cash dispensing (Revell, 1983: 42). But for simplicity of presentation this distinction will be abandoned. A first attempt at a mechanical cash dispenser, arguably an ATM, was developed and built by Luther George Simjian and installed 1939 in New York City by the City Bank of New York, but removed after six months due to the lack of customer acceptance.<sup>1</sup> Later on when cash machines were introduced in 1967 by Barclays Bank in the UK and by Philadelphia National Bank in the US in 1969, the ATM was perceived as a potential source of competitive advantage for individual banks. During the 1970s proprietary ATM networks developed in the UK while the ATM itself evolved from simple cash dispensers to multi-tasking machines. After having reached a peak of almost 200 individual networks in 1986, amalgamation between banks and also amongst the networks themselves resulted in five ATM networks controlling some 78 percent of transactions in the US (Sienkiewicz, 2002). At the same time, by the year 2000 there was only one single ATM network in the UK. Throughout this process of growth and consolidation, the ATM network turned into a threshold capability for retail financial services and included the provision of these services by non-banking participants and even the delivery of non-financial services such as topping-up balances in mobile phones.

The emergence of the first cash dispensers as the earliest form of ATM should be seen in the context of a long-term process of technical change and not only motivated as a short-term response to reduce cost structures. This view is supported when considering that mechanisation and automation permeate the evolution of clearing banks and building societies throughout the twentieth century (Wardley, 2000: ; Batiz-Lazo and Wood, 2002: ; Batiz-Lazo and Wardley, 2007).<sup>2</sup> For clearing banks and building societies, the 1960s saw the introduction of computer technology on the back of growing pressures in the labour market to source (cheap) female clerical work, private and public initiatives to introduce electronic payment of wages, antagonistic government officials, growing inflation and greater variability of interest rates. Banks were grappling with ways to ease overcrowding of activities within retail branches and an increasingly unionised work force while many building societies became active in developing retail branch networks.

Although banks and building societies usually resisted the uncharted novelties of the latest technology, they and the Bank of England opened individual channels with US

counterparts to discuss developments in computer technology (Bátiz-Lazo and Wardley, 2007). Despite a few obviously inappropriate decisions made with regard to the adoption of technology, it appears that financial intermediaries and clearing banks in particular, got things about right (Bátiz-Lazo and Wardley, 2007). Equally interestingly, when inappropriate decisions were made, recognition of this led to benign consequences for the individuals concerned. For example, after Barclays' misadventure with the adoption of a single mainframe computer system based on the Burroughs 8500, the senior managers who had determined this course of action suffered no long term career damage (Ackrill and Hannah, 2001: 73-6). It is notable that this was one of the very few occasions when a British bank deliberately adopted 'cutting-edge' technology and when bank staff appear to have been involved in the determination of technological specifications of a radically new technology. Moreover, internal capabilities were developed to ascertain the advantages and disadvantages of these technologies while the adoption of even the most expensive investments was assessed according to their expected pay-back. Generally, when the adoption of new technology was assessed, risk taking that was regarded as having the potential to be more profitable in the long run was seriously considered, even if it was regarded as being not immediately more lucrative.

In summary, research in this article proceeds while considering that executives of financial services had a degree of choice in adopting ATM technology to solve specific problems. These choices were influenced (but not determined) by a long-term process of technological change where learning around the adoption of main-frame computer technology was the most recent episode. However, other contextual forces (including the great variance of interest rates, the introduction of decimal currency in 1971 and ascension to the European Economic Community in 1973) should not be underestimated.

## **4 Proprietary Networks**

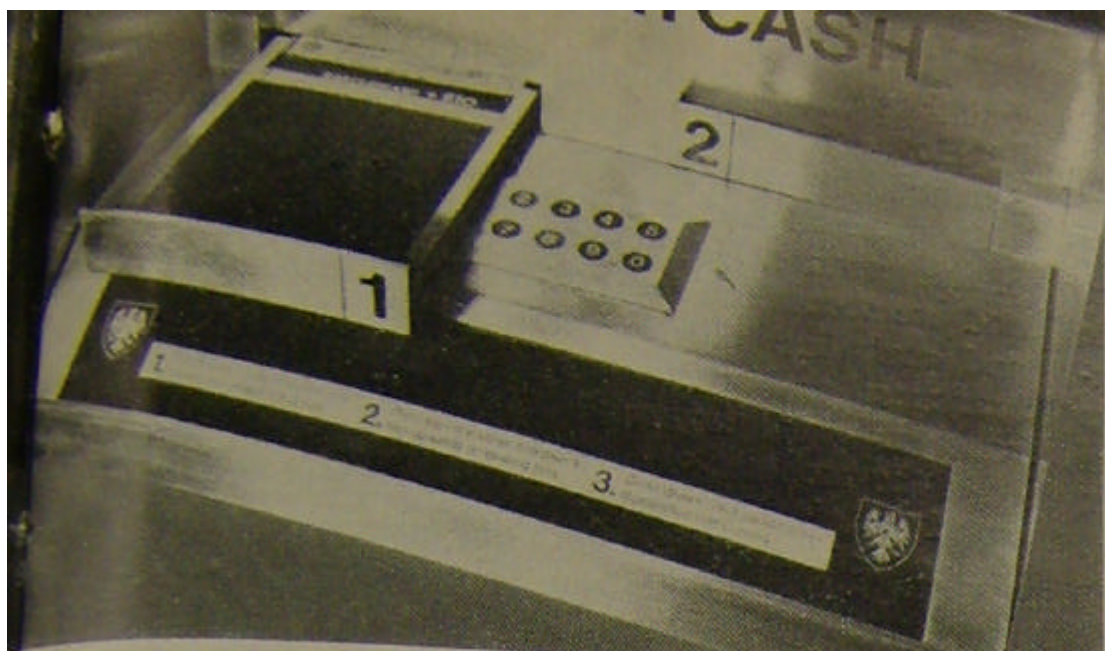
### *4.1 The First Machines*

It is claimed that the development of cash machines in the US was influenced by learning around punched card tabulators and early computer technology.<sup>3</sup> Geographical restrictions to retail branch banking also played an important role (McAndrews, 1991: 5). The development of ATM networks in the UK took a slightly

different road as it seems to have followed from the manufacturing of petrol dispensing equipment (Coopey, 2004: 177). The first of six machines in a pilot project, was installed by Barclays Bank in its Enfield retail branch in June 1967. See Figure 1.

**Figure 1: Barclaycash, 1967**

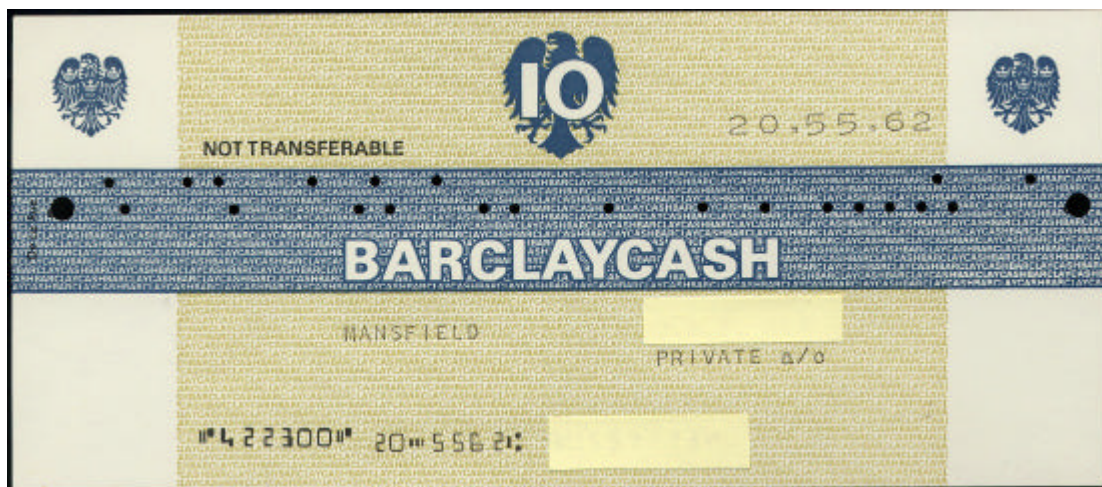
(Robot Cashier by De La Rue Instruments Ltd)



*Source:* Barclays Group Archive.

Advertised as ‘Barclaycash’ they were called ‘robot cashiers’ by internal and popular press.<sup>4</sup> Barclay customers were issued vouchers, which carried information in punched card form. See Figure 2. Customers applied in advance for the vouchers from Barclays (purchased from the retail branches during opening hours). These were valid for six months from the date of issue and prior to activating the machine, a manual signature was a first form of individual customers’ identification and authorisation. By introducing the voucher in one drawer, an electronic signature (a second form of identification) activated a second drawer which, in turn, dispensed the fixed sum of 10 pounds (in packs of £1 notes). The electronic signature was made out of a four-digit identity number. When the voucher was retrieved by bank staff, the transaction was processed like a cheque during normal banking hours.

Figure 2: Token to Operate Barclaycash Machines, circa 1967



Source: Barclays Group Archive.

Barclaycash was admittedly seen as an ‘experiment’ but it was hoped that, in due course, the ‘mini-banks’ would achieve ‘...its dual role, as a 24-hour customer service and as a relief to ease banking-hour pressure on the branch’s cashiers.’<sup>5</sup> The innovative move by Barclays was significant as cash machines were never intended as a stand-alone device but part of a network (in this case, complementing the web of retail bank branches). Indeed, from the outset there were expectations that, if successful, similar machines would ‘...follow in airports and main-line railway stations...’.<sup>6</sup>

Other clearing banks followed Barclays lead, the Westminster Bank installing their first machine in July 1967 at their retail branch next to Victoria railway station.<sup>7</sup> During the following four months nine other machines were also installed (two more in London and seven in major provincial cities such as Bristol, Nottingham, Oxford and Sheffield). The Westminster cash machines were all manufactured by Chubb & Son’s Lock and Safe Co. See Figure 3.

**Figure 3: Advertisement of Westminster Bank's Cash Dispenser, circa 1967**

(Chubb MD2 by Chubb & Son's Lock and Safe Co. Ltd.)



*Source:* The Royal Bank of Scotland Group Archive.

Customers were given a plastic credit card sized cards with punched holes in them.<sup>8</sup> See Figure 4. The card was inserted into the machine and the customer keyed a personal code. The Chubb MD2 dispensers delivered ten one pound notes in a pack – but ‘if desired, it could easily be arranged to dispense varying amounts of say £5, £10, £15, £20, etc.’.<sup>9</sup> The customer’s card was retained by the MD2 and returned to customers through the post for future use.

Other banks were also quick to adopt the cash dispenser idea: in Liverpool, Martins Bank decided for a Chubb MD2 in 1967.<sup>10</sup> The National Provincial Group installed its first machine (also a Chubb MD2) in January 1968, on the outside of the District Bank’s Piccadilly branch in Manchester.<sup>11</sup> At the same time, the Royal Bank of Scotland (RBS) was the first to introduced 24 hours service North of the border, using Chubb MD2 dispensers.<sup>12</sup> As had been the case for Baclays and the Westminster bank, in its advertisement the RBS reminded customers in Glasgow and Edinburgh they would be able to withdraw cash at anytime of the day or night from ‘Automated

Cash Dispensers' placed within retail branches. By the end of 1968, the RBS was providing similar services in some 25 branches throughout Scotland and in London.

**Figure 4: Token to Operate Chubb MD2 Dispensers, circa 1967**



*Source:* Ian Ormerod NCR UK Retirement Fellowship

The Chubb MD2 seems thus to have been the machine of choice for British banks in the early 1970s. Barclays, on the other hand, stuck to De La Rue. Eighteen months after the initial test at Enfield, in November 1968, Barclays ordered 75 automatic cash dispenser from De La Rue at an approximate cost of half a million pounds.<sup>13</sup> The design of new machines benefited from learning during the trial period of the prototypes. For instance, within a few days of operations, Barclays' first cash dispenser had been vandalized.<sup>14</sup> The new design was to have a single drawer rather than the prototype's two. By February 1973, there were 250 De La Rue Barclaycash machines in operation throughout Britain.<sup>15</sup>

As was the case with the Barclay's De La Rue machines, in the absence of a video display unit (VDU) the Chubb dispenser communicated with the customer using fixed light signals (primarily to indicate the card or voucher had been accepted).<sup>16</sup> From the outset banks adopting the Chubb MD2 and De La Rue were not limited to the banking hall. Most chose to fix the cash dispenser to the exterior wall of the branch. This was possible through a stainless steel exterior and interior cladding of thickened armour designed against attack making the MD2 operational 24 hours per day.<sup>17</sup>

Other manufacturers along side instrument maker De La Rue and security systems Chubb & Son's then emerged from a range of sectors - each with their own



competitive dynamics. Notably most came from the US such as Docutel (the spin-off of baggage handling equipment manufacturer Recognition Equipment Inc. and wrongly hailed as the inventor of the ATM)<sup>18</sup> as well as mainframe computer manufacturer companies such as NCR, IBM and Burroughs.<sup>19</sup> But there were others such as Japan's Fujitsu.

A fact often overseen in the popular accounts of the emergence of the ATM, is that the introduction of cash dispensers for the first time allowed customers to engage with their financial institution as a whole rather than with a single retail branch. This was not lost to senior managers, who were keen to advertise it:

'CASH DISPENSER SERVICE - ... The service is free to Westminster Bank customers who, irrespective of the branch at which they may bank, may draw from the Victoria Dispenser. It is available 24 hours a day, 365 days a year.... Already over 6,000 customers have applied for cards.'<sup>20</sup>

'One of the most attractive features of [Royal Bank of Scotland's 24 hour Cash Dispensing Service] is that you do not have to be an Account Holder at a Cash Dispenser Branch. You simply apply to your own Branch and you will be supplied with a special cash card and your own personal code number.'<sup>21</sup>

As was the case in the US due to legislation on retail branches, banking in the UK was highly localised. Customers of banks and building societies were expected to develop long-term relations with a single retail branch. The introduction of cash dispensers and credit cards was thus a response of banks to an increasingly mobile population (Coopey, 2004: 176-7; Bátiz-Lazo and Hacialioglu, 2005: 893) as much as a response to a drive for cost control (given the opportunities to lower encashment demands on human cashiers during banking hours and make better use of retail bank branch space). But as suggested in the quotes above, individual banks aimed to develop their own a network of cash dispensers, in the expectation that larger proprietary networks would be an advantage over intermediaries with small networks or even without any cash dispenser.

Selecting the location of the first machines by individual banks was given careful consideration. Explaining the reasons why Enfield and not a large city such as London, Glasgow or Edinburgh was selected as the first location, Barclays argued that the town had '... model cross-section community, fairly self-contained; it is not too

far from London, the branch has a good pavement façade, sufficiently high windows and enough space inside for the safe, and town-planning permission was readily given.<sup>22</sup> Five more Barclaycash machines were installed by the end of that Summer in towns with similar characteristics, namely Hove, Ipswich, Luton, Petersborough and Southend.

Not only was the cost of adoption was substantial in terms of the machine itself but also to consider was servicing (as the first prototypes were prone to frequent faults) and displacement of space in the retail branch. Walker's (1980) estimated that US banks would achieve economies of scale associated with ATM networks if customers realized at least 43,600 transactions per month per cash dispenser.<sup>23</sup> Although there are no similar estimates for the UK, data from the US would help understand the choice of the Westminster to place the first machine in an area of high traffic such as Victoria railway station. Moreover, with 6,000 customers applying for the cash machine cards, the Westminster's Chubb machines might have been initially under utilised if, on average, customers made less than one withdrawal per week. However, by the end of 1977, the bank was trading as National Westminster Bank (NatWest), had 506 machines in operation and 75,000 cards had been issued to customers.<sup>24</sup> This suggests senior managers of NatWest succeeded in making customers believe that automatic cash dispensing was a worthwhile technology.

#### *4.2 From Cash Dispenser to ATM*

As mentioned, after dispensing cash Chubb and De La Rue machines retained the access voucher and card. Customers' account were debited when the voucher or card was retrieved from the machine after use and the branch (where the cash dispenser was located) informed the customer's branch. Chubb cards were posted back to the customer together with the statement of account or returned the following time the customer's passbook was updated.<sup>25</sup> Barclaycash vouchers were non-returnable. The card and voucher were issued only if the customer had sufficient funds (or the manager of the retail branch wanted to give some credit). Mechanisation of cash withdrawal meant that individual banks could, if they so wished, continue with their system of accounting control of customers at retail branches. There was no need for centralised records as the cash dispenser was in effect a stand-alone machine. As had been the case with accounting machines, cash dispensers offered greater efficiency rather than alternative way of operation (Bátiz-Lazo and Wardley, 2007).



Cash dispensers remained stand-alone machines until Lloyds Bank introduced the first 'on-line' dispensers in December 1972. This development marked the move from the cash dispenser to the first ATM in the UK. At the time, Lloyds only had 24 cash dispensers in operation and said to have been cautious with the 'first generation' of machines.<sup>26</sup> C. B. Howland, General Manager (Organisation), opined in 1970:

*'...for many months we have been undertaking studies in depth into the possible uses and developments of cash dispensers.*

*It was, in fact, because we looked at them so closely that we came to the conclusion early on that the machines were very much first generation types, not nearly reliable enough and quite insufficient field trialled, thus explaining why we have not installed too many too quickly.*

*We are ready for "on-line" versions but the machines are not here yet. "On-line" in this context means that before we pay out to a customer reference is made by the machine to the computer to ensure that funds are in the account. Thus, all customers who want the facility could have it without out being concerned for their funds.'*<sup>27</sup>

Lloyds aim of linking dispensers to its computer accounting system implied changing processes and procedures in place for almost 50 years.<sup>28</sup> Introducing a device linked to the central computer, able to check the customer's balance before each withdrawal, dispensing variable amount according to the customer's requirements and being available to all customers would involve the creation of both a database and database management system (DBMS). That is, migrating customers' records into electronic form but also the creation of software (and underlying hardware) that would mediate and give access to the tables and records for which a given user had been authorised. This was a significant step as thirty years later integrated database and DBMS would be the essence of internet banking as well as virtually every administrative process in business, science or government (Haig, 2006).

Dispensing cash 'on-line' developed on the back of preparations for the change over to decimal currency. After five years of development efforts to computerise its back office systems, Lloyds was the first clearing bank to move its customer accounting systems away from retail bank branches to a central computer in November 1970.<sup>29</sup> At the time, Lloyds had 154 branches and 801 sub-branches, some five million

accounts (including nearly three million current accounts) and at least three computer centres (each reflecting its core business areas, namely one in London, one in Birmingham and a dedicated centre for cheque clearing in the City – which processed between 650,000 and one million cheques daily). Lloyds claimed to have invested £25 m in computers (£15 m already invested and £10 m on order) as well as doing it ‘less expensive’ than others.

Equipped with a database of customer records as well as processes and procedures to deal with them centrally, it was possible to consider ‘on-line’ cash withdrawal. Through the computerisation of the customer accounting system Lloyds developed a ‘successful partnership with IBM’.<sup>30</sup> It was based on this ‘partnership’ that the ‘on-line’ dispenser was designed and built.<sup>31</sup> In June 1971 an order for 500 machines, costing nearly £3.5 m in total was placed with IBM for it to deliver cash dispensing equipment which offered customers the choice of variable amounts of cash up to a maximum of £50 at any one time (up to £20 in £1 pound notes and up to £50 in £5 pound notes).<sup>32</sup>

The first so-called ‘Cashpoint’ made its public debut on December 1972, with the rest of introduced progressively to retail branches through 1973 and 1974.<sup>33</sup> The machine was innovative in as much as it was the first to be operated by a plastic card with a magnetic stripe on the back (containing the customer’s account number and the branch sorting code).<sup>34</sup> There was still no VDU as instructions to the customer were relied through a separate panel made out of plastic stripes with lights at the back. There were perhaps more moving parts than in the Chubb MD2. This as the keyboard would only be exposed after the card was validated, notes were first dispensed into a concealed cash tray (which was then lowered over the keyboard for the customer to collect the cash) and the card itself was return to the customer to end the transaction.<sup>35</sup>

The ‘Cashpoint’ was designed to work within banking halls as some other 100 ‘through the wall’ machines to be installed outside of retail branches ‘and in locations away from banking offices’ were also ordered.<sup>36</sup> By December 1976, 630 ‘Cashpoint’ machines were operational in 430 branches and this included Lloyds’ first ‘through the wall’ machine.

Baclays’ immediate response to Lloyds ‘Cashpoint’ was to review its own strategy. In February 1973, an urgent feasibility study by the Management Services Department to

the Automation Committee considered that the 250 De La Rue dispensers were unreliable, the paper voucher system inconvenient, functionality limited and the role of managers of retail branches in promoting their use, unsatisfactory as voucher had been issued to only 116,000 individual customers.<sup>37</sup> The report recommended adopting machines with card activated, on-line, variable amount dispensers. Owing to the on-line verification capability, balances of both current and Barclaycard (i.e. credit card) accounts could be ascertained indistinctively. It was estimated that development to suit Barclays needs would require some 12 to 18 months with IBM or Burroughs (longer if choosing Chubb or De La Rue) and each machine cost at least £8,000 (including installation).

Barclays then decided to proceed and make necessary changes for the new generation of cash dispensers. This required a third computer centre, centralization of accounting information, development of a dedicated electronic data interchange network, computer terminals in retail branches and microfiche equipment. Initially £83.4 m were budgeted (including £2 m for on-line automated tellers alone) for expenditure between 1974 and 1979. But this was soon to be insufficient. Adjustments and variations made as early as March 1974, already raised the forecast to £93.2 million pounds.<sup>38</sup>

On June 1975, a more sophisticated auto-teller services, called 'Barclaybank' was launched. These machines were 'on-line' and operated using a plastic card with magnetic stripe (also labeled 'Barclaybank'). The first of the two retail branches to offer the new machines were High Street and Cornmarket Street, Oxford.<sup>39</sup> Shortly after, in September 1975 NatWest introduced its first NCR 770 Self-service Financial Terminal (advertised as 'Servicetills').<sup>40</sup> See Figure 5.

**Figure 5: NCR 770 Cash Dispenser, circa 1975**

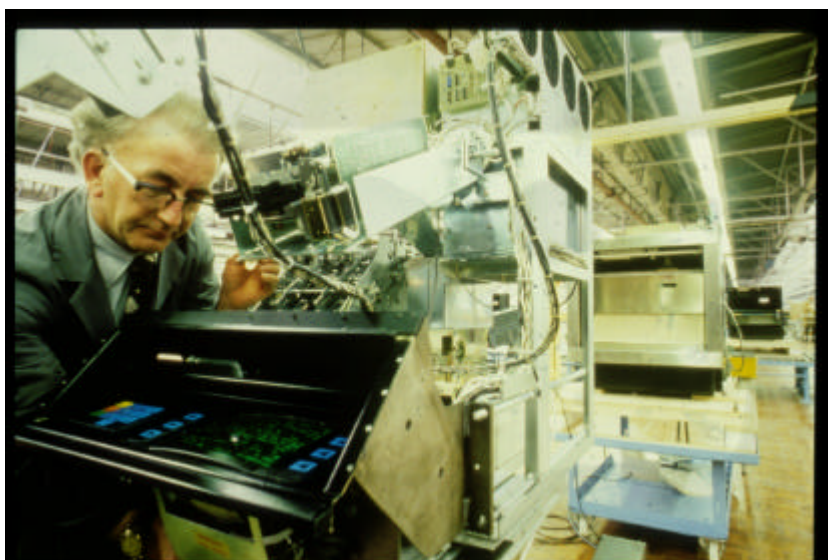


*Source:* Ian Ormerod NCR UK Retirement Fellowship

Figure 5 shows the NCR 770. Designed in the US, this machine had been released in 1974 to allow 24 hours cash withdrawal as well as requesting cheque books, statements and balance of accounts.<sup>41</sup> The first couple of machines installed in January 1975 were for staff use only. Two more were operational in banking halls in April and May and thus, were limited to banking hours. But that which came into operation in the Croydon branch in September was external and therefore provided service to the public all year round.<sup>42</sup>

By the end of 1977, NatWest had 100 NCR 770 machines in operation along side 406 Chubb MD2 dispensers. Very similar in functionality to the IBM ‘Cashpoint’, the 770 was ‘on-line’, operated with a plastic card and magnetic stripe, had a concealed cash tray (that was later exposed) and guided the customer through a moving drum of film (with back light). Encoded in the magnetic stripe was a personal credit limit that allowed individual customers withdrawing cash in varying amounts.<sup>43</sup> The 770 could be located in the banking hall or ‘through the wall’. One limitation to the service was that NatWest balance enquiries were only available during hours of the ‘teleprocessing day’ (08.00 to 18.00 hrs).<sup>44</sup> Another related to taking deposits: although the 770 (and many of the subsequent ATM designs) was capable of accepting and storing envelopes with cash and cheques for deposits (which would have to be validated by bank staff).

**Figure 6: Production Line of NCR 1780 in Scotland, circa 1980**



*Source:* Ian Ormerod NCR UK Retirement Fellowship

Interestingly, the bulk of NatWest's 770 machines were manufactured in Dundee, Scotland.<sup>45</sup> See Figure 6. The move to Scotland resulted from NCR's strategy to relocate production outside of Dayton, Ohio during the 1970s. The plant in Dundee dated to 1946 and initially ATM production aimed at servicing only the 'emergent European and British markets'.<sup>46</sup> However, facilities in Dundee expanded to become NCR's worldwide manufacturing centre of ATM (where it would remain until 2007) and a new model was rolled out in 1978, the NCR 1780. This kept many of the designs of the 770 except that it was the first ATM to be fitted with a VDU.<sup>47</sup>

For employees at Dundee, the relocation of the ATM production was an opportunity to apply expertise in mechanical engineering to an electronic product.<sup>48</sup> Unfortunately the first 1780s were hampered by a non-dedicated mix of components, some of them manufactured elsewhere. Performance of the 1780 was unreliable, orders were cancelled and some banks even refused to take delivery (with the subsequent damaged to NCR's reputation).

Jim Anderson was appointed head of the Dundee plant in 1979 with a mandate to bring about a radical change in production quality, focus on the manufacturing of a handful of ('world beating') products and lift employee moral. The 1780 was one of the chosen products and its improved performance also saw the functionality of the

ATM expanding rapidly. In 1981, the 1780 allowed transfer of funds and payment of bills, keyboard with tactile and audible feedback, dispensing one or two currency denominations, integrated 9x7 dot matrix printer (30 characters per line), transparent door (to protect from vandalism and weather), modular design (to enable choice between off-line cash dispensing or full service) as well as data encryption for added security of both customers and financial institution.<sup>49</sup> These developments seem to have responded from requests by the banks to add new functions to existing devices than from the foresight of engineers at manufacturers (Cortada, 2006: 24).

Reliability and vandalism were common considerations for banks and manufacturers alike. But as the technology evolved, so did the number of providers with the subsequent wave of disposals and amalgamation. Indigenous manufacturers who had failed to achieve economies of scale were the first to exit. Chubb's involvement in the early days of electronic funds transfer systems through the manufacture of ATM increased when it bought Gross Cash Registers in the early 1980s. This formed the origins of a company called Chubb Cash. The cash register business based in Hollingbury near Brighton was sold shortly after amalgamation while manufacturing of ATM related technology moved to Chubb Security Installations (CSI - established in 1964) in Bedford.<sup>50</sup>

As mentioned, some years later NCR's plant in Dundee position itself as the main designer and provider of ATM technology in the world. This to the extent that in 1990, IBM withdrew from ATM manufacture.<sup>51</sup> A move which was also influenced by IBM's restructuring its business portfolio away from manufacturing into software development and consultancy. Also in 1990, NCR manufactured its 10,000<sup>th</sup> ATM and it went to Barclays Bank which, using the 'Barclaybank' banner, installed it as a working exhibit in the Science Museum (Kensington, London).<sup>52</sup>

## **5 Shared Networks**

By the end of 1981, NatWest had 500 NCR dispenses in operation (a combination of 770 and 1780), a figure that rose to 600 in June 1982. The sharp increase in machines at NatWest was not unique. Towards the end of the 1970s other banks had also decided to increase their rate of adoption: 'The Barclays cash dispenser network is due to double to two hundred machines during 1979.'<sup>53</sup> At the same time, Lloyds Bank had its 100<sup>th</sup> 'Cashpoint' operational at the Picadilly branch in Manchester in

1981 and the 1500<sup>th</sup> in August 1983 at the Welling, Somerset branch.<sup>54</sup> Also in 1981, Williams & Glyn's Bank for the first time offered electronic cash withdrawal services, using IBM 3624 machines as part of Royal Bank of Scotland's 'Cashline' network.<sup>55</sup> This is further illustrated in Table 1.

**Table 1: Growth of Installed ATM Units and Value of Daily Transactions (1975-2003)**

	Transactions Total Value (£m p.a.)	% Change	Installed ATM (Machines)	% Change	Avg Value of Daily Transactions	% Change
1975	111	0%	568	0%	542.84	0%
1976	177	59%	676	19%	727.32	34%
1977	281	59%	875	29%	892.06	23%
1978	460	64%	1,005	15%	1,271.42	43%
1979	733	59%	1,184	18%	1,719.69	35%
1980	1,316	80%	1,707	44%	2,141.51	25%
1981	2,540	93%	2,807	64%	2,513.56	17%
1982	4,290	69%	4,061	45%	2,934.42	17%
1983	6,597	54%	5,740	41%	3,192.51	9%
1984	9,751	48%	6,815	19%	3,974.48	24%
1985	12,401	27%	8,845	30%	3,894.54	-2%
1986	15,590	26%	10,330	17%	4,192.21	8%
1987	18,848	21%	12,392	20%	4,224.95	1%
1988	24,320	29%	13,980	13%	4,832.30	14%
1989	31,948	31%	15,746	13%	5,636.00	17%
1990	38,474	20%	17,344	10%	6,161.91	9%
1991	52,080	35%	18,101	4%	7,992.19	30%
1992	55,975	7%	18,652	3%	8,336.16	4%
1993	60,200	8%	19,140	3%	8,736.79	5%
1994	65,170	8%	19,957	4%	9,070.89	4%
1995	72,090	11%	20,933	5%	9,566.24	5%
1996	80,235	11%	22,121	6%	10,075.27	5%
1997	89,994	12%	23,193	5%	10,778.40	7%
1998	98,230	9%	24,574	6%	11,103.65	3%
1999	107,852	10%	27,379	11%	10,942.29	-1%
2000	113,013	5%	33,000	21%	9,512.88	-13%
2001	127,428	13%	36,666	11%	9,653.81	1%
2002	136,364	7%	40,825	11%	9,278.36	-4%
2003	144,123	6%	46,461	14%	8,616.73	-7%

*Source:* Barrie (2006) and own estimates.

Table 1 shows that during the 1970s the stock of installed machines had been growing at about 20 per cent per annum. As a result if this growth, by the end of the decade a 'heritage' was at work (Cortada, 2006: 35): the stock of combined machines installed

throughout the decade with different functionality. This was banks installed new machines while failing to dispose of old ones.

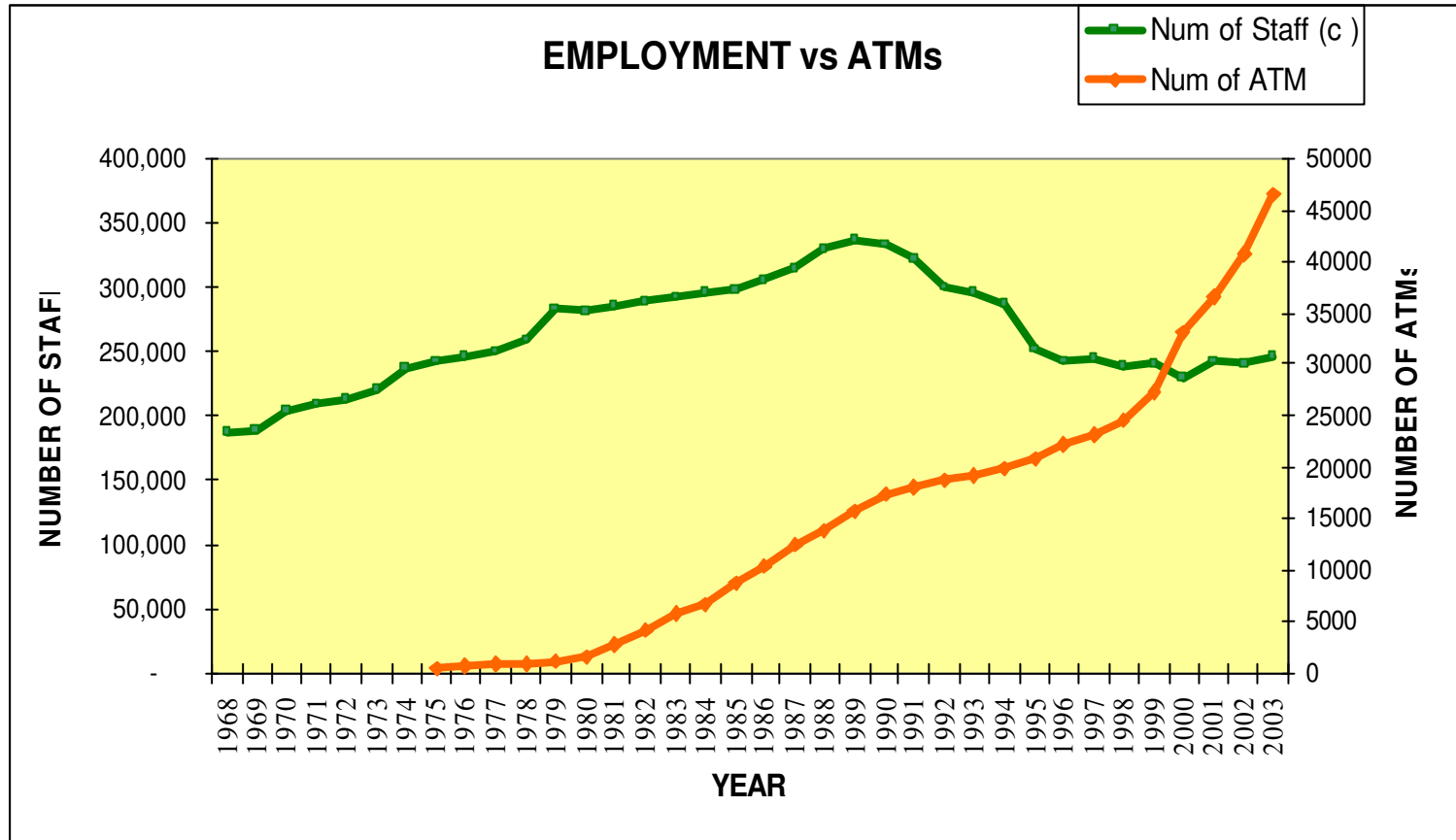
The early 1980s saw a change in the adoption trend. A number of factors were responsible for the growth of cash dispensers and machines with greater functionality beyond the 'tipping point' of ATM adoption in 1980 (see Figure 7). First, a sharp increase in the number of installed ATM followed the process of regulatory change that swept British banking in the early 1980s (a process which initiated after the removal of controls for retail currency transactions in 1979 and qualitative allocation of credit, 'the corset', in 1981). So the combination of individual strategies and regulatory changes resulted in the growth of ATM stock accelerating: 44 per cent between 1979 and 1980, 64 per cent by 1981, 45 per cent by 1982; and 41 per cent in 1983.

Second, the introduction of 'on line' machines in the late 1970s had opened possibilities for reciprocity agreements. To little surprise, 1983 also saw the first of these when NatWest and Midland Bank signed an agreement through which customers could use their cards in either bank's machines to withdraw cash.<sup>56</sup>

The installation of the first ATM by building societies was a third factor adding to the growth of the stock in the first half of the 1980s. Initially the number of ATM of the societies was modest. In 1982, there were only six machines in operation at retail branches of building societies. Alliance and Leicester was the first in the field with an IBM similar to Lloyds' 'Cashpoint'.<sup>57</sup> Cash dispensing machines at building societies soon grew to 112 in 1983 and 291 in 1984. The trend intensified with the passing of the Building Society Act in July 1986, which allowed the diversification of the business portfolio of the societies (while aiming to put them in the same footing with clearing banks). Cash dispensing machines installed by the societies then grew to 652 in 1985 (7 percent of total), to 1286 in 1986 (12 percent of total) and to 2072 in 1987 (17 percent of total).



Figure 7: NUMBER OF BANK EMPLOYEES AND ATM IN THE UK (1968 – 2003)



Source: Source: APACS, British Bankers Association, Barrie (2006, p. 92).

At the same time that societies were adjusting to their new business possibilities and with less than 20 per cent of total ATM machines installed, some societies and other non-bank participants of retail financial markets decided there was more to be gained by creating a shared network of cash dispensing machines. In February 1985, Abbey National (the second biggest society in terms of assets), Nationwide Building Society (the third largest in terms in assets), National Giro, the Co-operative Bank, American Express and some smaller societies created the LINK network.<sup>58</sup> The leverage gained through a shared network was self-evident: some members like the National Giro some were making its first machine operational.<sup>59</sup> Others like Abbey National, the single biggest contributor, installed 200 machines (in its retail branches as well as some retail stores such as House of Fraser and 7-Eleven) between February and May 1985.<sup>60</sup> But thanks to the LINK network, Abbey's six million depositors had access to five times more (1000 machines) by the end of 1986.

A second ATM network by building societies was launched in March 1986. Called 'MATRIX', its biggest contributor was the Woolwich Equitable Building Society (traditionally the fourth largest in terms of assets). The Woolwich launched its first 'cashbase' dispenser in August 1985. This was for exclusive use of the 150 staff who had opened a cashbase (i.e. current) account because the pilot project for general public in Greater London and the South East (i.e. the Woolwich longest trading areas) was launched until mid-October.<sup>61</sup> The name 'Cashbase' was chosen 'after market research among target customers' and supposed to be 'simple, memorable and which would not date.'<sup>62</sup> Cashbase machines offered a range of services namely, up to £250-a-day cash withdrawal, deposit and balance enquiry. See Figure 8.

As mentioned, the possibility of ATM accepting deposits was already offered by the NCR 770. Anecdotal evidence suggest this feature became quite popular in the US. In the UK, Barclays Bank explored the possibility of accepting deposits via ATM in 1976. But found that transactions involving withdrawals were ten times more frequent.<sup>63</sup> Although Barclays eventually discontinued the service in the 1970s, it was reintroduced as 'Express Deposit' with new Barclaybank machines using 'Barclay's Connect' cards in 1991.<sup>64</sup>

**Figure 8: Cashbase Advert, 1985**

(Cash Withdrawal and Deposit by the Woolwich Equitable Building Society)



*Source:* Barclays Group Archives – Woolwich World (v. 8, no. 7, p. 3)

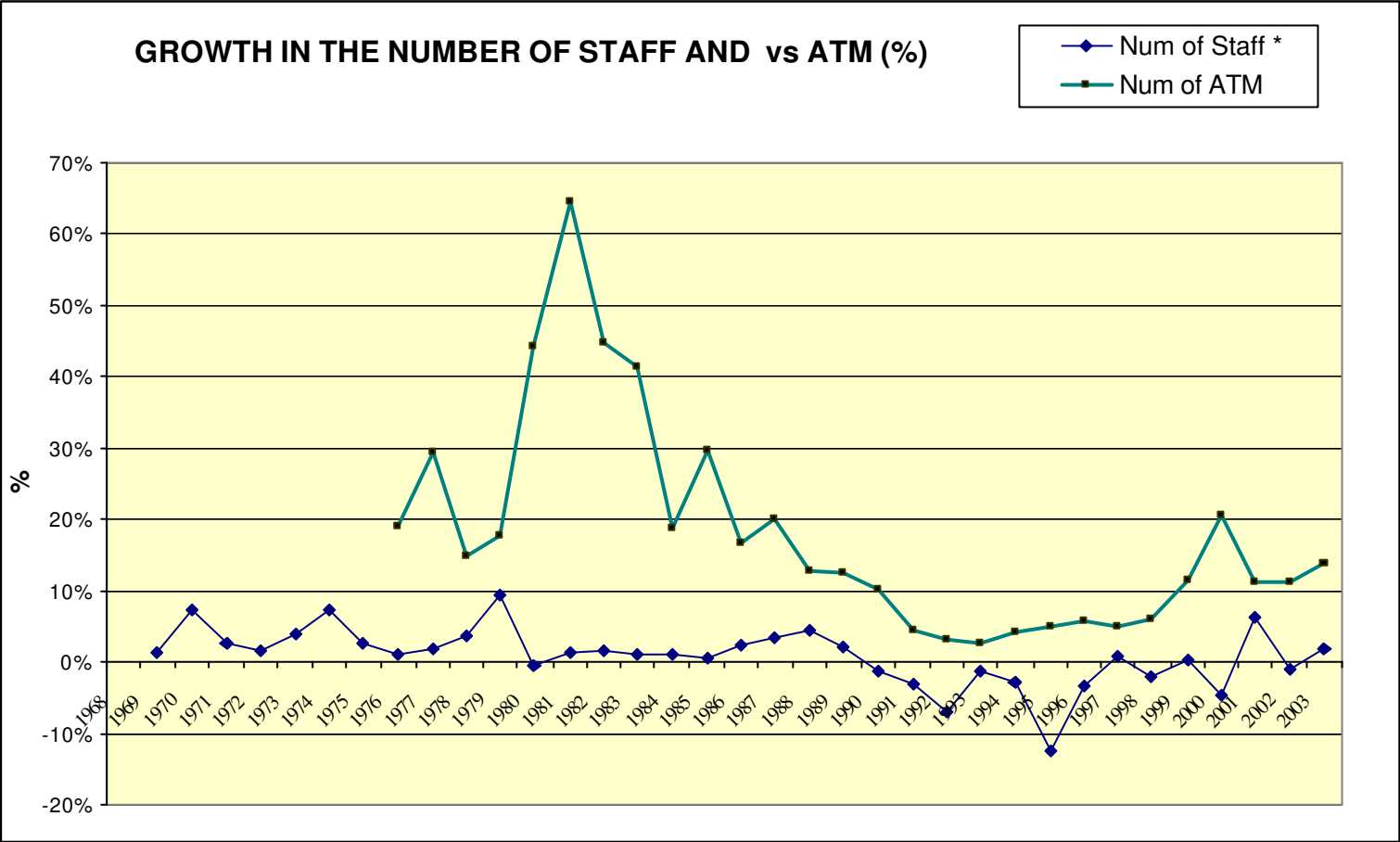
Prior to that, in March 1986, the Woolwich joined six other building societies as founding members of 'MATRIX' (namely Leeds, National & Provincial, Alliance, Anglia, Bradford & Bingley and Leicester) <sup>65</sup> This gave 8.1 million individual customers access to a network of 346 machines at the end of 1986. <sup>66</sup> Growth was relatively slow as, for instance, the Woolwich reached the 100 mark until October 1987 and installed the first non-branch machine at J. Sainsbury's retail store in September 1988. But in spite of the apparent disadvantage of a smaller network, for the Woolwich the rolling out of the 'Cashbase' account was helping to transfer customers from passbook operated deposit accounts to current accounts.

As mentioned, along side the LINK and MATRIX, operated two shared ATM networks in Britain in the mid to late-1980s: one based around Midland Bank, NatWest Bank and the TSB Group (Coopey, 2004: 181); a second established in March 1987 and was shared by Barclays, Lloyds, Bank of Scotland and the Royal Bank of Scotland (to which the West of England Building Society joined in 1988).<sup>67</sup> The emergence of shared ATM during the 1980s reflected, firstly, the start of a move in which the proprietary ATM network is no longer perceived as a source of competitive advantage by many participants in the markets for retail banking. Secondly, how the process of computerisation of certain routine jobs had the potential to lower headcount and increase financial returns. See Figure 9.

Figure 9 illustrates displacement through changes in total employment in banks versus the growth of installed ATM in the UK. The tipping point appears as the annual rate of growth speeds up between 1979 and 1982, when it is above 60 percent. At the same time, total staff in the banking sector hovers around a ten percent annual growth between 1970 and 1979. There after remains stable and close to zero, until sharp decreases took place between 1990 and 2001. The ATM is not solely responsible for the drop in bank staff during the 1990s. For one, other technological applications to deliver retail financial services (such as telephone and internet banking) come in to play. However, ATM was the alternative delivery to human teller during the 1980s and information in Figure 9 seems to support Revell's (1983: 67) idea of displaced human cashiers by automated teller machines by lower recruitment rather than redundancies during the 1980s.

A fourth element that can be associated with the emergence of shared ATM during the 1980 is the presence of network externalities. These occur when the value of the network increases as new users join the network. As more member banks join, the network becomes more valuable to each individual user. This network externality results in 'increasing returns', that is, as the network continues to growth, it becomes easier to attract additional users. The larger number of users in the expanded network makes deployment of ATM more profitable, which further enhances accessibility for existing members.

**Figure 9: ANNUAL GROWTH IN THE UK OF OPERATIONAL ATM AND TOTAL BANK STAFF (1969 – 2003)**



\* Average weekly employed staff in the UK

Source: Barrie (2006, p. 95).

In the US when financial intermediaries began to realise the benefits of shared ATM networks, the number of networks grew, reaching a peak of almost 200 in 1986 (Sienkiewicz, 2002: 4). In the UK the same recognition led to a decrease in the number of proprietary networks. This as there were economies of scale to be found as more transactions processed over an individual network, the lower the cost become on a per unit basis.

Network externalities were also found by sharing facilities at locations away from the retail bank branch and where space could be at a premium (such as hospitals, universities, airports and railway stations). For instance, NatWest's first non-branch ATM was fitted at retailer J. Sainsbury's Cristal Palace store in 1983.<sup>68</sup> However, one of Lloyds Bank's 'Cashpoint' was operational at the retail branch at John Lewis' store in Birmingham in December 1974.<sup>69</sup> Giving Lloyds the prestige of having operated the first cash dispenser in a non-banking site for almost 10 years before others.<sup>70</sup>

The move to non-banking sites was not immediate. As late as 1986 there was room to improving provision in retail branches (by installing second and third machines in high-usage sites) as well as enhancing reliability and convenience of installed machines (e.g. by extending on-line services to 24 hrs a day to all machines).<sup>71</sup> Indeed, it was until 1994 that NatWest embarked on an active program to operate cash machines in non-bank locations (which included high-traffic sites at Boots the Chemist, J. Sainsbury's supermarkets and railway stations).<sup>72</sup> Barclays went even further and installed cash dispensing machines in the House of Commons (1990), the House of Lords (1996) and even a 'drive thru' at Hatton Cross near Heathrow airport (1998).<sup>73</sup>

In the process of 'optimising' locations at retail branches, some cash points were closed to reciprocal agreements. NatWest, for one, kept its 'Rapid Cash Tills' (RTC) outside the agreement with Midland as late as 1986. Introduced in April 1983, two years later there were 650 RCT in operation. The RCT was installed by NatWest mainly in Saturday opening branches as a way to service customers and keep low the number of human cashiers (who had previously been the main hurdle for Saturday opening branches). This followed from Barclays having been the first to re-introduced Saturday opening in

August 1982.<sup>74</sup> NatWest increased the number of RTC to 900 in 1986, emphasizing its concern with making more of automation while moving away from routing paper processing.

Early adopters of ATM technology like Midland Bank with a 2,000 strong network of machines in operation, continued to abandon proprietary networks. In April 1992, customers of the Royal Bank of Scotland were granted access to a network that was already in use by 'customers of National Westminster Bank, TSB Bank, Clydesdale Bank, Northern Bank, Honkong Bank (sic), Firstdirect and Britannia Building Society, as well as by holders of all Visa, Plus, Cirrus, Mastercard and Eurocheque cards'.<sup>75</sup> At the time of the agreement, the Royal Bank had 700 machines and its customers could access (without incurring in additional fees) those of Barclays, Lloyds and Bank Scotland. Midland could then offer its customers access to the biggest Scottish cash network. Achieving scale in an under-represented geographical area could have been one motivation for the Midland-Royal Bank interconnection.

Another motivation for the interconnection could have been the creation of a reciprocal sharing agreement. These allow proprietary networks to conduct transactions directly rather than route them through a network switch (McAndrews, 1991: 4). A reciprocal sharing agreements makes sense to the extent that prior to the agreement, customers of Midland were actively using Royal Bank's machines and vice versa. In the absence of interconnection, transactions between Royal Bank and Midland would be cleared through a network switch, that is, equipment that receives and transmits transactions between the bank that operates the ATM and the bank of the customer's account. Potential network switches for Midland-Royal Bank in the UK were the likes of Visa, Plus, Cirrus, Mastercard and Eurocheque. International reciprocal sharing agreements also allowed customers of the Royal Bank (carrying 'Cashline' and 'Highline' cards) to debit their current accounts when in Spain, Portugal and Belgium.<sup>76</sup> Greater connectivity through reciprocal agreements and network switches (such as Visa and Mastercard, a joint LINK/Plus system covering the US, UK and Japan) in the early 1990s thus reflected the increasing overlap between credit card and debit cards in ATM transactions as well as of national and international networks.

Although slowly, the creation of greater connectivity continued as cost containment gave way to fee income generation through interchange fees. The interchange fee (also known as terminal income), is the amount paid to the owner of an ATM by the network member bank whenever that member's cardholder uses the owner's ATM (McAndrews, 1991: 4). Although exact numbers were not available, between the 1980 and 2000 these fees oscillated between 25p and 45p in the UK (Barrie, 2006: 74). Anecdotal evidence suggests these could have been two or three times higher for transactions involving international network switches such as Visa, MasterCard, Cirrus and PLUS.

The average withdrawal in the NatWest network almost doubled in nominal value from £28.64 in 1986 to £47.00 in 1997.<sup>77</sup> It is likely this was not unique but part of a trend where retail banking customers had responded to a greater number of machines deployed. For the likes of Midland, NatWest and Barclays who had the largest proprietary networks, reciprocity agreements been seen as a way to generate fee income. This to the extent that reciprocity fees accurately priced the cost of transactions and non-customers withdrawals in proprietary networks superseded transactions made by own customers in other networks. In other words, this was a rare occurrence of first mover advantage in banking, as greater sized proprietary networks offered possibilities to generate net fee income. This as cash withdrawals from non-account holders could cover costs of account holders making withdrawals elsewhere, but offered to make a financial contribution to the running cost of proprietary networks.

Offsetting the cost of transactions by own-customers was possible as the deployment of ATM by larger networks had already positioned devices in high traffic non-branch locations such as railway stations, airports, petrol stations, motoring services and retail stores. Generating fee income offered possibilities to reduce high sunk (i.e. irrecoverable) costs in setting up proprietary networks by achieving economies of scale in their running costs. Increase in the number of withdrawals provided incentives for those with larger networks to increase the number of reciprocity agreements. At the same time, a reduction of two percent in the average value of withdrawals between 1986 and 1997, provided the incentive for effective pricing of interchange fees.<sup>78</sup>



Possibilities for ATM networks to become a source of fee income was also influenced by individual corporate strategies. Barclays, for one, had traditionally been reluctant to share any of its systems and preferred to develop assets organically. Others shared 'through the wall' machines but not dispensers within banking halls (thus avoiding any potential dilution of brand name).

NatWest joined the LINK network in March 1997 and in the process, doubled the number of machines available to its customers to 17,622.<sup>79</sup> From October of the same year, individual customers could also access Royal Bank of Scotland machines when the later also joined LINK. When Barclays joined the network in November 1998, 21,000 machines became available to customers of member banks.

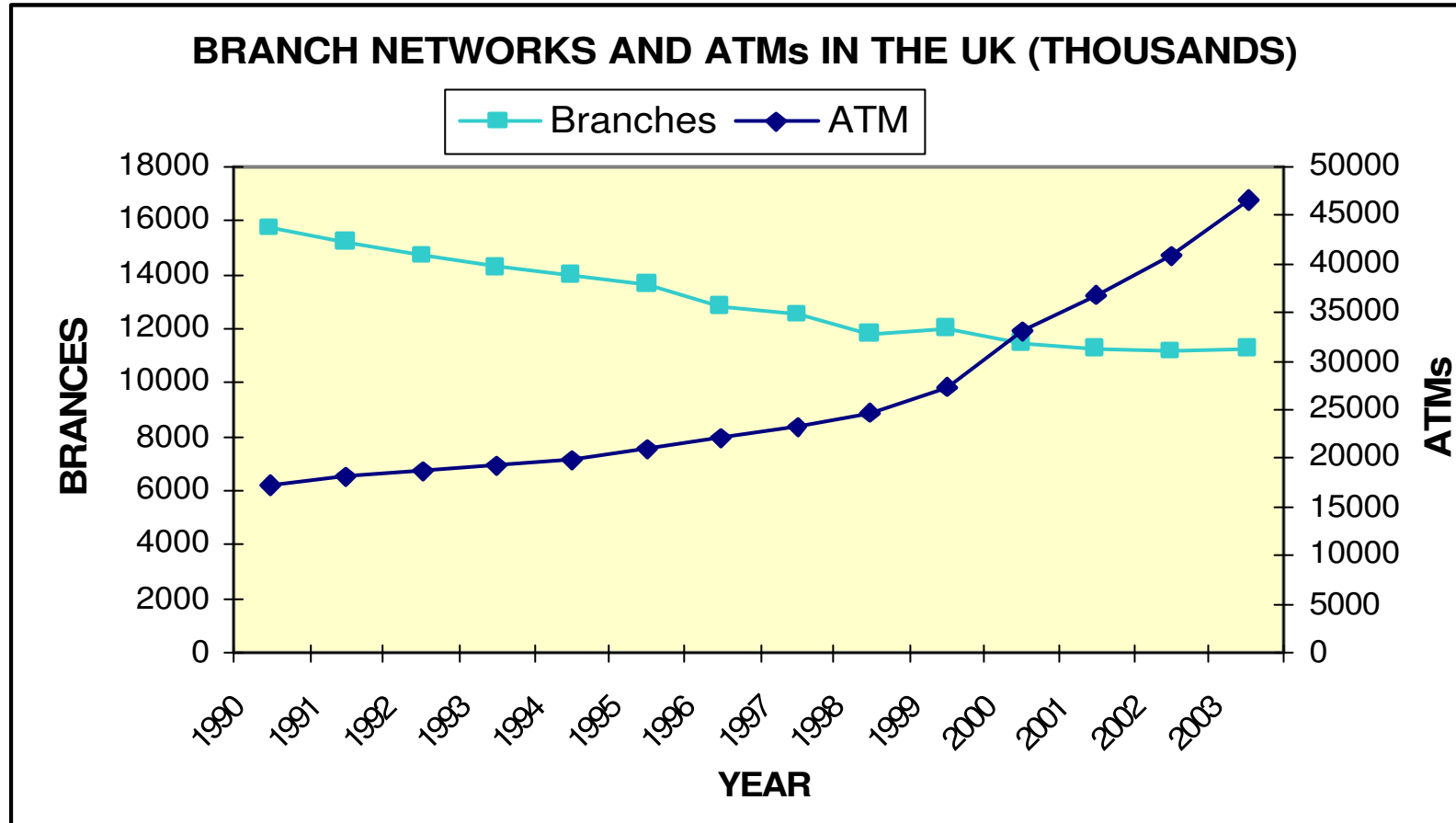
In December of 1998, NatWest advertised its position as the intermediary operating the largest single network when the 1,000<sup>th</sup> machine in a non-banking site was installed at London's Oxford Street outlet of John Lewis department store.<sup>80</sup> Figure 10 suggests that the growth of non-banking sites was accompanied with a reduction of retail bank branches.

Figure 10 illustrates how during the 1990s the ATM increasingly became part of multi-channel delivery strategies (Bátiz-Lazo and Wood, 1999: ; 2002). The ATM effectively became a required capability to be a credible participants in retail financial markets rather than a source of competitive advantage (Bátiz-Lazo and Wood, 2001: ; Bátiz-Lazo and Woldensenbet, 2006). Cost containment of ATM networks was appealing for most participant, namely the handful of small banks and the majority of building societies (many of which were in the process of abandoning their mutual status and being floated in the stock exchange). As was expected by McAndrews (1991: 12) for the US, the potential for shared costs and other network externalities resulted in a national network ultimately displacing proprietary networks in the UK. In 1999, Barclays, having recently joined the then dominant LINK network, attempted to impose blanket charges on ATM transactions. The move was vilified by the press and resisted primarily by participating building societies (Coopey, 2004: 182). All charges for cash withdrawal from current accounts were dropped and in effect, interconnectivity amongst all banks and building

societies offered a single national ATM network in the UK. Figure 11 summarizes the entry of independent providers to this market in 2000.

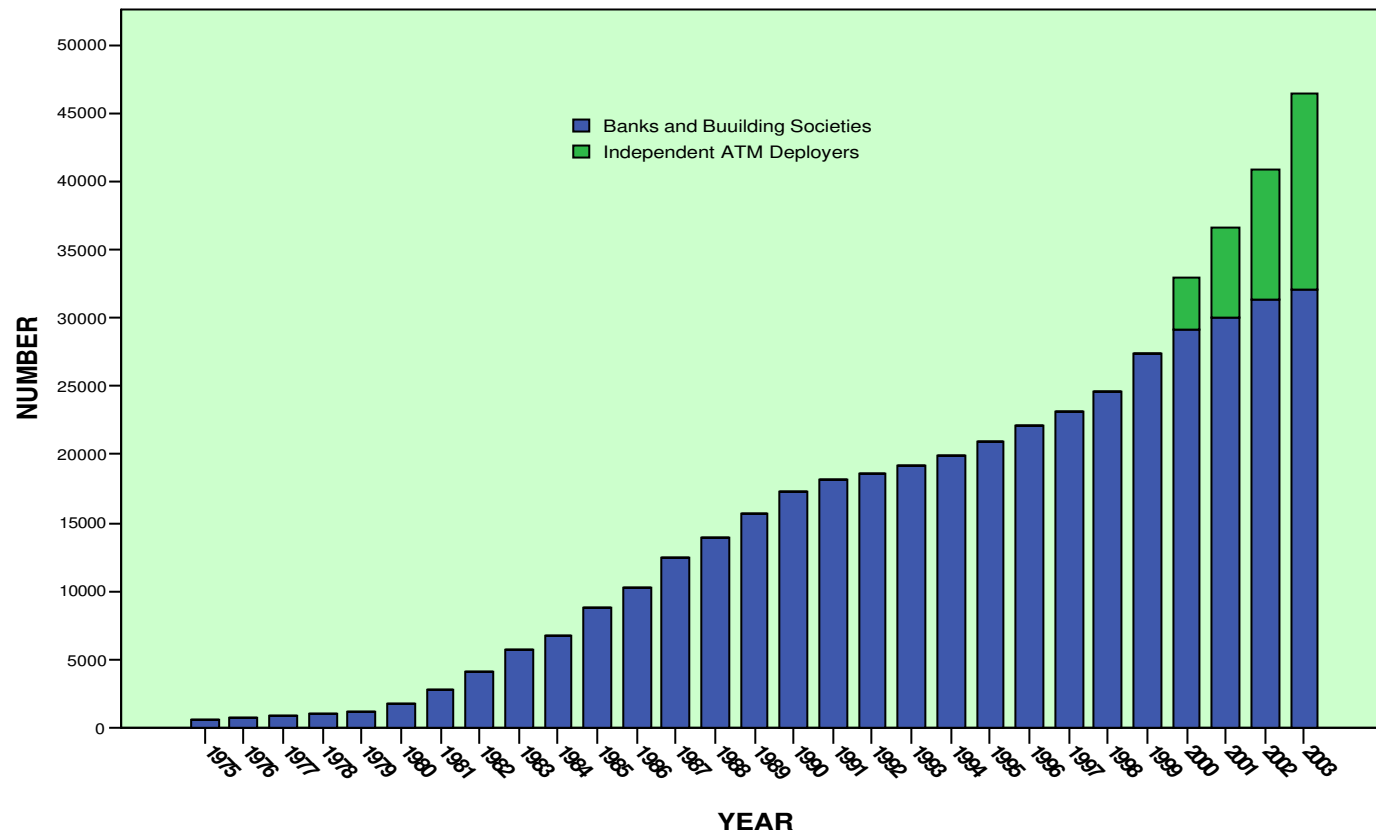
By the end of 2003 a total of 14,436, dispensers were operated by Independent ATM Deployers (IAD). This was an increase of 270 percent from those operated three years earlier and effectively taking 31 per cent of the total ATM installed outside of banking sites (that is, retail branches of banks and building societies). Some 13 IAD came into existence after regulatory changes in 1999 allowed the non-bank operators to provide cash dispensing services (Barrie, 2006: 78). Interchange fees were said to be based on the genuine cost of the transaction and these charges which range between 25p and 45p (Barrie, 2006: 79).

Figure 10:



Source: Barrie (2006)

Figure 11: Number of ATM IN THE UK (1975-2003)



Source: APACS, BBA

## 6 Discussion

During the last three decades of the twentieth century, British banks abandoned international aspirations, consortia and efforts to become a 'global financial supermarket' to focus on providing a diversified offering in UK retail finance (Bátiz-Lazo and Wood, 2000). Building societies continued to consolidate, remained the main providers of mortgage loans and after 1986, diversified into other areas of consumer finance. A key element of these processes was office mechanisation and automation of service provision on the back of computer technology. In this context, the emergence of cash dispensers and their transformation into ATM help better understand a number of changes. Firstly, how the process of mechanisation leading automation begins to abandon the search for greater efficiency in discrete processes (such as the accounting function). Activities begin to be redefined from first principles hoping to gain greater effectiveness in operation.

Secondly, the retail bank and building society branch ceases to exist as the main (and sole) point of contact with retail clients. Contrary to popular accounts (e.g. Cortada, 2006: 41) and as suggested in Bátiz-Lazo and Wood (2002) and Bátiz-Lazo and Wardley (2007), retail financial intermediaries began to change their mode of operation and retail customers' access to bank markets long before the advent of the internet. This is evident as the ATM expands the retail branch service hours, economising in labour costs and increasing customer convenience (including, for the first time, the possibility to bank at any retail branch). But ATM emerges as an 'experiment' of banks. A purposeful strategy which aimed to develop retail branch and non-retail branch locations from the outset and which is mediated by advertising and capital budgeting. This is not a response to an 'impending need' of a more mobile population.

Along side changes in service delivery, shared ATM networks enable individual banks and building societies to expand geographically. Although restrictions for geographical expansion of retail branches were more important in US market, opportunities opened in both sides of the Atlantic for financial intermediaries and individuals to interact through different spaces (e.g. ATM, post, telephone and internet) and media (i.e. synchronous and asynchronous communication). Synchronous and asynchronous interaction was possible as banks move away from working directly together with individual customers, to allow

their computers working with individuals (as in the case of the ATM), bank staff working with the individual customers' computer, as well as the working of computer to computer communication. The emergence of ATM networks was key in the development of information technology infrastructure (hardware, software, skills of individuals and organisational learning) which later on enabled other spaces and ways of interaction.

Thirdly, there was a consistent and sustained effort of the main clearing banks to support the development of proprietary networks. This even after the 'tipping point' of ATM adoption had been passed. As opposed to the example in the US, interconnectivity is slow to develop in Britain. It seems to develop more as a result of competitive pressures than the potential to achieve economies of scale. In this sense, proprietary ATM networks should be seen as being perceived as a source of competitive advantage by clearing banks.

Later on, building societies embrace ATM technology in force following regulatory changes and a drive to diversify throughout British financial markets. Sharing ATM networks made sense for the building societies as a way to resolve apparent scale disadvantages. At the same time, economies of scale and the potential for the machines with greater traffic to make net fee income contributions seem to have been a key incentive for those with larger proprietary networks to support the emergence of total interconnectivity. In this process, the ATM becomes a threshold competency in retail finance when shared networks replace proprietary networks. A move which also comprises the emergence of standardised, high volume, high margin retail financial services (i.e. commodities).

Fourthly, except for De La Rue's invitation to Barclays, during the initial period of adoption banks largely sought manufacturers that would design the new technology. Choice of functionality and manufacturer empowered individual banks to influence the evolution of design rather than having to accept technological solutions determined by manufacturers. As expected by Galbraith's (1967) 'reverse sequence', banks proceeded with caution, committing to a limited number of machines and conducting market research (i.e. pilot test) at carefully thought-out locations. There is evidence of this behaviour in the strategies of Barclays Bank and Lloyds Bank in the 1970s but also in the

1980s around the Woolwich. Staff at banks advised manufacturers of changes in design while engaged advertising and finance staff to ensure success of the new offering.

But individual choice and market controlled were limited as new designs incorporate international standards (e.g. plastic cards, magnetic stripe, electronic exchange protocols). Manufacturers then offered designs with a number of modular options from where they could chose. This is clearly more evident in the processes of building societies, that is, the 'late comers' to ATM technology (which, incidentally, benefited from lower capital expenditure around a tried and tested technology).

One important actor missing from this story is the bank regulator as well as monetary authority. Just as there were changes in the culture and habits of retail bank customers and within the organisational milieu of financial intermediaries, automation on the back of computer technology brought about the changes in the money supply and monetary control. For instance, joint ATM networks imply the creation of electronic fund payments systems (EFPS) protocols. Automation also had a potential impact on the balance between cash deposits and non-cash deposits as well as in preferences of cash at hand. The ATM also associates with a change from payments in cash and checks to the predominance of plastic and digital payments on the back of credit and debit cards. For most of the period examined in this paper, the Bank of England assumed the roles of bank regulator and shared that of monetary authority. As had been the case in the US, 'it would be difficult to overestimate the influence of regulatory bodies and laws in the character and practices of the Financial Sector.'(Cortada, 2006: 15). When and how did the Bank of England became interested in the ATM and the emergence of EFPS in retail financial markets has yet to be documented.

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Images and photographs

NCR 770 (various)

NCR 1780 (various)

Production facilities at Dundee

N.C.R. Post – several numbers

NCR Corporation, Annual Report and Accounts, 1978.

NCR Pocket Digest, Products and Services, May 1981.

The History of NCR, Dayton OH : The NCR Corporation (circa 1999)

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Lloyds Bank News (Internal magazine) – several issues, 1970-73

Index cards - ATM

The Royal Bank of Scotland Group Archives – London

Archives of

District Bank

Drummonds Charing Cross

National Provincial Bank

National Westminster Bank (NatWest)

Royal Bank of Scotland

Westminster Bank

Williams and Glyn Bank

Personal Communications

Nigel Hardman, Group Archives, Alliance and Leicester plc (03-May-2007)

Alan Jaques, Design and Engineering Manager, Gunnebo CSI (01-May-2007)

Ian Finn (through Jane Garland Marketing Communications Manager), Chubb

Fire Limited (10-Apr-2007)

Nicholas Webb, Barclays Group Archives (21 and 23-Jun-07)



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## Notes

- <sup>1</sup> [http://en.wikipedia.org/wiki/Automated\\_teller\\_machine](http://en.wikipedia.org/wiki/Automated_teller_machine) (accessed 16-Apr-07) and <http://web.mit.edu/invent/iow/simjian.html> (accessed 16-Apr-07).
- <sup>2</sup> By 1911, a process of amalgamation left some 80 percent of deposits in the hands of five banks (Midland, Barclays, Lloyds, Westminster, National and Provincial). These plus some six others controlled access to the cheque clearing system. Hence the name, clearing banks. Amalgamations also had the effect of providing clearing banks with a national web of offices and retail bank branches. Building societies are mutual organizations which for most of their history specialized in deposit taking and mortgage provision. Societies used agents and developed retail branches more organically than clearing banks. Other participants in British retail finance included insurance companies, trustee savings banks and hire purchase companies. After 1970s, these were joined by the National Giro Bank and the Co-operative Bank.
- <sup>3</sup> <http://americanhistory.si.edu/collections/comphist/wetzel.htm> (accessed 16-Apr-07).
- <sup>4</sup> Nye, Peggy (1967) 'Instant Case at Enfield', *Spread Eagle*, vol. 42 (Aug), p. 326.
- <sup>5</sup> Nye, Peggy (1967) 'Instant Case at Enfield', *Spread Eagle*, vol. 42 (Aug), p. 327.
- <sup>6</sup> Nye, Peggy (1967) 'Instant Case at Enfield', *Spread Eagle*, vol. 42 (Aug), p. 328.
- <sup>7</sup> In 1970 the Westminster Bank and the National Provincial Bank merged into National Westminster Bank (NatWest). The amalgamation also considered the District Bank, which had been acquired by the National Provincial Bank in 1962 but allowed to operate under its own name.
- <sup>8</sup> The Royal Bank of Scotland Group Archives (hereafter RBSGA) - WES/693, Westminster Bank, press release 31 July 1967.
- <sup>9</sup> RBSGA - WES/963, Westminster bank, 'Technical Information, Chubb & Son's Lock & Safe Co Ltd', 1967.
- <sup>10</sup> Personal communication (e-mail), Nicholas Webb, Barclays Bank Archive, 'ATM Paper', 19-Jun-07.
- <sup>11</sup> RBSGA - DIS /641, District Bank, photographs of Piccadilly branch cash dispenser on first day of use, 5 January 1968.
- <sup>12</sup> RBSGA - RB/150/2, The Royal Bank of Scotland, staff newspaper 'Newline', February 1993. According to this article the actual date of operation was 28 December 1967: 'The first cash machine soon proved a hit!'
- <sup>13</sup> 'Round-the-clock cash service', Barclays Bulletin, 1968, vol. 12 (Autumn).
- <sup>14</sup> Nye, Peggy (1967) 'Instant Case at Enfield', *Spread Eagle*, vol. 42 (Aug), p. 328.
- <sup>15</sup> BGA - Automation Committee Minutes: 80/2709, 2.e On-Line Cash Dispensers, 5-Mar-73.
- <sup>16</sup> RBSGA - DR/418, The Royal Bank of Scotland, Drummonds Branch, leaflet '24 hour cash service', circa 1968.
- <sup>17</sup> RBSGA - WES/963, Westminster bank, 'Technical Information, Chubb & Son's Lock & Safe Co Ltd', 1967.
- <sup>18</sup> Certainly the account that predominates in the US popular press see – <http://www.atmmarketplace.com/article.php?id=1339> (accessed 18-Apr-07); [http://money.cnn.com/magazines/fortune/fortune\\_archive/2004/07/26/377172/index.htm](http://money.cnn.com/magazines/fortune/fortune_archive/2004/07/26/377172/index.htm) (accessed 18-Apr-07); a brief oral history of Dan Wetzel at <http://americanhistory.si.edu/collections/comphist/wetzel.htm> (accessed 16-Apr-07)
- <sup>19</sup> By 2007, NCR had about 70 percent of the world ATM installations. In Britain it was about 90 percent. Personal communication (email), Ian Omrod, Ex-Officio Historian of NCR, 11-Apr-2007. Company documents claimed that by 1981 the ATM had made over 1.7 billion transactions in the US alone and NCR was the world leading manufacturer (The History of NCR, p. 107).
- <sup>20</sup> RBSGA - WES/693, Westminster Bank, press release, 31 July 1967.
- <sup>21</sup> RBSGA - DR/418, The Royal Bank of Scotland, Drummonds Branch, leaflet '24 hour cash service', circa 1968.
- <sup>22</sup> Nye, Peggy (1967) 'Instant Case at Enfield', *Spread Eagle*, vol. 42 (Aug), p. 326.
- <sup>23</sup> Considering 6000 customers and nine Chubb machines, there were 667 customers per machine. The Westminster would achieve economies of scale if each of those customers made, on average, 1.2 withdrawals per week.
- <sup>24</sup> Walker (1980) estimated that in 1974, the fixed cost of purchasing and installing an ATM was between \$25,000 and \$30,000 while \$200,000 should be added to consider operating costs of armored car services and data processing. At the time the Westminster Bank had 6000 customers with cash cards and nine Chubb

machines (RBSGA - unpublished research note compiled by Group Archives). That is, an average of 667 customers per machine. The Westminster would achieve economies of scale at Walker's rate of 44 thousand transactions per machine per month if each of the Westminster's customers made, on average, 1.2 withdrawals per week.

<sup>25</sup> RBSGA - DR/418, The Royal Bank of Scotland, Drummonds Branch, leaflet '24 hour cash service', circa 1968.

<sup>26</sup> The bank had dispensers installed at branches in the West End of London (3); the Home Counties (9); and the Birmingham area (12) ('On-line' Ready Cash, Lloyds Bank News, Sep 1970, Front Page).

<sup>27</sup> "'On-line" Ready Cash', Lloyds Bank News, No. 45 Sep 1970, Front Page. Italics in the original.

<sup>28</sup> 'Counter Revolution', Lloyds Bank News, No. 50 Feb 1971, p. 5.

<sup>29</sup> Unless otherwise stated, this paragraph borrows freely from 'Bank scores "first" in branch computer link-up', Counter Revolution', Lloyds Bank News, No. 50 Feb 1971, p. 5.

<sup>29</sup> Unless otherwise stated, this paragraph borrows freely from 'Bank scores "first" in branch computer link-up', Lloyds Bank News, No. 47 Nov 1970, Front Page.

<sup>30</sup> 'Bank scores "first" in branch computer link-up', Lloyds Bank News, No. 47 Nov 1970, Front Page.

<sup>31</sup> 'New 'robot' cashier to help staff', Lloyds Bank News, No. 54 Jun 1971, Front Page.

<sup>32</sup> Idem.

<sup>33</sup> 'Run-up begins for cash point launch', Lloyds Bank News, No. 69 Sep 1972, Front Page.

<sup>34</sup> 'New 'robot' cashier to help staff', Lloyds Bank News, No. 54 Jun 1971, Front Page.

<sup>35</sup> Idem.

<sup>36</sup> 'Run-up begins for cash point launch', Lloyds Bank News, No. 69 Sep 1972, Front Page.

<sup>37</sup> Unless otherwise stated, this paragraph borrows freely from BGA – Automation Committee Minutes: 80/2709, 2.e On-Line Cash Dispensers, 5-Mar-73.

<sup>38</sup> BGA – Automation Committee Minutes: 80/2709, C Other Items, 25-Sep-74.

<sup>39</sup> BGA, 'Barclays Fact Sheet – Cash Machines', undated. Note compiled by Barclays Group Archives.

<sup>40</sup> RBSGA – NWB/914/2, National Westminster Bank, press release, 9 Sep 1975.

<sup>41</sup> Personal communication, Ian Ormerod (19-Apr-07) and RBSGA – NWB/914/2 NatWest press release, 9 Sep 1975

<sup>42</sup> RBSGA – unpublished research note compiled by Group Archives. This makes a reference that perhaps Barclays made available to the public a similar external machine shortly before NatWest

<sup>43</sup> RBSGA – NWB/19/101, National Westminster Bank, internal circular DB 56 – 1975 (G.D. Burnett, General Manager, Domestic Banking Division), 29-May-1975.

<sup>44</sup> Idem.

<sup>45</sup> RBSGA – NWB/914/2, National Westminster Bank, press release, 09 Sep 1975.

<sup>46</sup> "Cash Advance": The History of NCR in Scotland 1946-1996, p. 28.

<sup>47</sup> NCR Corporation, Annual Report and Accounts, 1978.

<sup>48</sup> "Cash Advance": The History of NCR in Scotland 1946-1996, p. 28.

<sup>49</sup> NCR Pocket Digest, p. 36

<sup>50</sup> CSI was subsequently divested in 2000 and acquired by Gunnebo Group (of Sweden). Since then it has traded as CSI Gunnebo and retained some related products such as Armapod Plus, Citypod and Cityroom; all of which were designed to house the ATM machines and to protect those individuals who replenish or service them and may be at risk from a physical assault or armed attack whilst doing so. *Source*: Personal Communication (email), Jane Garland, Marketing Communications Manager, Chubb Fire Limited (A UTC Fire & Security Company), 10-Apr-07; Personal Communication Alan Jacques (email), Design and Engineering Manager, Gunnebo CSI (01-May-2007); [http://www.csisec.com/company\\_profile\\_history.htm](http://www.csisec.com/company_profile_history.htm) (accessed 16-Apr-07) and <http://www.chubb.co.uk/chserver/request/setTemplate:singlecontent/contentTypeA/webdoc/contentId/646/navId/00000b000> (accessed 16-Apr-07).

<sup>51</sup> Cash Advance (1996, p. 37) quotes and briefly discusses the following heading that appeared in Fortune magazine: 'The wee outfit who decked IBM'.

<sup>52</sup> BGA, 'Barclays Fact Sheet – Cash Machines', undated. Note compiled by Barclays Group Archives.

<sup>53</sup> Barclays Bank Annual Report and Accounts, 1978, p.43.

<sup>54</sup> Lloyds TSB Archive, Index cards on ATM.

<sup>55</sup> RBSGA – WG/133, Williams & Glyn's Bank, folder 'New branch terminals', c.1980. The move is not to be considered as an independent ATM network. The Royal Bank of Scotland (RBS) and Williams &

Glyn's were part of the same banking group but trading independently. As part of RBS's expansion after World War I, it acquired various small English banks, including London based Drummonds Bank in 1924; and William Deacon's Bank based in North West England in 1930; and Glyn, Mills and Co in 1939. The latter two were merged in 1970 to form Williams and Glyn's Bank; and later rebranded as the Royal Bank of Scotland in 1985.

<sup>56</sup> RBSGA – unpublished research note compiled by Group Archives..

<sup>57</sup> Personal Communication (email), Nigel Hardman, Group Archives, Alliance & Leicester (03-May-07).

<sup>58</sup> “Building society in cash link”, *The Times*, 16-Feb-85, pg. 3, Issue 62064, col. A.

<sup>59</sup> Personal Communication (email), Nigel Hardman, Group Archives, Alliance & Leicester (03-May-07).

<sup>60</sup> The first machine installed in a British rail station took place in 1970, when a cash dispenser became operational in London's Victoria Station by the National Provincial Bank (shortly before its brand name changed to National Westminster Bank or NatWest). This was, however, within the premises of the bank's Victoria branch. Source: RBSGA – NW/B1239, National Westminster Bank, photograph of a member of staff using the cash dispenser at Victoria Station Branch of National Westminster Bank.

<sup>61</sup> ‘Cashbase: switch-on at Head Office’, *Woolwich World* vol. 8, no. 8, p. 01 (Aug 1985).

<sup>62</sup> ‘Cashbase set for launch later in the year’, *Woolwich World* vol. 8, no. 7, p. 01 (Jul 1985).

<sup>63</sup> For instance, In December 1976 the Management Services Department reported that 43,670 Barclaybank cards had been issued in the four weeks to 27<sup>th</sup> of November there had been 6,983 withdrawals (at an average of £21 per withdrawal) and 663 deposits (average amount not disclosed). BSA– Automation Committee Minutes: 415/156 – ‘Use of Machines’, 15-Dec-76.

<sup>64</sup> Personal Communication (email), Nicholas Webb, Barclays Group Archives, (23-Jun-07).

<sup>65</sup> ‘Countdown to Cashbase’, *Woolwich World* vol. 8, no. 7, p. 03 (Jul 1985).

<sup>66</sup> Initially there were 120 cash dispensers. These were expected to increase to 400 in number by the end of the year and to 1,000 installed machines within two years. See further ‘Scotland joins Cashbase link’, *Woolwich World* vol. 9, no. 10, p. 01 (Sep 1986) and ‘Matrix gets off to a flyer’, *Woolwich World* vol. 9, no. 03, p. 01 (Mar 1986).

<sup>67</sup> BGA, ‘Barclays Fact Sheet – Cash Machines’, undated. Note compiled by Barclays Group Archives. However, an internal document also compiled by Barclays Group Archives claims ‘Barclays joins a consortium of five banks sharing ATM facilities’ in April 1983.

<sup>68</sup> RBSGA – NWB/914/12, NatWest, news release 288/98, 1 December 1988.

<sup>69</sup> Lloyds TSB Archive, Index cards on ATM.

<sup>70</sup> Lloyds Bank acquired the in-store branches of Lewis’ and Selfridges in the early 1970s. It was evident from the staff magazine (*Lloyds Bank News*) these were operated as an integral part of the bank rather than at arms length.

<sup>71</sup> RBSGA - NWB/1358, NatWest, ‘NatWest Update’ circular, no. 56, ‘Developing Technology’, January 1986.

<sup>72</sup> RBSGA – unpublished research note compiled by Group Archives.

<sup>73</sup> BGA, ‘Barclays Fact Sheet – Cash Machines’, undated. Note compiled by Barclays Group Archives.<sup>73</sup>

Interestingly, Barclays ‘drive thru’ came some twenty years after similar facilities had been tried and tested in other countries. Some of these remained a part of every day life (i.e. USA) while others were very short lived (i.e. Mexico).

<sup>74</sup> Anonymous, Barclays Fact Sheet: Cash Machine, undated note prepared by Barclays Group Archives.

<sup>75</sup> RBSGA - RB/184/23674A, The Royal Bank of Scotland, press release ‘Midland and Royal Bank sign cash machine agreement’, 27-Apr-1992.

<sup>76</sup> RBSGA - RB/184/23674A, The Royal Bank of Scotland, press release ‘Midland and Royal Bank sign cash machine agreement’, 27-Apr-1992.

<sup>77</sup> RBSGA – NWB/914/12, NatWest, news release 288/98, 1 December 1988.

<sup>78</sup> The UK's Retail Price Index (base January 13 1987), was 160.0 at the end of December 1997 (<http://www.statistics.gov.uk/rpi>, accessed 07 Jun 2007). The deflated value of NatWest's average withdrawals in 1997 is then £28.20 or 2 percent below £28.62 observed at the end of 1986.

<sup>79</sup> RBSGA – unpublished research note compiled by Group Archives.

<sup>80</sup> RBSGA – NWB/914/12, NatWest, news release 288/98, 1 December 1988.