Emergence and evolution of ATM networks in the UK, 1967–2000

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Research in this article traces the origins of a process of competitive change in British retail financial markets by looking at the emergence of cash dispensers technology, how it transformed into automated teller machines (ATMs) and how proprietary ATM networks gave way to total interoperability of cash withdrawals through a single common switch. Cash dispensers were an industry-specific innovation developed by British manufacturers (e.g. Chubb and De La Rue) which were, in turn, overtaken by US (e.g. NCR) and German (e.g. Siemens-Wincor) manufacturers. However, as the ATM became a global technology some of the leading providers (i.e. Burroughs, IBM and NCR) kept manufacturing and even their main design facilities in Scotland. The evolution of this technology illustrates changing boundaries of the banking organisation, the challenges faced by financial intermediaries to adopt on-line, real-time computing and highlights the role of network externalities in financial markets. From a business history perspective, the ATM, electronic funds transfer and other retail payment media have largely been neglected by British historians and management scholars. Yet the success of automated cash dispensers as a distribution channel in retail banking 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. This article thus promotes the idea that the history of technology must consider its users, their strategies and business models inasmuch as business histories of the late twentieth century will be incomplete without attention to developments in information and communications technologies.

Keywords: banks; building societies; cash dispensers; ATM; technological innovation; diffusion; UK; networks; payment systems

Introduction

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 was in the absence of secondary markets for government debt and as governments anticipated changes in the business cycle by introducing qualitative and quantitative criteria to allocate credit. Moreover, in Europe business organisations financed themselves primarily through bank credit rather than open market transactions. The decades that followed World War II saw cheques rather than bills and coins becoming the predominant medium of retail payment. A significant and sustained increased in the number (but not the value) of cheques to be cleared has been identified by a number of studies as one of the key motivations for banks on both sides of the Atlantic to automate

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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 (Bátiz-Lazo & Wood, 2002; Richardson, 1970).

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 (ATMs). In today’s global economy the ATM is ubiquitous. They facilitate travel and have helped to redefine urban and global space. The ATM is an expensive, industry-specific piece of capital equipment which also embodies the first step in multi-channel delivery strategies for the provision of retail banking services. The ATM has been heralded as a 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, p. 80). But as the research that follows illustrates, a number of things had to happen before the ATM achieved ‘software status’.

The importance of cash dispensing technology in US banking was perhaps first noticed by Richardson’s pioneering contribution (Richardson, 1970; also see Hayashi, Sullivan, & Weiner, 2003, 2006; McAndrews, 1991; Sienkiewicz, 2002). But neither Richardson nor other systematic studies on the evolution of ATM networks within the business and technological history of US banking challenged conventional wisdom as to the creation and diffusion of different versions of cash dispensing technology.

Hopton (1979), Kirkman (1987) and Howells and Hine (1993) summarise developments in the British payment system. Coopey (2004) and Barrie (2006) touch on the emergence of ATMs in the UK from an historical perspective. Coopey offers evidence as to 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, pp. 214 and 332–4) authoritative history of Barclays Bank. Meanwhile, Barrie positioned the ATM within the overall process of technological change of UK banks. However, none of these contributions provide a detailed account of the transformation of cash dispensers into ATM networks.

Alongside systematic studies from an historical perspective, there is an extensive body of cross-sectional analyses by scholars who have explored marketing dimensions of ATMs, industrial policy dimensions and the ATM as a computer network. A recent survey by Vázquez-Alanís (2007), identified two areas that group academic contributions in the broad areas of economics and management, namely performance effects and networks effects. Performance effects aims to tell how investments in ATMs 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. A first sub-category involves studies dealing with the
size of the network. Of particular importance are network externalities, role of participants, role of ‘switches’, economies of scale or scope in the provision of services, and density (i.e. number of devices per capita or km²). 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 (McAndrews, 2003).

Beyond Vázquez-Alanís’ performance and network effects, there might be two other areas of research. Both of these are in need of empirical and analytical attention. First, the effects of computerisation of banking on the money supply and monetary control (Walker, 1975). This is an area that considers the interaction of banks’ corporate strategy and bank regulators in the creation of network standards. An area exploring how the development of EFTS was influenced by decisions of banks’ senior managers, changes in customer behaviour and preferences as well as policy goals of monetary authorities. Second, the role of ATMs within interpretative studies of organisational change and information technology (Coombs, Knights, & Willmott, 1992). However, both of these alternative research agendas are beyond the scope of this article.

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 while overlooking the corporate strategy motivating investments in expensive and highly industry-specific devices such as cash dispensers. Archivally-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. Moreover, it offers an opportunity to demonstrate how the history of technology must consider its users inasmuch as business histories of the late twentieth century will be incomplete without attention to developments in information and communications technologies.

Technological know-how and bank strategy

As suggested by Revell (1983, p. 42) and McAndrews (1991, p. 4), the ATM is a technology used for banking services, which embodies a machine incorporating a video display unit (VDU), 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. The ATM is thus seen as much more than a simple cash withdrawal device and as part of a self-service offering.

There are other interesting features of ATMs. For instance, a machine 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 straightforward 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 had suggested for some time that it was technologically possible for machines to identify and count notes and coins. However, it was not until circa 2005 that cash and coins were counted and credited to customers’ accounts alongside cash distribution through self-service machines in the high street (Bátiz-Lazo & Reese, 2008).

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’ (Coopey, 2004, p. 175). The potential coexistence of different technological solutions highlights the fact that senior managers of financial intermediaries can (and do) choose amongst alternative technological configurations. Choice empowers individual organisations to influence the evolution of these configurations rather than having to accept technological solutions determined by manufacturers. With these ideas in mind, British banking offers a particularly good example of user-driven change given that a highly concentrated market and densely populated retail branch network resulted in individual orders being large when compared to North American standards. Indeed, throughout the twentieth century the likes of IBM, Burroughs and NCR worked hard to keep the custom of British banks, savings banks and building societies.

Revell (1983, p. 42) called a cash machine an ATM as long as it provided at least one additional service to that of cash dispensing. As will be evident below, this distinction fails to ascertain that the first cash dispensers were stand-alone devices which required human intervention to credit and debit customer’s accounts. These early machines were no different to other contemporary technology in US and European retail finance such as mobile branches, postal deposits, drive-through and drive-in banking. All of these were in place during the late 1950s and 1960s as alternatives to ‘bricks and mortar’ distribution of cash withdrawal and deposit (Bátiz-Lazo & Maixe-Altes, 2008). Instead, the success of cash dispensers enabled the deployment of ATM fleets from the mid-1970s onwards as characterised by electronic data processing technology, databases of customer information, software to manage electronic repositories and other hardware and software which enabled the device to credit or debit the customer account without human intervention. In other words, synchronous electronic data processing (EDP) at the point of contact with the customer is the feature which distinguishes the cash dispenser from the ATM. This process of transformation required an intermediate state where the same device operated according to the context and choice of individual financial intermediaries, namely stand-alone, synchronous or asynchronous communication to a central computer. The devices also transformed from being set up and wired to a single form of operation to a more general platform which allowed the storage of pre-programmed instructions (for their operation to suit purchasing specifications and the emulation of alternative vendors). Only when the device achieves on-line, real-time communication at the point of contact with the customer can one say the ATM acts as a remote device that enables individual customers to interact directly, with ease, securely, reliably and unobtrusively with the financial intermediary’s central computer – and thus become a ‘true’ software application as proposed by Ceruzzi (2003, p. 80).

Initially, cash dispensing technology was perceived as a potential source of competitive advantage for individual banks. During the late 1970s and early 1980s proprietary ATM networks developed in the UK while the machines themselves transformed from simple
cash dispensers to multi-tasking devices. 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% of transactions in the US by 2001 (Sienkiewicz, 2002). Meanwhile, in 1998 there was only one single ATM network in the UK as participants developed full interoperability for cash withdrawal around a single common platform (e.g. LINK). Throughout this process of growth and consolidation, proprietary ATM fleets turned into a threshold capability for retail financial services, included the provision of these services by non-banking participants (e.g. food retailers and Independent ATM Deployers) and even the delivery of non-financial services such as topping up mobile phone account balances.

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 British retail financial intermediaries throughout the twentieth century (Bátiz-Lazo & Wardley, 2007; Bátiz-Lazo & Wood, 2002; Wardley, 2000). 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 (cheaper) 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 begin to grapple with ways to ease physical overcrowding within retail branches and an increasingly unionised work force, which was demanding the end of Saturday morning opening of retail branches. Indeed, how to articulate Saturday closing was a top concern for the Committee of London Clearing Banks in the early and mid-1960s. But it came about in 1969 and only after the introduction of cash dispensers. Meanwhile many building societies became active in developing retail branch networks while their mortgage loan portfolio expanded rapidly (Bátiz-Lazo & Billings, 2007; Davies, 1981). The trustee savings banks (TSB) also used computer technology to tackle the decimalisation of sterling, reduce back office work at branches while they amalgamated into a single provider in 1985.

But for a handful of instances such as the development of on-line, real-time retail branch network by the TSB or Barclay’s fiasco with the Burroughs B8500, retail financial intermediaries usually resisted the uncharted novelties of the latest technology. Most banks and building societies selected career staff (typically from accounting or operational methods departments) to be trained in and head their computerisation efforts. As a result, the speed of computerisation was often ‘conservative’ but despite a few obviously inappropriate decisions made with regard to the adoption of technology, it appears that building societies, savings banks and clearing banks in particular got things about right (Bátiz-Lazo & Wardley, 2007).

In summary, research in this article proceeds while considering that executives of financial organisations 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 mainframe computer technology was the most recent episode. However, other contextual forces should not be underestimated and these include the government’s view of an increasingly inefficient banking sector, the government’s ‘buy British’ computer policy, reluctance of staff and unions to continue with Saturday opening hours, staff shortages, internal and external pressures to reduce staff costs, limited space within retail branches when increased business had to be processed, great variance of interest rates, the introduction of decimal currency in 1971 and ascension to the European Economic Community in 1973.
Proprietary networks

It is claimed that the development of cash machines in the US was influenced by learning around punched card tabulators and early computer technology. Geographical restrictions to retail branch banking also played an important role (Hayashi, Sullivan, & Weiner, 2003; McAndrews, 1991, p. 5). Popular accounts link the first attempt at a mechanical cash dispensing technology to the Bankograph developed by Luther George Simjian, allegedly in 1939. I have documented elsewhere my challenge to the ‘conventional wisdom’ as to who ‘invented’ the cash dispenser as well as reassessed the contribution by Simjian (Bátiz-Lazo & Reid, 2008a, b). Suffice to say that Simjian’s patent US3079603 was first filed in 30 June 1960 and the roll-out of the Bankograph was delayed a couple of years. This was partially due to his Reflectone Electronics Inc. being acquired by Universal Match Corporation (‘Universal Match’, 1961). The Bankograph was an automated envelope deposit machine and it did not have cash dispensing features. The Bankograph, however, embodied the preoccupation by US banks in finding alternative means to capture core deposits; while the concern of British banks was cash distribution. There also was a Japanese cash dispenser machine in operation in July 1966. It activated with a ‘special’ credit card and, rather than accessing current account balances, it dispensed a ¥20,000 (about $55) three month loan. Although this technology challenged the British claim to have the first operational cash dispenser, there are few or limited details about its workings. Moreover it had no immediate impact on the international market, whereas British patents and devices were promptly operational, licensed or replicated elsewhere in Europe and North America.

The genesis of cash dispensing in the UK dates to three teams working independently of each other (namely Barclays Bank and De La Rue Instruments; Smiths Industries, Chubb & Son’s Lock and Safe Company Group (Chubb) and Westminster Bank; Midland Bank and Speytec) (Bátiz-Lazo & Reid, 2008a, b). It is common knowledge that the first to market was one of the six machines in a pilot project installed by Barclays Bank in its Enfield retail branch in June 1967. This development was closely followed internationally as similar machines were in operation in 1969, namely at the Philadelphia National Bank in the US and the Umeda branch of the Sumitomo Bank in Japan.

Internally denominated De La Rue Automatic Cash System (DACS) but advertised as ‘Barclaycash’, the machines were called ‘robot cashiers’ by internal and popular press (Nye, 1967, p. 326). Barclay’s customers were issued vouchers, which carried information in punched card form (Figure 1). 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 ten pounds (in packs of one pound notes). The electronic signature was in the form of a six-digit identity number. Inside the machine a section of the voucher was guillotined to bring it to the standard size of a cheque. When the voucher was retrieved by bank staff, the transaction was processed like a cheque during normal banking hours.

Barclaycash was admittedly seen as an ‘experiment’ but it was hoped that, in due course, the ‘mini-bank’ 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’ (Nye, 1967, p. 327). Cash machines were never intended as a stand-alone device but as 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’ (Nye, 1967, p. 328).

Other clearing banks followed Barclays’ lead, the Westminster Bank installing its first machine in July 1967 at its retail branch next to Victoria railway station. During the following four months nine other machines were also operational (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. Customers were given plastic credit card sized cards with holes punched in them (RBSGA, press release, 31 July 1967). The card was inserted into the machine and the customer keyed a four digit personal code (Figure 2). 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.’ (RBSGA, ‘Technical Information’, 1967). At the bank’s request, during the design stage, the customer’s card was retained by the MD2 and returned to customers through the post for future use.

Other banks were quick to adopt the cash dispenser idea but given the exclusivity agreement signed between De La Rue and Barclays, they became users of the Chubb MD2.

Figure 1. Voucher to operate Barclaycash machines, circa 1967.
Source: Barclays Group Archive.

Figure 2. Token to operate Chubb MD2 dispensers, circa 1967.
Source: Ian Ormerod Personal Archives (NCR UK Retirement Fellowship), 2006.
For instance, also in 1967, Martins Bank installed its first machine in Liverpool (N. Webb, Barclays Bank Archive, personal communication, 19 June 2007). The National Provincial Group did likewise in January 1968, on the outside of the District Bank’s Piccadilly branch in Manchester (RBSGA, District Bank, photographs, 5 January 1968). The Royal Bank of Scotland (RBS) was the first to introduce a 24-hour service north of the border (RBSGA ‘Newsline’, February 1993). By the end of 1968, RBS’s ‘Automated Cash Dispensers’ were providing similar services in 25 branches throughout Scotland and in London.

The Chubb MD2 became the machine of choice for British banks in the late 1960s and 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 dispensers from De La Rue at an approximate cost of half a million pounds (‘Round-the-clock cash’, 1968). The design of these 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 vandalised (Nye, 1967, p. 328). 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 (BGA, minutes, 5 March 1973).

As was the case for the De La Rue’s DACS machines, in the absence of a VDU the Chubb dispenser communicated with the customer using fixed light signals (primarily to indicate the card or voucher had been accepted) (RBSGA, leaflet ‘24 hour cash service’, c. 1968). From the outset banks adopting the Chubb MD2 and DACS chose to fix the cash dispenser to the exterior wall of the branch rather than in the banking hall. 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 (RBSGA, ‘Technical Information’, 1967). Here it is important to note the number of engineering challenges the different teams faced as, for instance, never before had any other machine positioned electronic circuits so close to enduring changing weather, imposing the need to develop metal alloys that would not easily succumb to the inclemency of seasonal changes and different climates within the British Isles.

A fact often overlooked in the popular accounts of the emergence of cash dispensers and ATMs is that the introduction of credit cards and cash dispensers marked the first time that technology was really modifying services for retail customers since computerisation began in the late 1950s. Changes were beyond the superficiality (from a customer perspective) of pre-printed stationary, mechanical annotations or magnetic characters in cheques. The introduction of these machines for the first time allowed customers to engage with their financial institution regardless of location instead of a single retail branch. This was not lost on 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. (RBSGA, press release, 31 July 1967)

Together with the development of direct-selling capabilities around credit cards, the introduction of cash machines were marking the start of a trend where more work was processed centrally and less at retail branches – with the subsequent loss of their autonomy as a ‘self-sufficient production unit’ (Ackrill & Hannah, 2001, pp. 328–329):

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 [centrally generated] special cash card and your own personal code number. (RBSGA, leaflet ‘24 hour cash service’, c. 1968)

As was the case in the US due to legislation on retail branches and in spite of ‘national’ retail bank branch networks, banking in the UK was highly localised. Customers of financial intermediaries were expected to develop long-term relations with a single retail branch. The introduction of cash dispensers and credit cards was thus a response to an increasingly mobile population (Bátiz-Lazo & Hacialioglu, 2005, p. 893; Coopey, 2004, pp. 176–177) 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 to make better use of retail bank branch space).

But as suggested in the quotes above, individual banks aimed to develop their own networks 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. Selection of the location for the first machines 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 site, Barclays argued that the town had a ‘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’ (Nye, 1967, p. 326). Five more Barclaycash machines were installed by the end of that summer in towns with similar characteristics, namely Hove, Ipswich, Luton, Peterborough and Southend.

The cost of adoption was substantial. This was in terms of the machine itself, but also in terms of servicing, as the first prototypes were prone to frequent faults, and displacement of space within the retail branch as many were quite bulky. Nevertheless, banks in the Europe and North America took to the idea of cash dispensers while manufacturers alongside instrument maker De La Rue and security systems Chubb then emerged from a range of sectors – each with their own competitive dynamics. Notably most came from the US, such as Diebold, Money Machine, Digital Security Systems and Docutel (the spin-off of baggage handling equipment manufacturer Recognition Equipment Inc. and wrongly hailed as the inventor of the ATM) as well as mainframe computer manufacturing companies such as NCR, IBM and Burroughs. There was also Omron-Tatesi and Fujitsu in Japan, Siemens and Nixdorf in Germany, Sweden’s Asea-Metior and Italy’s Olivetti. Many other smaller outlets emerged, particularly in Europe, as each individual manufacturer coerced their own governments and their own banks to be protective:

throughout Europe you had so many rules and regulations in the 1970s that the emerging industry was slow to grow and slow to create something that was useful and marketable. Until the early 1980s none of them was easy to use or particularly reliable, apart from Chubb all of them were large, none of them was on line, interlinked, easy to change, alter or adapt and they had all these faults that they carried with them. They were so difficult to use that when the customers got out there and tried to use them, didn’t quite know what they were doing, they were unreliable and most of the customers tried them once and didn’t seem to help, so the usage rates were extremely low . . . then there was Burroughs [in the UK] and there was Docutel in the United States and then there were the Japanese . . . , but IBM was the only one who really had a system, had the potential at that time take over the market. [Because they] were truly international and because they had the mainframe control and all of the control of the software into the systems. (J. Adamson, former CEO of NCR Dundee, personal communication, 18 June 2008)
From cash dispenser to ATM

As mentioned, early cash machines retained the access card or voucher after the transaction. Customers’ accounts 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 (RBSGA, leaflet ‘24 hour cash service’, c. 1968). 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 an alternative way of operation (Bátiz-Lazo & Wardley, 2007).

As the 1970s progressed, slowly but steadily cash dispensers stopped being stand-alone machines and developed on-line, real-time capabilities (Bátiz-Lazo & Reid, 2008b). At the same time electronic data interchange networks, solid state memory, programming languages, integrated circuits, etc. became readily available. Financial intermediaries deployed mini-computers as well as synchronous and asynchronous electronic fund transfer (EFT) terminals to support further moves to EDP centralisation.

The transformation from the cash dispenser to the ATM in the UK started when Lloyds Bank deployed its first ‘on-line’ dispensers in December 1972. Lloyds had 24 cash dispensers in operation and was said to have been cautious with the ‘first generation’ of machines. C. B. Howland, General Manager (Organisation), opined in 1970:

\[ F \text{or many months we have been undertaking studies in depth into the possible uses and developments of cash dispensers.} \]
\[ I t \text{ was, in fact, because we looked at them so closely that we came to the conclusion early on that the machines were very much first generation types, not nearly reliable enough and quite insufficient field trialled, thus explaining why we have not installed too many too quickly.} \]
\[ W e \text{ are ready for ‘on-line’ versions but the machines are not here yet. ‘On-line’ in this context means that before we pay out to a customer reference is made by the machine to the computer to ensure that funds are in the account. Thus, all customers who want the facility could have it without being concerned for their funds. (‘On line’ ready cash’, 1970; italics original) \]

Lloyds’ aim of linking dispensers to its computerised accounting system implied changing processes and procedures in place for almost 50 years (‘Counter revolution’, 1971). Introducing a device linked to the central computer, able to check the customer’s balance before each withdrawal, dispensing variable amounts 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 30 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 (Haigh, 2006). Lloyds thus had its computer system ready on time for decimalisation while the likes of Barclays did not following the Burroughs B8500 fiasco (Ackrill & Hannah, 2001, pp. 322–324).
Dispensing cash ‘on-line’ for Lloyds developed as part of the preparations for the changeover 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. 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 (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 million in computers (£15 million already invested and £10 million on order) as well as doing it ‘less expensively’ 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. After all, commercial applications based on synchronous EDP had been in place for a number of years (such as airline reservation systems). The computerisation of the customer accounting system resulted in Lloyds developing a ‘successful partnership with IBM’ (‘Bank scores “first”’, 1970). It was based on this ‘partnership’ that the ‘on-line’ dispenser was designed and built (‘New “robot”’, 1971). In June 1971 an order for 500 machines, costing nearly £3.5 million in total, was placed with IBM for delivery of 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 one pound notes and up to £50 in five pound notes) (‘New “robot”’, 1971).

The first so-called ‘Cashpoint’ made its public debut in December 1972, with the rest introduced progressively to retail branches through 1973 and 1974 (‘Run-up begins’, 1972). The machine was initially only available in the UK and was innovative as it was the first widely deployed machine to be operated by a plastic card with a magnetic strip on the back (containing the customer’s account number and the branch sorting code) (‘New “robot”’, 1971). There was still no VDU as instructions to the customer were relayed through a separate panel made out of plastic strips with lights at the back. There were perhaps more moving parts than in the Chubb MD2, 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 returned to the customer to end the transaction (Bátiz-Lazo & Reid, 2008a).

The ‘Cashpoint’ was designed to work within banking halls, ‘through the wall’, and ‘in locations away from banking offices’ (‘Run-up begins’, 1972). By December 1976, 630 ‘Cashpoint’ machines were operational in 430 branches and this included Lloyds’ first ‘through the wall’ machine. The long period to roll out the ‘Cashpoint’ was partially explained by the high cost, low reliability and low availability of telephone lines for EDP. These hampered possibilities for a generalised synchronous updating of customer records of the scale UK banks required. Instead, and driven by developments outside the UK, vendors offered different modes of operation. Some models stored transaction information electronically in themselves (first in magnetic tape cassettes and later in floppy disks). This was transmitted for general clearing at the end of the day through an EFT terminal (such as the Burroughs RT500). Others informed a mini-computer within the branch, which kept balances and corresponded with the central computer. The advent of storage within the machine also opened possibilities for customising the device through software applications as well as storing different types of records (such as a table of cancelled or overdrawn accounts). A combination of ‘stand alone’, batch and synchronous processing machines thus characterised the 1970s.
Barclays’ immediate response to Lloyds’ ‘Cashpoint’ was to review its own strategy. In February 1973, an urgent feasibility study by the Management Services Department for 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 vouchers had been issued to only 116,000 individual-customers. The report recommended adopting machines with card-activated, on-line, variable amount dispensers. Owing to the lack of an on-line verification capability, balances of both current and Barclaycard (i.e. credit card) accounts could only be ascertained through data encoded on the magnetic strip. It was estimated that developments 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 would cost at least £8000 (including installation).

Barclays decided to proceed and make necessary changes for the new generation of cash dispensers. This required a third computer centre, centralisation of accounting information, development of a dedicated electronic data interchange network, computer terminals in retail branches and microfiche equipment. Initially £83.4 million was budgeted (including £2 million 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 raised the forecast to £93.2 million (BGA, minutes, 25 September 1974).

In May 1975, a more sophisticated auto-teller service, called ‘Barclaybank’ was advertised (‘Barclays has ordered 100 NCR 700’, 27 May 1975, p. 18). The announcement followed a decision made by Barclays’ Automation Committee to order 100 NCR 770 Self-service Financial Terminals in June 1974 (Ackrill & Hannah, 2001, p. 336). The first retail branches to offer the new machines were High Street and Cornmarket Street, Oxford (BGA, ‘Barclays fact sheet: Cash machines’, undated). Shortly after, in September 1975 NatWest introduced its first NCR 770 (advertised as ‘Servicetills’) (RBSGA, press release, 9 September 1975). The first two machines installed in January 1975 were for staff use only. Two more were operational in banking halls in April and May and therefore limited to banking hours. But the machine that came into operation in the Croydon branch in September was external and therefore provided service to the public all year round (RBSGA unpublished research note). By the end of 1977, NatWest had 100 NCR 770 machines in operation alongside 406 Chubb MD2 and MD4 dispensers while 75,000 cards had been issued to customers.

Designed in the US with very similar functionality to the IBM–Lloyds ‘Cashpoint’, the 770 operated using a dedicated plastic card with magnetic strip. They were released in 1974 to allow 24-hour cash withdrawal, envelope deposits as well as requests for cheque books, statements and account balances (I. Ormerod, personal communication, 19 April 2007; RBSGA press release, 9 September 1975). The 770 had a concealed cash tray (that was later exposed) and guided the customer through a moving drum of film (with back light). Encoded within the card there was a magnetic strip which stored a personal credit limit and personal identification number that allowed individual customers to withdraw cash in varying amounts (RBSGA, internal circular, 29 May 1975). 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 hours) (RBSGA, internal circular, 29 May 1975). Another related to taking deposits. As had been the case in previous models, the 770 was capable of accepting and storing envelopes with cash and cheques for deposits (which would have to be validated by bank staff). To support the EFT through the retail branch network, in November 1976 NatWest ordered 2000 B80 mini-computers from Burroughs at an estimated cost of $18 million dollars. Barclays followed suit ordering 500 B80s in 1977 and 500 B90s in 1980.
Also in 1975, Burroughs launched a competitor to the NCR 770, the TC750 with a price tag ranging from $10,500 to $12,000 (equivalent leases valued at $303 to $344 per month, per device).\(^{19}\) Advertised as ‘an intelligent, programmable terminal’, it sought to reduce maintenance costs by being fully compatible with its predecessor (TC700 model) as well as other EFT terminals (such as the popular TC500). This offered financial intermediaries a hardware upgrade without modification to the host’s computer programmes while also enabling the same engineer to service a range of machines during a single call. Other features included updating passbooks (while aiming at mutual financial institutions) and saving in communication costs by using the same line as other terminals. The TC750 had two magnetic tape cassette stations as an extension of memory. One hosted instructions to customise operation. The other stored transaction information when off-line as well as tables of customer card numbers that had been cancelled or had to be retained. These cassettes allowed the machine ‘to operate independently of the data communications network or the central computer’. A couple of years later, programming capabilities allowed the TC750 to emulate IBM terminals. For all its technological capacity, however, it seems that only the TSB adopted Buroughs cash dispensers in Britain.

Meanwhile, the bulk of NatWest’s and Barclay’s NCR 770 machines were to be manufactured in Dundee, Scotland (RBGSNA, press release, 9 September 1975). The move to Scotland resulted from NCR’s strategy to relocate production outside of Dayton, Ohio during the 1970s (NCR Report and Accounts, 1975, p. 2; see further Kotter, 1990; Martin & Riddell, 1996; Rosenbloom, 2000). The plant in Dundee was originally established in 1946 and initially the production of ATMs aimed at servicing only the ‘emergent European and British markets’ (‘Cash advance’, 1996, p. 28). During the move a new model was rolled out in 1978, the NCR 1780. This kept many of the features of the 770 except that it was the first NCR ATM to be fitted with a VDU (NCR Report and Accounts, 1978).

For employees at Dundee, the relocation of the ATM production was an opportunity to apply expertise in mechanical engineering to an electronic product (‘Cash advance’, 1996, p. 28). 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 at one point Barclays even refused to take delivery (with subsequent damage to NCR’s reputation). To remedy the situation and after a couple of years of courting him, a Scott named 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 morale.

Improved performance saw the functionality of the NCR’s ATMs expanding rapidly. For instance, changes implemented by Adamson included introducing a customer-friendly VDU as well as delivering cash horizontally (i.e. long side) rather than vertically (i.e. short side) thus reducing jams by increasing contact and control of individual notes. In 1981, the 1780 allowed transfer of funds, payment of bills and the option of dispensing one or two currency denominations while featuring a keyboard with tactile and audible feedback, integrated 9 × 7 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, but more important to compartmentalise faults so if one component failed the machine continued to be operational) as well as data encryption for added security of both customers and the financial institution (Ian Ormerod Personal Archives, 1981, p. 36). These developments came not from the foresight of engineers at manufacturers but from Adamson actively courting banks as well as ultimate consumers for feedback on their interaction with cash machines.
In 1984 NCR launched the 5070, considered the first full function machine which offered transfers, payments, printing of detailed statements and envelope deposits (Kotter, 1990, p. 27). This model resulted from Adamson’s team outmanoeuvring Dayton-based engineers and effectively relocating the design of cash machines within NCR to Dundee. The features and operability of the 5070 were so advanced for its time that other manufacturers were only at their planning stage and thinking of offering similar features three or four years down the line. This ‘wee outfit’ was thus very much on its way to dominate the cash dispensing market.

As the technology evolved, so did the number of providers with the subsequent wave of disposals and amalgamations. Indigenous manufacturers who had failed to achieve economies of scale were the first to exit. This included Chubb whose involvement in the early days through the manufacture of cash dispensers had increased when it bought all the manufacturing, assets, patents and stock in cash dispensing of Smiths Industries for £218,000 in August 1973 (Chubb Report and Accounts, 1974, p. 5). In 1976, Chubb acquired Gross Cash Registers Ltd. (Chubb Report and Accounts, 1977, p. 11). Together they formed the origins of a company called Chubb Cash.20 As the 1970s drew to a close, observers were aware that replacement demand for cash registers, office machines and cash dispensers, initially spurred by decimalisation, was likely to benefit the likes of Chubb (Investor’s Chronicle, 3 March 1978).21 Results, however, were disappointing. Chubb had introduced a second generation machine (an ‘on-line’ hole-in-the-wall called MD4 and a lobby machine called MD6000 both circa 1975) but the integrated circuits revolution simply escaped the company. By 1980 the trading performance of Chubb Cash Ltd., the company that manufactured and supplied electronic and electromechanical cash registers, automated tellers and point-of-sale-systems, had considerably deteriorated and the company reported operating losses of £4.7 million (including research and development costs to manufacture a new cash dispenser). Shortly after, in 1982, Chubb exited the cash dispenser market for good (Chubb Report and Accounts, 1980, 1981 and 1982).

By 1990 the likes of Burroughs, De La Rue and Docutel had abandoned the manufacturing of cash dispensers as well. But 1990 was memorable for two reasons. First, it was the year IBM withdrew from ATM manufacture,22 a move which was influenced by IBM’s lack of success in that market as much as by the restructuring of its business portfolio away from manufacturing into software development and consultancy. Secondly, NCR became the undisputed leader as marked by the manufacturing of its 10,000th ATM. A machine sold to Barclays Bank which, using the ‘Barclaybank’ banner, was installed as a working exhibit in the Science Museum (Kensington, London) (BGA, ‘Barclays fact sheet: Cash machines’, undated). In 2007, however, a change of policy within NCR resulted in ATM manufacturing relocating to Eastern Europe.

Shared networks

In 1981, a decade after Lloyds installed its first ‘on-line machine’, NatWest had 500 NCR dispensers 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’ (Barclays Report and Accounts, 1978, p. 43). Barclays had fewer machines not only when compared with the other clearing banks but even the smaller TSB (Ackrill & Hannah, 2001, 336). At the same time, Lloyds Bank had its 100th ‘Cashpoint’ operational at the Piccadilly branch in Manchester in 1981 and the 1500th in August 1983 at the Welling, Somerset branch.
(Lloyds TSB Archive, Index cards on ATM). 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 (RBSCG, folder ‘New branch terminals’,
c. 1980). Table 1 summarises the growth of installed ATMs in Britain.

Table 1 shows data collected from three independent sources: that of Gurley combined
a survey of banks and building societies (1972–1992) as well as data from the Association

| Year | Gourley (1999) | Barrie (2006) | RBR (2007) | Average | Change (%) | Total value of transactions (£m) | Change (%) | Avg value of daily transactions | Change (%) |
|------|---------------|---------------|------------|---------|------------|---------------------------------|------------|-------------------------------|------------|
| 1967 | n/a           | n/a           | 192        | 192     | 0          | n/a                             | n/a        | n/a                           | n/a        |
| 1968 | n/a           | n/a           | 355        | 355     | 85         | n/a                             | n/a        | n/a                           | n/a        |
| 1969 | n/a           | n/a           | 595        | 595     | 68         | n/a                             | n/a        | n/a                           | n/a        |
| 1970 | n/a           | n/a           | 646        | 646     | 9          | n/a                             | n/a        | n/a                           | n/a        |
| 1971 | n/a           | n/a           | 738        | 738     | 14         | n/a                             | n/a        | n/a                           | n/a        |
| 1972 | n/a           | n/a           | 925        | 925     | 25         | n/a                             | n/a        | n/a                           | n/a        |
| 1973 | 230           | n/a           | 1243       | 737     | –20        | n/a                             | n/a        | n/a                           | n/a        |
| 1974 | 337           | n/a           | 1491       | 914     | 24         | n/a                             | n/a        | n/a                           | n/a        |
| 1975 | 568           | 568           | 1873       | 1003    | 10         | 111                             | 0          | 542.84                        | 0          |
| 1976 | 676           | 676           | 2055       | 1136    | 13         | 177                             | 59         | 727.32                        | 34         |
| 1977 | 875           | 875           | 2221       | 1324    | 17         | 281                             | 59         | 892.06                        | 23         |
| 1978 | 1000          | 1005          | 2221       | 1409    | 6          | 460                             | 64         | 1271.42                       | 43         |
| 1979 | 1184          | 1184          | 2273       | 1547    | 10         | 733                             | 59         | 1719.69                       | 35         |
| 1980 | 1235          | 1707          | 2585       | 2009    | 30         | 1316                           | 80         | 2141.51                       | 25         |
| 1981 | 2805          | 2807          | 3227       | 2946    | 47         | 2540                            | 93         | 2513.56                       | 17         |
| 1982 | 3928          | 4061          | 4149       | 4046    | 37         | 4290                            | 69         | 2934.42                       | 17         |
| 1983 | 5481          | 5740          | 5631       | 5617    | 39         | 6597                            | 54         | 3192.51                       | 9          |
| 1984 | 6680          | 6815          | 6886       | 6794    | 21         | 9751                            | 48         | 3974.48                       | 24         |
| 1985 | 8664          | 8845          | 9168       | 8892    | 31         | 12,401                          | 27         | 3894.54                       | –2         |
| 1986 | 10,032        | 10,330        | 10,578     | 10,313  | 16         | 15,590                          | 26         | 4192.21                       | 8          |
| 1987 | 11,749        | 12,392        | 12,389     | 12,177  | 18         | 18,848                          | 21         | 4224.95                       | 1          |
| 1988 | 13,342        | 13,980        | 14,116     | 13,813  | 13         | 24,320                          | 29         | 4832.30                       | 14         |
| 1989 | 15,235        | 15,746        | 16,100     | 15,694  | 14         | 31,948                          | 31         | 5636.00                       | 17         |
| 1990 | 16,730        | 17,344        | 17,353     | 17,142  | 9          | 38,474                          | 20         | 6161.91                       | 9          |
| 1991 | 17,466        | 18,101        | 18,237     | 17,935  | 5          | 52,080                          | 35         | 7992.19                       | 30         |
| 1992 | 18,258        | 18,652        | 18,761     | 18,557  | 3          | 55,975                          | 7          | 8336.16                       | 4          |
| 1993 | n/a           | 19,140        | 19,377     | 19,259  | 4          | 60,200                          | 8          | 8736.79                       | 5          |
| 1994 | n/a           | 19,957        | 20,165     | 20,061  | 4          | 65,170                          | 8          | 9070.89                       | 4          |
| 1995 | n/a           | 20,933        | 20,922     | 20,928  | 4          | 72,090                          | 11         | 9566.24                       | 5          |
| 1996 | n/a           | 22,121        | 22,118     | 22,118  | 4          | 80,235                          | 11         | 10,073.27                     | 5          |
| 1997 | n/a           | 23,193        | 23,349     | 23,349  | 6          | 89,994                          | 12         | 10,778.40                     | 7          |
| 1998 | n/a           | 24,574        | 24,941     | 24,758  | 6          | 98,230                          | 9          | 11,103.65                     | 3          |
| 1999 | n/a           | 27,379        | 27,671     | 27,525  | 11         | 107,852                         | 10         | 10,942.29                     | –1         |
| 2000 | n/a           | 33,000        | 32,296     | 32,648  | 19         | 113,013                         | 5          | 9512.88                       | –13        |
| 2001 | n/a           | 36,666        | 36,593     | 36,630  | 12         | 127,428                         | 13         | 9653.81                       | 1          |
| 2002 | n/a           | 40,825        | 40,795     | 40,810  | 11         | 136,364                         | 7          | 9278.36                       | –4         |
| 2003 | n/a           | 46,461        | 46,938     | 46,700  | 14         | 144,123                         | 6          | 8616.73                       | –7         |
| 2004 | n/a           | n/a           | 54,404     | 54,404  | 16         | n/a                             | n/a        | n/a                           | n/a        |
| 2005 | n/a           | n/a           | 57,798     | 57,798  | 6          | n/a                             | n/a        | n/a                           | n/a        |
| 2006 | n/a           | n/a           | 60,642     | 60,642  | 5          | n/a                             | n/a        | n/a                           | n/a        |

Sources: Gourley, 1999, p. 4.9; Barrie, 2006, p. 115; Retail Banking Research (London, 2007) and own estimates.
for Payment Clearing Services (APACS); Barrie’s was based on surviving records of the
British Bankers Association and APACS, while the methodology of Retail Banking
Research (RBR) was not disclosed. The largest variance is observed between RBR and
the other two series for the 1967 to 1985 period. Thereafter differences seem minor. It is
thus likely that RBR is overestimating installed capacity by considering different types of
devices (such as EFT terminals). The comments that follow are thus based on Barrie
(2006) as it offers the longest series from the same source.

Data in Table 1 suggests that during the 1970s the cash dispenser fleet grew at about
20% per annum. As a result a ‘heritage’ was at work: a fleet of combined machines
installed throughout the decade with different functionality (Cortada, 2006, p. 35). This
was due to the installation of new machines before disposing 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 with greater functionality beyond the ‘tipping point’ in 1980. First, a
sharp increase in the number of installed ATMs, followed the process of regulatory change
that swept British banking in the early 1980s (a process initiated after the removal of
controls for retail currency transactions in 1979 and qualitative allocation of credit, ‘the
corset’, in 1981). During this period, large pools of people were joining the banking system
as the payment of wages directly into current accounts accelerated (Bátiz-Lazo & Reese,
2008, p. 4). Cash dispensers were seen as a critical device for competition in retail finance,
as a way to ease congestion at retail bank branches. So the combination of individual
strategies and regulatory changes resulted in the growth of ATM stock accelerating: 44%
between 1979 and 1980, 64% in 1981, 45% in 1982 and 41% in 1983.

A second element deals with how the process of computerisation of certain routine jobs
had the potential to lower headcount and increase financial returns. Growth of installed
ATM in the UK speeds up between 1979 and 1982, when it is above 60% (according to the
data collected by Barrie and reported in Table 1 above). At the same time, total staff in the
banking sector hovers around a 10% annual growth between 1970 and 1979 (APACS,
various issues). Thereafter it 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 thing, other technological applications to deliver retail financial
services (such as telephone and internet banking) come into play. However, the ATM was
the chief alternative to the human teller during the 1980s. Comparing the growth rates of
installed cash machines and employees in banking thus seems to support Revell’s idea that
human cashiers being displaced by ATMs took place by lowering recruitment rates rather
than through redundancies during the 1980s (Revell, 1983, p. 67).

The installation of cash dispensers by building societies was a third factor adding to the
growth of the ATM stock during the 1980s. Initially the number was modest. The Halifax
installed six to experiment with the technology while servicing a small group of customers
who had access to cheque accounts.24 The first was an IBM 3614 in 1978 at head office
while five IBM 3624 were deployed in different retail branches throughout 1979 (Barrow,
2006, p. 72). Alliance & Leicester followed shortly after, also installing IBM machines.25
The timing of these developments is interesting because before the Building Societies Act
1986 societies were limited to accepting deposits and lending only for house purchase
because they could not offer overdraft facilities. This meant that building societies and
TSB had to develop on-line, real-time capabilities before they could offer automated
withdrawals from savings accounts.

According to Barrow, the Halifax’s initial encounter was useful to learn about the
‘failities’ of IBM cash dispensers (Barrow, 2006, p. 82). Not surprisingly when the time
came to install a large fleet in 1983, this society deployed 100 Phillips devices, that is,
Diebold cash machines manufactured in the USA but distributed under licence while incorporating De La Rue note dispensing capabilities.

Cash dispensers at building societies grew to 112 in 1983 and 291 in 1984. The trend intensified with the passing of the Building Societies Act in July 1986, which allowed the diversification of the business portfolio of the societies (while aiming to put them on the same footing with clearing banks). The number of machines then grew to 652 in 1985 (7% of the total according to data in Table 1 by Barrie), to 1286 in 1986 (12% of total) and to 2072 in 1987 (17% of total). Interestingly through this process the societies, most of which had started their computerisation on the back of IBM System 360, were no longer loyal to ‘Big Blue’ and purchased the much quicker, more reliable, cheaper and sophisticated NCR cash machine.

At this point some societies and other non-bank participants of retail financial markets decided there was more to be gained by creating a shared network than developing their fleet of ATMs organically. Its genesis dates to 1982 when the then head of strategic planning at Girobank, John Hardy, faced a dilemma: how to offer an increasingly popular technology to some 1.3 million customers evenly distributed through the UK. Investing in some 1000 devices was out of the question. Management was only willing to purchase a couple of hundred machines while Hardy estimated that transaction volume was also low (and would not justify a four-digit fleet). Partly out of necessity and partly influenced by developments in the US (namely the actions of Western Trust and Savings), Hardy found that big clearing banks were not interested in sharing their network but a small group of like-minded executives existed in other financial providers. 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 LINK (‘Building society’, 1985).

LINK established as a joint-owned company which invested in computer technology to articulate a central platform for an ATM network. The company was chaired by Hardy from its inception until he retired in 2005. The leverage gained through a shared network was self-evident as some members like the National Giro were making their first machine operational (N. Hardman, Group Archives, Alliance & Leicester, personal communication, 3 May 2007). 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. 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 called ‘Sharing Group’ was built by bringing together a small group of building societies, but it was short-lived as it amalgamated with LINK (J. Hardy, former CEO of LINK, personal communication, 21 November 2007). A third network was launched in March 1986. Its biggest contributor was the Woolwich Equitable Building Society (traditionally the fourth largest in terms of assets). The Woolwich had launched its ‘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 the general public in Greater London and the South East (i.e. the Woolwich’s longest trading areas) was not launched until mid-October (‘Cashbase: Switch-on’, 1985). The name ‘Cashbase’ was chosen ‘after market research among target customers’ and supposed to be ‘simple, memorable and which would not date’ (‘Cashbase set for launch’, 1985). Cashbase machines offered a range of services namely, up to £250-a-day cash withdrawal, deposit and balance enquiry. The Woolwich then led six other building societies to establish ‘MATRIX’ (namely Leeds, National & Provincial, Alliance, Anglia, Bradford & Bingley...
and Leicester) (‘Countdown to Cashbase’, 1985). This gave 8.1 million individual customers access to a network of 346 machines at the end of 1986.\textsuperscript{30} Growth for MATRIX was relatively slow as, for instance, the Woolwich reached the 100 mark until October 1987 (but had installed the first non-branch machine at J. Sainsbury’s retail store in September 1988). However, in spite of the apparent disadvantage of a smaller network for the Woolwich, the rolling out of MATRIX and the ‘Cashbase’ account was key to transfer customers from passbook operated deposit accounts to current accounts.

LINK then grew in size and credibility when the Halifax’s 1200 ATMs were made available to all customers in July 1989. However, the Halifax introduced a 50 pence ‘disloyalty charge’ (paid when using a non-Halifax ATM) in order to encourage Halifax customers to use the society’s ATMs whenever possible (Barrow, 2006, p. 98).

Alongside the creation of LINK and MATRIX, banks signed reciprocal sharing agreements. One built in around Midland, NatWest and the TSB Group. NatWest and Midland had signed an agreement through which customers could use their cards in either bank’s machines to withdraw cash back in 1983 (RBSGA unpublished research note). The TSB joined them shortly after. A second established in March 1987 by Barclays, Lloyds, Bank of Scotland and the Royal Bank of Scotland (which the West of England Building Society joined in 1988) (BGA, ‘Barclays fact sheet: Cash machines’, undated).\textsuperscript{31} The main difference between banks’ sharing agreements and building societies’ LINK was that banks had wired their mainframes directly rather than to a central computer acting as a network switch. In contrast, LINK’s central computer would act as clearing house by receiving and transmitting transactions between the member that operated the ATM and the member hosting the customer’s account. However, in the early 1990s early adopters of ATM technology like Midland, with a 2000 strong network of machines in operation, abandoned sharing agreements as these proved cumbersome to manage and were found to have limited capabilities to increase their scale.

The emergence of shared ATMs during the 1980s effectively meant the commoditisation of retail financial services (in this case, cash withdrawal). Shared networks were also symptomatic of the end of the proprietary ATM network as a source of competitive advantage in the markets for retail finance. This strategic shift was reinforced by the presence of network externalities. These occur when the value of the network increases as new users join the network. As more members join, the network becomes more valuable to each individual user. Network externalities result in ‘increasing returns’, that is, as the network continues to grow, it becomes easier to attract additional users. The larger number of users in the expanded network makes deployment of ATMs more profitable, which further enhances accessibility for existing members.

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 Crystal Palace store in 1983 (RBSGA, news release, 1 December 1988). At the time this was heralded as a bank’s first off-branch location. However, a Lloyds Bank ‘Cashpoint’ was operational at John Lewis’ store in Birmingham in December 1974 (Lloyds TSB Archive, Index cards on ATM). This gave Lloyds the prestige of having operated the first cash dispenser in a non-banking site for almost 10 years before others.\textsuperscript{32}

The move to non-banking sites was not immediate. As late as 1986 there was room for improving provision in retail branches (by installing second and third machines in high-usage sites) as well as enhancing the reliability and convenience of installed machines (e.g. by extending on-line services to 24 hours a day to all machines) (RBSGA, circular,
January 1986). Indeed, it was not until 1994 that NatWest embarked on an active programme to operate cash machines in non-branch locations. These included high-traffic sites at Boots the Chemist, J. Sainsbury’s supermarkets and railway stations (RBSGA unpublished research note). Other attractive sites included hospitals, airports, petrol stations and motoring services. Barclays went even further and installed cash dispensing machines in the House of Common (1990), the House of Lords (1996) and even a ‘drive in’ at Hatton Cross near Heathrow airport (1998) (BGA, ‘Barclays fact sheet: Cash machines’, undated).33

In the process of ‘optimising’ locations at retail branches, some cash points were closed to reciprocal agreement. NatWest, for one, kept its ‘Rapid Cash Tills’ (RCT) outside the agreement with Midland as late as 1986. Introduced in April 1983, two years later there were 650 RCTs in operation. The RCT was installed by NatWest mainly in Saturday opening branches as a way to service customers and keep down 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-introduce Saturday opening in August 1982 (BGA, ‘Barclays fact sheet: Cash machines’, undated). NatWest increased the number of RTCs to 900 in 1986, emphasising its concern with making more of automation while moving away from routing paper processing.

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, p. 4). Although exact figures were unavailable, between the 1980 and 2000 these fees oscillated between 25p and 45p in the UK (Barrie, 2006, p. 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. At the same time, the average withdrawal almost doubled in nominal value. For NatWest the average withdrawal (in nominal value) grew from £28.64 in 1986 to £47.00 in 1997 (RBSGA, news release, 1 December 1988). It is likely that this was not unique to NatWest but part of a trend where retail banking customers responded to a greater number of available machines and locations.34 For the likes of Midland, NatWest, Halifax, the TSB and Barclays, who had the largest proprietary networks and managed the most attractive off-branch sites (such as the busiest railway stations and forecourts of the largest supermarkets), reciprocity agreements were seen as a way to generate fee income. 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. The increase in the number of withdrawals provided incentives for those with larger networks to increase the number of reciprocity agreements that would make their fleet available to others.

The passing of the international standard on the physical characteristics of cards and magnetic strip in 1978 facilitated the use of Visa and Mastercard credit cards at ATMs. This accelerated as the international franchises opened their clearing networks to EFT and synchronous retail electronic payments as well as cash withdrawals by individuals. Meanwhile, the collapse of EFPOS UK Ltd. and the subsequent introductions of ‘SWITCH’ by Midland, NatWest and RBS while Barclays launched its ‘Connect’ card in June 1987, resulted in the debit card replacing payments by cheque and withdrawals using ATM cards.

The mid-1990s were rather uneventful for the ATMs. NCR’s Dundee plant was the world’s leading manufacturer while debit cards helped cash withdrawals to grow in popularity. However, things started to change when NatWest joined the LINK network in
March 1997 and, in the process, doubled the number of machines available to its customers to 17,622 (RBSGA, unpublished research note). From October of the same year, individual customers could also access RBS machines when the latter also joined LINK. When Barclays joined the network in November 1998, 21,000 machines became available to customers of members. This expansion of LINK was followed by an attempt to impose blanket charges on ATM transactions by Barclays in 1999. The move was vilified by the press and resisted primarily by participating building societies (and notably Nationwide). All charges for cash withdrawal from current accounts were dropped and, in effect, interconnectivity amongst all banks and building societies offered all retail customers a ‘free to use’, single national ATM network in the UK.

Also in 1998 the first ‘Independent ATM Deployer’ (IAD) joined LINK. Sponsored by the Woolwich and following the successful business model its main shareholder had developed in the US, Hanco broke the mould by charging a withdrawal fee (£1.50), using simple to use and inexpensive machines (Triton), and deploying in locations far away from ‘free to withdraw’ cash machines (such as pubs and small food stores). LINK then changed its rules to discourage sponsorships while, at the same time, open to any financial or non-financial organisation that met a set of minimum requirements to become a member. By the end of 2003 some 13 IADs came into existence. They owned or managed a total of 14,436, dispensers or about 30% of installed capacity. By 2007 the IADs operated about half the fleet in the UK. However, they were responsible for less than 5% of total withdrawals. Instead, the largest net acquirers of the interchange fee in LINK were those operating in the forecourts of large food retailer chains, namely two joint ventures (Tesco Personal Finance between Tesco and the RBS, and Sainsbury’s Bank owned in equal share by J. Sainsbury’s and the HBOS Group) and those operated by the Co-operative Bank in the retail space of stores owned by its parent (The Co-operative Group).

Conclusion

During the last three decades of the twentieth century, British banks replaced their ambition to become a ‘global financial supermarket’ to focus on providing a diversified offering in UK retail finance. Building societies continued to consolidate, remained the main providers of mortgage loans and, after 1986, diversified into other areas of consumer finance. The TSB amalgamated into a single provider in 1985. It also diversified its business portfolio but was merged with Lloyds Bank in 1995. 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 ATMs help explain a number of changes in the internal and external environment of financial intermediaries in at least five instances as follows.

First, 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.

Second, the retail branch ceases to exist as the main ‘production unit’ and dominant point of contact with retail clients. Contrary to popular accounts, 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 on labour costs and increasing customer convenience (including, for the first time, the possibility to bank at any retail branch). But
ATM emerges as part of a purposeful strategy. One which from the outset aimed to blur the physical boundaries of the banking organisations while it developed retail branch and non-retail branch locations as well as being mediated by advertising and capital budgeting. 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 with retail customers (such as electronic funds at point of sale terminals, telephone and internet banking). Thus, the history of the ATM is much more than telling a story of a response to an ‘impending need’ of a more mobile population. It is a history of technical and organisational innovation.

Thirdly, there was a consistent and sustained effort of the main clearing banks to support the development of proprietary networks, even after the ‘tipping point’ of ATM adoption had been passed, as proprietary ATM networks were perceived as a source of competitive advantage by clearing banks. As opposed to experiences in Portugal, Sweden and the US, interconnectivity was slow to develop in Britain. Building societies and the TSB embraced ATM technology 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. Attempts to introduce disloyalty charges failed through a combination of bad public relations and the strategies of some participants (notably the large building societies). The ATM then 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 involvement with 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 (2005) ‘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 banks engaged advertising and finance staff to ensure the success of the new offering.

But individual choice and market control were limited as new designs incorporated international standards (e.g. plastic cards, magnetic strip, electronic exchange protocols). Manufacturers then offered designs with a number of modular options from where they could choose. 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).

Finally, two important actors are missing from this story. These are the bank regulator and the 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 within central banks, in the money supply and in monetary control. For instance, joint ATM networks imply the creation of electronic fund payments systems protocols. Automation also had a potential impact on the balance between cash deposits and non-cash deposits (Walker, 1975) as well as for preferences of cash at hand. The ATM is also associated with a change from payments in
cash and cheques 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 role of bank regulator and shared that of monetary authority in Britain. 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, p. 15). When and how 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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Notes
1. Others who have written on the emergence and diffusion of ATMs in the US include doctoral dissertations by Hopkins, 1986; Lane, 1989; Lee, 2000; Lozano, 1987; Peffers, 1991.
2. Note that by 1911, a process of amalgamation left some 80% 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 organisations which for most of their history specialised 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 the 1970s, these were joined by the National Giro Bank and the Co-operative Bank.
3. Bank of England Archive, C54/10 Chief Cashiers Duplicate Letters, C.L.C.B. Meeting of June 30, July 2, 1964; Webb, 1969; Thomas, 1969.
4. Retrieved April 16, 2007, from http://americanhistory.si.edu/collections/comphist/wetzel.htm
5. Retrieved April 16, 2007, from http://en.wikipedia.org/wiki/Automated_teller_machine and http://web.mit.edu/invent/iow/simjian.html
6. In 1970 the Westminster Bank and the National Provincial Bank merged into the 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.
7. According to this article the actual date of operation was December 28, 1967: ‘The first cash machine soon proved a hit!’
8. The other exception being the Bank of Scotland which also adopted De La Rue’s DACS in 1971 (and called it ‘Scotscash’) thanks to the shareholding links with Barclays.
9. Certainly the account that predominates in the US popular press, see http://www.atmmarketplace.com/article.php?id=1339 (accessed April 18, 2007); http://money.cnn.com/magazines/fortune/fortune_archive/2004/07/26/377172/index.htm (accessed April 18, 2007); a brief oral history of Dan Wetzel at http://americanhistory.si.edu/collections/comphist/wetzel.htm (accessed April 16, 2007).
10. By 2007, NCR had about 70% of the world ATM installations. In Britain it was about 90% (I. Ormerod, Ex-Officio Historian of NCR, personal communication, April 11, 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’s leading manufacturer (The history of NCR, c. 1999, p. 107).
11. 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", 1970).
12. Unless otherwise stated, this paragraph borrows freely from ‘Bank scores “first”’, 1970, ‘Counter revolution’, 1971.
13. However, the team at Speytec (which by that time had moved to be a subsidiary of Burroughs in the UK) already had a couple of years experience in developing a cash machine operated by a card and magnetic stripe (Bátiz-Lazo and Reid, 2008a).
14. Unless otherwise stated, this paragraph borrows freely from BGA, minutes, March 5, 1973.
15. This suggests that perhaps Barclays made available to the public a similar external machine shortly before NatWest.
16. 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 armoured 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). That is, an average of 667 customers per machine. The Westminster would achieve economies of scale at Walker’s rate of 44,000 transactions per machine per month if each of the Westminster’s customers made, on average, 1.2 withdrawals per week.
17. Burroughs Corp., Annual Report and Accounts, 1977, p. 23. Charles Babbage Institute holdings (CBI), Burroughs Corp., Press Releases (90:72, Box 10, Folder 6, Item 60, November 16, 1976).
18. Burroughs Corp., Annual Report and Accounts, 1978, p. 7. CBI (90:72), Burroughs Corp., Press Releases (Box 10, Folder 14, Item 45, May 8, 1980).
19. Unless otherwise stated this paragraph borrows freely from CBI (90:72), Burroughs Corp., Press Releases (Box 10, Folder 1, Item 12, February 18, 1975).
20. The cash register business based in Hollingbury near Brighton was sold shortly after amalgamation while manufacturing of cash dispensing technology moved to Chubb Integrated Systems. The latter was eventually renamed Chubb Security Installations or CSI. 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. J. Garland, Marketing Communications Manager, Chubb Fire Limited, personal communication, April 10, 2007; A. Jacques, Design and Engineering Manager, Gunnebo CSI, personal communication, May 1, 2007; retrieved April 16, 2007, from http://www.csisec.com/company_profile_history.htm; http://www.chubb.co.uk/chserver/request/setTemplate:singlecontent/contentTypeA/webdoc/contentId/646/navId/00000b000
21. Note that in 1970, Chubb purchased ICC Machines Ltd., a specialist in devices for counting, issuing and changing coins.
22. ‘Cash advance’ (1996, p. 37) quotes and briefly discusses the following heading that appeared in Fortune magazine: ‘The wee outfit who decked IBM’.
23. 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 & Glyn’s Bank; and later rebranded as the Royal Bank of Scotland in 1985.
24. Prior to the amalgamation of the Halifax Equitable and Halifax Permanent in 1928 both had their own banks. This resulted in a legacy of 11,000 deposit cheque accounts (DCA) serviced through four branches (Halifax, Huddersfield, Bradford and Sheffield). These accounts enabled the deployment of a small number of IBM3624 cash machines (R. Barrow, Halifax, personal communication, May 19, 2008; Barrow, 2006, pp. 72 and 82).
25. Disregarding the small experiment by the Halifax, Alliance & Leicester has a claim to be the first in the field. It is not clear whether these were IBM3614 or IBM3624. (N. Hardman, Group Archives, Alliance & Leicester, personal communication, May 3, 2007).
26. Note that the survey by Gourley (1999, p. 4.46) attributes the first ATM to the Halifax until 1983 and claims the Alliance & Leicester had 16 in operation in 183 (to a total of 17 for all building societies).
27. Unless otherwise stated, the reminder of this paragraph borrows freely from J. Hardy, former CEO of LINK, personal communication, November 21, 2007.
28. The first machine to be installed in a British rail station was 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. (RBSGA, January 5, 1968).

29. Renewing the offer of envelope deposits by Cashbase in the mid-1980s was interesting. As noted above, this was the central feature of the Simjian machine in 1960 and had been pushed by US banks along cash dispensing given their interest in capturing core deposits during the 1970s. In the UK, Barclays explored the possibility of accepting envelop deposits via cash dispensers as early 1976, but found that transactions involving withdrawals were ten times more frequent. Indeed, in December 1976 the Management Services Department reported that 43,670 Barclaybank cards had been issued in the four weeks to November 27, while there had been 6983 withdrawals (at an average of £21 per withdrawal) there were only 663 deposits (average amount not disclosed). 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 (BSA, minutes, December 15, 1976; N. Webb, Barclays Group Archives, personal communication, June 23, 2007).

30. Initially there were 120 cash dispensers. These were expected to increase to 400 in number by the end of the year and to 1000 installed machines within two years. See further ‘Scotland joins Cashbase link’, 1986; ‘Matrix gets off to a flyer’, 1986.

31. However, an internal document also compiled by Barclays Group Archives claims ‘Barclays joins a consortium of five banks sharing ATM facilities’ in April 1983.

32. 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) that these were operated as an integral part of the bank rather than at arm’s length.

33. Interestingly, Barclays ‘drive in’ came some 20 years after similar facilities had been tried and tested in other countries. Some of these remained a part of everyday life (i.e. USA) while others were very short-lived (i.e. Mexico).

34. 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 June 7, 2007). The deflated value of NatWest’s average withdrawals in 1997 is then £28.20 or 2% below £28.62 observed at the end of 1986.

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