

Recent changes in the use of cash⁽¹⁾

- *Demand for cash has recently been growing much more slowly than expected.*
- *This is difficult to reconcile with the proposition that the 'black economy' has been expanding.*
- *There are a number of possible explanations for the slower growth: changes in the way consumers make payments, away from cash and towards cheques, are emphasized.*
- *These changes have been more rapid in the UK than in many other countries; we now use rather less cash in relation to spending levels than other European countries, but still more than North America.*
- *Such structural changes imply that movements in cash are unlikely to be helpful as a guide to general economic or financial conditions.*

The Bank of England has several reasons for maintaining a close interest in the amount of cash in circulation and its composition. The Bank prints and issues most of the notes in circulation in the United Kingdom;⁽²⁾ changes in the note circulation influence the balances that banks keep at the Bank and hence affect money-market operations; and in the conduct of monetary policy, the Bank needs to assess and to interpret movements of all the monetary aggregates. Cash in the hands of the non-bank public represents the major part of the wide definition of the monetary base⁽³⁾ (91% as at November 1982), a sizable proportion of M_1 the narrow definition of the money supply (29% at the same date), and progressively smaller proportions of the wider aggregates. Recently, however, cash holdings appear to have been growing notably more slowly than bank deposits—over the last two years the value of the public's cash holdings grew by 10%, while sight deposits grew by 28% and time deposits by 30%. Moreover, the recent slower growth in cash holdings was not predicted by the Bank's forecasting equations, whereas the growth in M_1 was broadly in accordance with expectations.⁽⁴⁾

This article discusses some possible explanations of this development and analyses survey evidence of the way that the use of cash has been changing. Although such evidence needs to be treated with caution, there appears to have been a pronounced movement in recent years away from cash and toward other means of payment.

The article concentrates on cash held outside the banking system, which accounts for over 90 per cent of the total UK currency in circulation⁽⁵⁾ and currently amounts to about

£11 billion.⁽⁶⁾ The remainder (about £1 billion) is held by the banks in their tills and vaults, in order to meet the demands placed on them by the public; the determination of this latter part of the currency in circulation was discussed in the June 1979 *Bulletin* and is not of direct concern here. No reliable figures are available regularly on the division of the stock of cash by type of holder, but it is thought that about 90 per cent is held by individuals. The remainder is mostly accounted for by industrial and commercial companies and the public sector (notably the Post Office), with insignificant amounts held overseas and by the 'other financial institutions' category (which includes building societies).

The slower growth of cash

For much of the 1960s and 1970s, cash holdings grew rather more slowly than nominal income and expenditure. In the fifteen years to the end of 1978, the value of consumers' expenditure increased on average by some 11½% each year, while cash increased by about 9½% per annum. But in the latest three years the value of consumers' expenditure has grown on average by 11% while cash has grown by only 5% per annum. As a result, the ratio of consumers' expenditure to cash has grown at an appreciably faster rate since 1978 (Chart 1).

This development is not the direct result of action by the monetary authorities because the size of the outstanding stock of cash is determined by the public rather than by the authorities.⁽⁷⁾ Anyone with a bank current account can transform balances held there into cash at will; and the

(1) This article is based largely on the work of J M Trundle of the Bank's Economics Division; P V Temperton also of the Bank's Economics Division helped, primarily in preparing the Appendix. The Bank is grateful to both the Inter-Bank Research Organisation (IBRO) and AGB Index Ltd. for their co-operation.

(2) The three Scottish clearing banks and the four banks operating in Northern Ireland issue their own notes, but these must be covered, apart from their very small fiduciary issues, by holdings of Bank of England notes, or by coin.

(3) See the March 1981 *Bulletin*: 'The monetary base—a statistical note'.

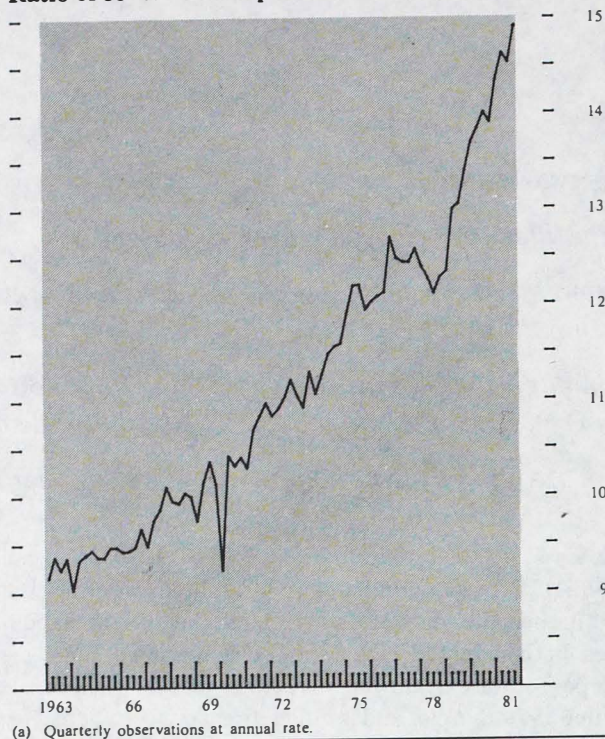
(4) The forecasts are subject to substantial margins of error but have not systematically over- or under-predicted monetary growth.

(5) Unless otherwise stated 'cash' in this article refers to notes and coin in circulation outside the banking system.

(6) There is a strong seasonal pattern in currency circulation. For example, the level rises during holiday periods and falls back afterwards. This article is not concerned with such fluctuations which have no macro-economic significance.

(7) That is not to say that the authorities do not wish to influence cash use, for example by encouraging the payment of wages by bank means. The Bank also wishes to encourage economy on the part of the public in the use of new (as opposed to re-issued) notes, but the occasional moratoria on the issue of new notes are not intended to restrict cash use. See page 523 for a discussion of these restrictions on the supply of particular denominations.

Chart 1
Ratio of consumers' expenditure^(a) to cash



It is hard to reconcile the experience of slower growth in the demand for cash with the purported expansion of the 'black economy' to which some have pointed. If this phenomenon were as prevalent as suggested, it would have tended to lead to greater use of currency rather than the reverse. By definition, few hard facts about the 'black economy' are available. The recent faster growth of higher denomination notes is sometimes adduced in evidence. It is argued that, since high-value legal transactions are relatively infrequently made in cash, the faster growth of high-denomination notes than of low-denomination ones implies an expanding 'black economy'. This development, however, is more likely to reflect the effect of inflation on the value of goods which each denomination of note will buy (this is discussed further on page 523).

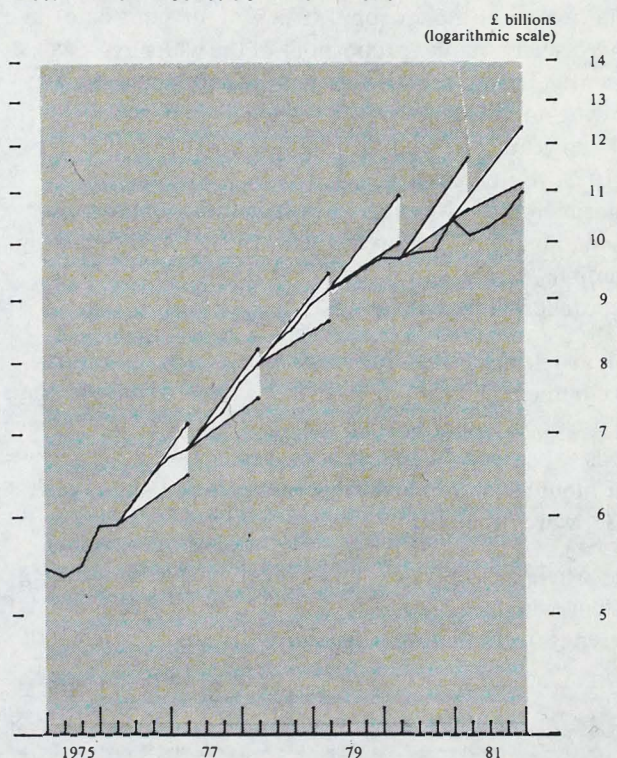
There are a number of possible explanations for the surprising development in cash demand, although most of them are not susceptible to rigorous statistical testing.

High nominal interest rates may have caused individuals and companies to make particular efforts to economise on cash balances. But there is no reliable evidence to support the hypothesis that they have in fact done so in the United Kingdom. In contrast to the experience of some other industrialised countries,⁽³⁾ it has not proved possible to find a stable econometric relationship between interest rates and cash balances in this country. On the other hand, in studies

Bank of England and the Royal Mint supply notes and coin to the banks freely on demand. Any increase in the net demand for notes by the public will first of all be felt by the banks. Their reserves of notes will be drawn down, but they will seek to replenish these by drawing notes from the Bank (paid for out of the working balances which they hold at the Bank⁽¹⁾). No controls or limits are placed on this process, so the total level of cash balances held by the public is demand-determined. Similarly, in respect of coin, the Royal Mint (which is responsible for coin production and circulation as agent of HM Treasury) aims broadly to supply the banks with their requirements on demand. In practice, the banks' demand for notes from the Bank (and to a lesser extent coin from the Royal Mint) is very responsive to variations in public demand because it is costly for the banks to hold too many idle balances in the form of non-interest-bearing till money,⁽²⁾ although the banks have been very successful in economising on average cash balances in the last few years.

Recently, growth in the demand for cash has been much less than expected on the basis of previous experience, and the Banks' cash forecasting equations have overpredicted. (Forecasts from a representative equation are shown in Chart 2.) These equations relate the demand for cash to consumers' expenditure since cash is held primarily to make transactions. The econometric procedures used and typical results obtained are reported in the technical appendix.

Chart 2
Actual and forecast demand for cash^(a)



(1) The implications of changes in these balances for the Bank's money-market operations are described in the March 1982 *Bulletin*.
 (2) Banks have to balance this consideration with the problems (not least of acute embarrassment) which might follow if cash reserves were inadequate to meet demand. The factors determining till money stocks will include the average size, variability and maturity structure of deposits, the number of branches and the ease with which cash can be transferred between branches.
 (3) Significant evidence of such an effect has been found in particular in West Germany, Switzerland and the United States.

of M_1 a significant interest sensitivity is generally observed; M_1 tends to grow more slowly when interest rates are rising. This moderation is concentrated in sight deposits⁽¹⁾ rather than cash.

Rising unemployment could have been an important influence. Those becoming unemployed might have previously used cash to a greater extent than average and the lower level of unemployment benefits might have thus reduced the average demand for cash. It is hard to test this hypothesis adequately, but a simple attempt is reported in the appendix; it provides some apparent support for such an effect. A rise in the rate of unemployment appears significantly to reduce the demand for cash. If this variable is included in the cash equation previously used, the forecasting properties and goodness of fit are improved. The improvement is not dependent upon the last three years of data, when large changes in the rate of unemployment accompanied much slower growth of cash. Nevertheless it is equally clear that the rise in unemployment since 1978 does not completely explain the slowing in the demand for cash. Moreover, a change in the growth in cash had already taken place by mid-1980 when unemployment stood at about two million.

The exchange rate has been found in some studies in other countries to influence the demand for cash. In some small part this may be because of speculative demand, with exchange rate expectations playing a role. In addition, a large migrant population making transfer payments abroad and the increasing popularity of foreign travel may help to explain this effect. No such influence has been found in the United Kingdom, but non-resident holdings of sterling notes are thought to be very small (perhaps 1% of the total stock).

Perhaps most important of all, the *use of banking services* has increased at the same time that the growth of cash has slowed. This spread of the banking habit is reflected in the increasing proportion of wages and salaries that are paid directly into bank accounts rather than as cash in wage packets; and consumers are more frequently using cheques drawn on bank accounts rather than cash to make payments.

A number of other developments in the financial system have also affected the need for consumers to carry cash. The introduction of cheque cards has allowed cheques to be much more widely used in transactions, the use of credit cards is increasing,⁽²⁾ and access to cash has been improved by the proliferation of cash dispensers:⁽³⁾ all these have

Table A
Wage and salary payments

	1969	1976	1979	1981
			<i>Percentages</i>	
Cash	75	59	54	44
Cheques(a)	10	12	14	15
Credit transfers(b)	15	27	31	38
Other	—	2	1	3
			<i>Millions</i>	
Employed population	25	25	25	23½

Source: IBRO.

(a) Cheques are sent to the employee and may be cashed or paid into a bank or building society account.

(b) Credit transfers are payments directly credited to a bank account.

reduced the amount of cash needed to meet unexpected transactions. The statistical evidence for these developments is now discussed.

Wage payments

Statutory requirements can influence the demand for cash. For example, the Truck Acts (enacted between 1831 and 1940), designed to stop workers being paid in goods or tokens, require that manual workers be paid in cash. Subsequently modifications were made to these acts, introduced in the Payments of Wages Act (1960), to enable manual workers to be paid by other means if they wish.⁽⁴⁾ As a result there has been a gradual move away from payment in cash which has recently been gathering pace. Between 1979 and 1981 the proportion of employees paid in cash is estimated to have fallen from 54% to 44% (Table A); this fall is more rapid than in any previous period. The recent increase in unemployment will have had some effect, because it seems to have particularly affected those paid in cash. But, in contrast to its apparent impact on consumers' demand for cash, the influence of unemployment on the pattern of wage payments is small.⁽⁵⁾ The major change was a switch by over two million people, who were paid in cash in 1979, to payment by other means in the following two years.

This move has been most marked among manual workers where the proportion paid in cash fell particularly sharply between 1976 and 1981. It seems likely to have continued since 1981 because of a promotion campaign by the banks. And there would seem to be plenty of further room for a decline in the cash-paid proportion. In 1981, there were still over ten million adults paid in cash and about half of these already had a bank account.

Account Holding

There has been an accompanying movement towards monthly rather than weekly pay,⁽⁶⁾ and an increase in the

(1) An increasing proportion of sight deposits, however, are interest-bearing and are therefore less responsive to changes in the general level of (as opposed to relative) interest rates.

(2) The number of credit cards issued has doubled to over twelve million in the five years to 1981 and at least one card is now held by about a quarter of the adult population.

(3) The number in use has risen from about 2,200 in 1979 to about 3,200 in 1981 with 4,000 projected for 1982 and 5,300 for 1983. AGB Index estimate that about 13½% of the value of personal cash withdrawals from banks and building societies are through cash dispensers.

(4) More information on the Truck Acts may be found in the Central Policy Review Staff report *Cashless Pay*; HM Stationery Office, London, 1981. This also considers the advantages and disadvantages of a move towards cashless pay.

(5) There was an increase of about 1.5 million in the unemployed between the 1979 and 1981 IBRO surveys and about 1 million of these were probably previously paid in cash. If this had been the only influence on wage payments, the proportion paid in cash would have fallen only by one percentage point to 53% during those two years.

(6) Although the (small) proportion of people paid weekly by cheque or credit transfer has increased, this often proves to be a stage in the movement from weekly payment in cash to being paid monthly through a bank account.

holding of bank accounts. IBRO estimates that in 1976 45% of adults held a bank current account, on which cheques could be drawn, but by 1981 this had risen to 61%. At the same time the percentage of adults with Post Office or National Savings Bank accounts fell from 22% to 18%. By contrast, over the same period the number with building society accounts grew even faster than current accounts. The proportion of adults with such accounts grew from 30% to 50%, while the proportion without any type of account fell from 32% to 15%—leaving only about 6 million adults with no account. Nevertheless, despite their importance as savings accounts, building society accounts are used less for making transactions than bank accounts and it is the growth in the number of bank accounts which seems to have been most important in the movement away from cash for making consumer payments.

Consumer payment behaviour

The demand for cash will also be affected by the use made of bank accounts. The number of banking transactions approximately doubled over the period 1976 to 1981; there was a 40% increase in the number of accounts and a similar rise in the average number of transactions per account. But over the same five-year period, the average value of bank transactions has fallen by perhaps 30% in real terms. (Figures from AGB Index show that most of this fall occurred between 1979 and 1981.) This suggests that transactions through the banking system have been replacing the use of cash.

IBRO estimate that over 50 billion payments are made every year in the United Kingdom; the great majority of payments are of low value and in cash. In 1981 about 36 billion of these were for sums less than £1 and only about 3½ billion payments were not by cash. Even when the lowest value payments are excluded, cash still predominates, but increasing the threshold below which payments are excluded reduces the share of cash and increases the share of other means of payment. (Table B—the 1976 figures are for transactions over 50 pence and over £1.50, but since prices approximately doubled between then and 1981, the 1981 figures, for transactions over £1 and over £3, are

Table B
Shares of number of payments

Percentages

Payments of:	1976		1981	
	50p or more	£1.50 or more	£1 or more	£3 or more
Cash	93.8	89.5	88.0	78.4
Cheques	3.7	6.8	6.4	13.6
Standing orders/Direct debits	1.5	1.7	2.8	2.5
Bank credit transfers	0.3	0.5	0.9	1.7
Credit cards	0.4	0.7	1.0	2.7
Other	0.3	0.8	0.9	1.1
	100.0	100.0	100.0	100.0

Source: IBRO.

Table C
Shares of value of payments

Percentages

	1976	1981
	Payments of £1.50 or more	Payments of £3 or more
Cash	68	50
Cheques	19	30
Standing orders/Direct debits	6	12
Credit transfers	1	2
Credit cards	2	3
Other	4	3
	100	100

Source: IBRO (1976 data), AGB Index (1981 data).

comparable⁽¹⁾). The proportion of payments made in cash in 1981 was much lower than five years earlier, but there was a sharp increase in the use of cheques. Bank credit transfers, credit cards, and pre-authorised payments also increased their shares at a fast rate but remained relatively insignificant.

Similar trends are clear when the value of payments is considered, but their distribution is markedly different. Data compiled by AGB Index⁽²⁾ show that in 1981 only 50% of the value of transactions over £3 were in cash while 30% were made by cheques and 12% by standing orders or direct debits. Comparing these results with IBRO data for 1976 (Table C), a large fall in the share of cash is again seen, matched by rapid increases in the share of cheques, standing orders and direct debits during the five years to 1981. The share of credit cards also increased rapidly, but they still accounted for only 3% of the total value of transactions in 1981.⁽³⁾

The Index results, as expected, show that the means by which payments are made varies with the size of payment. The higher the value of a transaction, the less likely it is to be made in cash; conversely the proportion of transactions settled by cheques rises sharply with the size of transaction (Chart 3). The other important methods of payment, such as pre-authorised payments and credit cards, also increase their shares as the value of transactions increases.

Since the likelihood of a transaction being made in cash falls as the size of the transaction increases, the proportion over a given nominal threshold would be expected to rise as inflation lowers the real value of that threshold. So changes in observed payments habits are partly caused by inflation and partly represent a change in 'real' habits. This can be allowed for in comparisons of consumer behaviour at different dates by comparing the proportions of transactions (by value) settled in cash measured at *constant prices* (Chart 4). The movement away from cash is clear even over the two years since 1979. The overall fall in the payments curve between 1976 and 1981 represents a large change in real payments habits.

(1) As inflation acts to diminish the purchasing power of a given nominal amount of cash, it might reasonably be expected that an increasing proportion of higher value payments would be settled in cash. Indeed, for given (real) payments habits the same proportion of transactions would be effected in cash at each level of real purchasing power. This argument ignores the effect of fixed nominal denominations of notes and coin which is discussed in the box opposite.

(2) From a panel of 10,000 adults living in Great Britain.

(3) The importance of credit cards lies not just in their role as a means of payment but also as a source of credit. The share of credit cards in the personal sector credit market is larger than their role as a means of payment, standing at about 20% in 1981.

Currency denominations

There have been marked changes over time in the contribution of each denomination of note and coin to the total of cash in circulation. High denomination notes have grown more rapidly than low ones and it is sometimes suggested that this may reflect the fast growth of the 'black economy'. It seems more likely, however, that this development merely reflects the impact of inflation. (The statistics in this box relate to total cash in circulation and include banks' holdings.)

The share of each note within the total can be measured in terms of its *number* or its *value*. The £1 note has been consistently the most *numerous* until recently, although the number has been steadily declining with the increasing popularity, at least until 1979, of the £5 note (Chart A). Whereas twenty years ago £1 notes comprised 85% of the number of notes in circulation, they are now only about 36%. On the other hand £5 notes increased from about 10% in 1962 to almost 40% in 1979, before declining to around 33% now. Since the early 1970s £10 notes have begun to form a significant proportion of notes, increasing particularly sharply in the last five years; they now account for nearly 25% of the total in circulation. £20 notes account for just over 5% and the £50 note for an insignificant proportion.

In terms of *value*, the £10 note takes the largest share (Chart B). It now accounts for about 42% of the note circulation, having overtaken the £5 note in 1979. The £20 note is third (18%) and has been increasing its share—as has the £50 note, first issued in March 1981. The £5 and £1 notes have had falling shares.

Coin accounts for less than 10% of the value of cash in circulation. Its share has tended to decline slowly but was raised temporarily after the introduction of the 50p coin in 1969. Recently it has begun to increase slightly, probably influenced by rapid growth in the number of vending machines, increases in the relative price of some items often paid for in coin (like gas charges, bus and underground fares, and telephone charges) and the less marked movement away from cash as a means of payment for low value transactions.

It is important to distinguish inflation from other effects on note and coin denominations. At the end of a period in which prices double, the real value of notes will be halved and, for example, one might expect £10 notes to be used to the same extent as £5 notes were at the beginning of the period. On this argument the average denomination of notes used would rise at the rate of inflation.

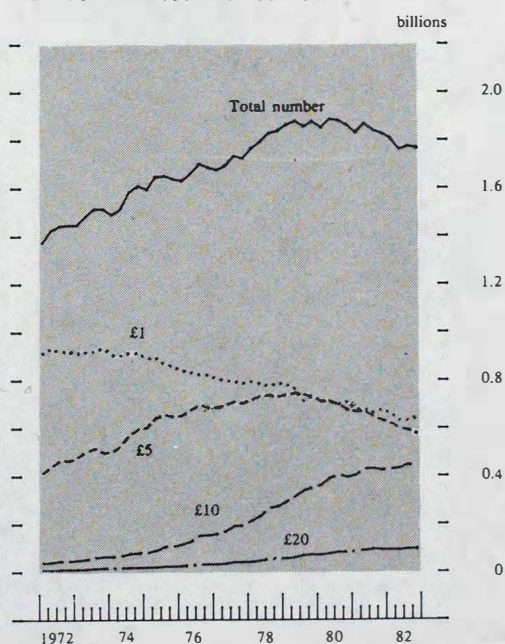
If the 'black economy' were growing and this encouraged the use of higher denomination notes, the average denomination after allowance for inflation would be expected to rise. In fact this has not happened. Over the past ten years, the average denomination has risen by 120% while retail prices have risen by 290%: thus the real value of the average denomination has declined, by 40% over this period.

The timing of the introduction of new denominations of notes and coin is also important in determining the average denomination of notes. When the £1 coin is introduced in April 1983 the share of coin will rise. But it will reduce the share of £1 notes and raise the average denomination of notes outstanding. Had the £1 coin been introduced rather earlier, for example when its purchasing power was similar to that of the 50p coin when that was introduced, the average denomination of notes would have grown more, but not sufficiently to support the 'black economy' case. The average denomination of cash will also have been affected by inertia: individuals respond only slowly to the erosion of the real value of notes. This 'money illusion' has also been reflected in a general tendency for cheques to be written on average for smaller real sums.

There are other rigidities besides the limited choice of denominations which influence the denomination composition of the demand for cash: the range of notes offered in some cash dispensers is restricted; employees paid in cash may not be able to choose how their wage packets are made up; and very occasionally banks may run out of some denominations. Nevertheless, just as the total currency in circulation is demand-determined, so its composition is mostly demand-determined. Individuals are free to ask for whatever denomination they wish when drawing cash from banks or other financial institutions.

The Bank of England imposes notes moratoria on occasions in the interest of public economy. These are to prevent the excessive issue of new notes and to offset the tendency for the lives of notes to shorten: they should not affect the denominational mix but are intended to influence the split between new and used notes in issue. The Bank also wishes to encourage the use of higher denomination notes because the number of notes in issue has grown by over 30% in the past ten years (because of money illusion and the fixed boundary between notes and coin at £1). Nevertheless, neither the total value of notes in issue nor the split between denominations is used as an instrument of economic management.

Chart A
Number of notes in circulation^(a)



(a) The £50 note was introduced in March 1981 but there are too few in circulation to show on the chart.

Chart B
Value of notes in circulation

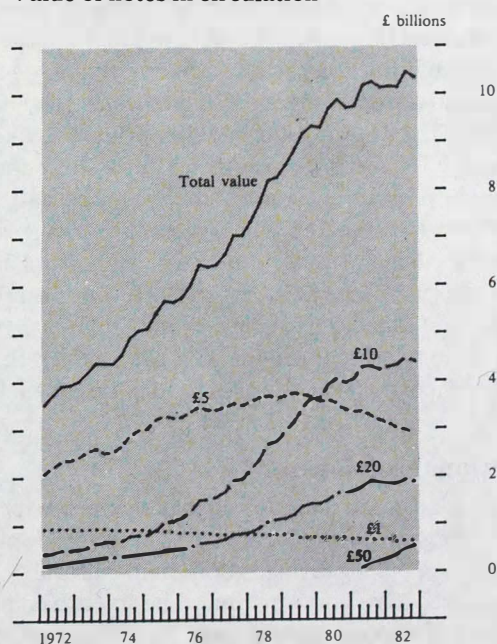
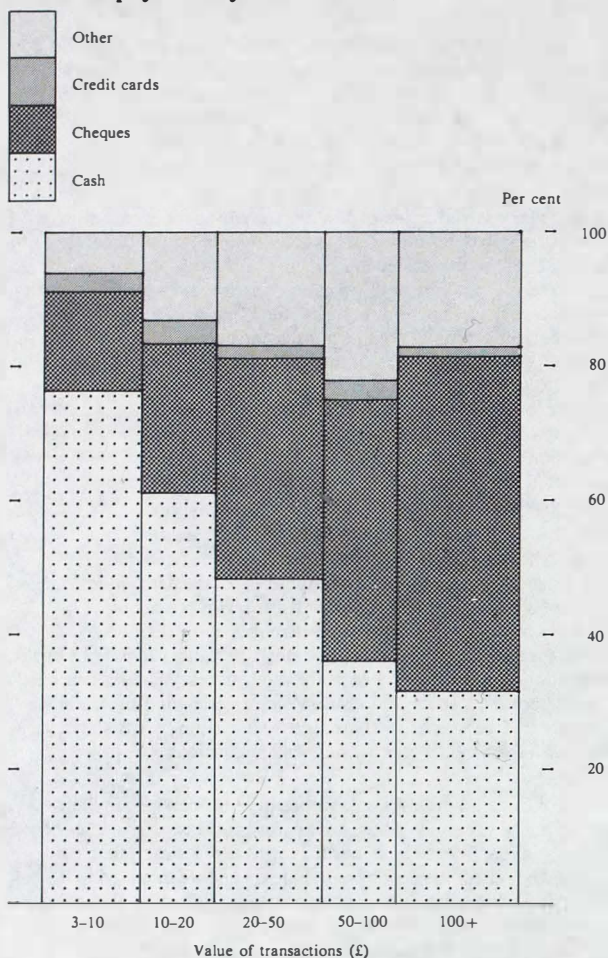


Chart 3
Means of payment by value^(a) (1981)



Source: AGB Index.

(a) The width of the bands represents the proportions of all transactions over £3 in that range.

The effect of this change on the demand for cash cannot be determined precisely. In particular the results are based on surveys which exclude a large number of small transactions. But the value of these transactions can be estimated—the 36 billion or so transactions of less than £1 may account for about 15% of the value of all transactions. It seems likely that virtually all were made in cash; on this assumption figures for the proportionate use of cash in making all payments may be estimated. These calculations suggest that the share of cash in the total value of payments fell sharply from 75% to 65% in the five years to 1981. If this sharp fall in the use of cash led to a concomitant fall in cash holdings, it would explain a significant part of the recent overprediction of the equations reported in the appendix.

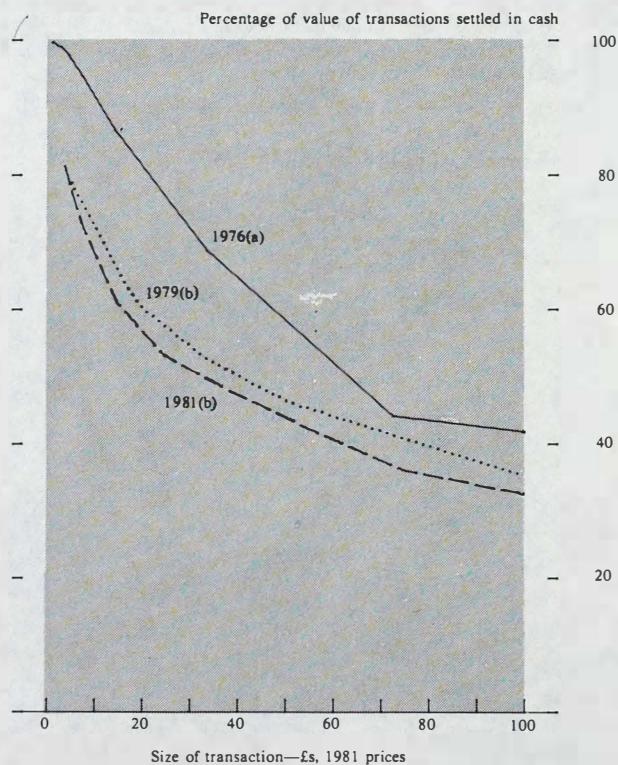
International comparisons

Some indication of the scope for further changes in the use of cash can be gained from looking at the experience of other countries, but legal, institutional and cultural differences need to be borne in mind. The size of a country, its geography and population density, as well as traditions

and local preferences, may all influence the payments methods adopted. Even within the United Kingdom such differences can cause marked variations in consumers' financial behaviour. For example, in Scotland 56% of adults (2.2 million) do not have a bank current account, against 37% in England and Wales, but the holding of savings accounts in Scotland is much higher than in the rest of the United Kingdom (partly because building societies are less strongly established in Scotland). As a result, the overall holding of bank accounts is higher there than in England and Wales.

A number of general statements about the international experience can be made. Almost all developed countries have witnessed rapid growth in cashless payments systems and a rise in the ratio of consumers' expenditure to cash over the past twenty years. Most have seen a movement away from the payment of wages and salaries in cash and some, such as West Germany, have seen a large decline in the use of cash for transactions.⁽¹⁾ By 1978, less than 5% of workers were paid in cash in the United States, Canada, West Germany and Sweden. In the Netherlands and France, the proportion was rather larger (closer to a sixth and a quarter respectively), whilst the comparable figure for the United Kingdom was much bigger still (about a half). Among advanced economies, only Italy and Japan had higher proportions; in those two countries, almost all workers were paid in cash.⁽²⁾

Chart 4
Cash transactions: proportion by value (1981 prices)



(a) Data compiled by IBRO.
(b) Data compiled by AGB Index.

(1) See, for example, the Deutsche Bundesbank publication, *Geldpolitische Aufgaben und Instrumente*.

(2) In Italy, there is a move to pay state employees by other means, and in Japan there are a few signs of a movement away from payment in cash by larger firms.

Another general observation is that, in countries where the use of cheques is widespread, the value of transactions at which cheques are commonly substituted for cash is much lower than where giro transfers are more common. This helps to explain some of the differences in the amount of cash per head of the population (Table D).

Table D
Cash ratios and cashless payments

	Cash per head (expressed in \$)		Ratio of consumers' expenditure to cash ^(a)		Number of cashless payments per head per annum
	1978	1981	1978	1981	1978
Belgium	1,089	975	5.6	6.2	40
Canada	334	367	15.1	17.8	n/a
France	549	549	10.1	12.5	57
West Germany	619	604	9.4	10.2	60
Italy	395	455	7.4	8.5	12
Japan	672	722	7.1	7.7	n/a
Netherlands	620	628	9.6	9.4	79
Sweden	737	856	7.9	8.3	62
Switzerland	2,085	1,977	4.0	4.7	24
United Kingdom	306	339	11.1	13.7	57
United States	445	552	13.6	14.5	159

Sources: *International Financial Statistics*, IMF, October 1982.

Payments systems in eleven developed countries, Bank for International Settlements, February 1980.

(a) Annual consumers' expenditure divided by the stock of cash outside banks at end of year.

In 1978, the United Kingdom had a lower stock of cash per head on this international comparison than every other country listed, but when differences in consumption per head are taken into account it was more similar to most other European countries. The North American countries, however, had much lower holdings of cash relative to expenditure and Belgium and Switzerland had higher holdings.

These figures are influenced by the non-resident demand for each country's cash. Although foreign holdings of sterling notes are very small indeed, they are important for the US dollar, Swiss and Belgian franc, and the deutschemark. This demand tends to lower the measured ratio of spending to cash in these countries as well as making it more variable and subject to the influence of exchange rates. Foreign demand for the Belgian franc is most pronounced in Luxembourg, where it is the main currency in circulation. For this reason, the figures for Belgium in the first four columns of Table D include those for Luxembourg but this makes little difference. Foreign holdings of the deutschemark are increased through the large number of foreigners working in Germany, while there is a more widespread demand for Swiss and American currency.

The high ratio of expenditure to cash in the United States is all the more surprising because of the size of the foreign demand for the US dollar. A number of factors may account for this. First, in Canada and the United States, giro payments are insignificant, while cheques are very common. As cheques are used for low value transactions, the need for cash is reduced. Wide use of cheques is shown by the very high number of cashless payments per head each year in the United States. Second, the cheque is a debit

transfer instrument; that is, it is an instruction from the drawer to debit his account. The giro system is a credit transfer system—it is based on an instruction from the drawer to credit some other account. The North American preference for the former may reflect the widespread use of consumer credit to finance personal transactions rather than using previously acquired stocks of cash. This preference is shown in the popularity of credit cards in North America; more than 60 per cent of Canadian and American households hold at least one card, further reducing the need to hold cash.

The low ratio of spending to cash for the Swiss franc reflects both significant foreign demand, which is particularly important given the small population of the country, and the dominance of cash in households' transactions. The Swiss made only twenty-four cashless payments per head in 1978—less than half the figure for the United Kingdom. In addition, the popularity of the postal cheque system increases the use of cash. There were 0.8 million postal cheque accounts in 1978, compared with 1 million sight accounts at banks. This system encourages the use of cash because the Post Office does not issue cheques but offers an efficient and cheap system for making payments. An estimated 70 per cent of Swiss households pay their bills at the Post Office in cash.

In Italy, the low number of cashless payments reflects the undeveloped personal banking system, partly the result of legal restrictions on banks and their marketing activities, and the large number of consumer payments deducted at source by the employer. In other countries, regular payments of this type are often made through the banking system.

These international data are of interest in themselves, but it is hard to draw from them any firm conclusions for the United Kingdom. In recent years, the United Kingdom does not seem to have been very different from many other European countries in its attitude towards the holding, and use, of cash. But the increase in the ratio of spending to cash in the United Kingdom between 1978 and 1981 was greater than in any other country except France. All countries except the Netherlands had higher ratios in 1981 than in 1978. These developments will have tended to move the United Kingdom, but probably not very far, towards the North American position. But cultural and other differences may be as important as differences in financial technology in explaining the importance of cash on eachside of the Atlantic, so it is not easy to use the United States as a model from which to predict the pace of future developments away from cash in the United Kingdom.

Future developments

This article has drawn attention to those developments which have contributed to a reduction in the demand for cash by the general public. The term 'cashless society' is however, and will for the foreseeable future continue to be, an implausible prospect for the United Kingdom (and indeed for most other countries). It is more realistic to think

of a 'less-cash society' in which the use of cash gradually becomes even more restricted to lower value transactions and to those transactions in which both parties seek anonymity.

In the last few years, there has been a growing impetus towards the use of means of payment other than cash. The future course of this impetus now depends on two main factors. The first is the extent to which people are prepared to make a more intensive use of the banks' money transmission facilities. An important determinant of this will be developments in bank charges; the higher the cost of making a non-cash payment, the more likely it is that the payment will be made in cash. In the recent past, the main UK commercial banks have made some moves towards recovering more of the costs they incur in the provision of money transmission services through specific tariffs. Some banks have imposed charges for the use of the bank giro system and for the encashment of other banks' cheques. It is too soon to be certain whether these have had a significant impact, but any further move by the banks towards full recovery of costs would provide a greater incentive for the public to settle transactions in cash (provided that cash can still be obtained more cheaply).

The second factor is the speed of any future movement towards cashless pay, since this trend is now perhaps the main means of extending the banking habit. IBRO studies have shown that the 39 per cent of adults in the United Kingdom who do not have bank current accounts are heavily concentrated among the old, the non-working and the lower socio-economic groups, most of whom will feel little need for banking services without the incentive provided by the receipt of their income in cashless form (they are also likely to be particularly sensitive to any

further move to recover the full cost of money transmission services). Continuation of the trend towards cashless pay will depend, to a large extent, on those sections of the population with a bank or building society account who are now paid in cash. Over one-third of those without a bank account are building society account holders. So, if the building societies generally were to introduce a more developed money transmission system, a significant number of the unbanked could be encouraged to use cashless payments without having to open bank accounts. But against this, the banks and the building societies are rapidly introducing large numbers of cash dispensers, or the more sophisticated automated teller machines; although these remove the need for customers to carry large amounts of cash, they do buttress cash as a major means of payment. It will probably take some time for people to adjust to the continuous availability of cash and to reduce their average holdings accordingly. After this period of adjustment, during which the demand for cash may fall relative to consumers' expenditure, it could then stabilise at a new, albeit lower, level.

In the next few years the more intensive use of credit cards, with their ready supply of free credit (if settlement is made promptly and in full), might be expected to reduce the use of cheques more than the use of cash—the more so if banks' pricing policies were to give customers an incentive to reduce the number of cheques they draw each month. It is difficult to foresee any marked impact on the demand for cash, however, from the advanced schemes now being discussed such as electronic fund transfers at the point of sale. Such schemes, if introduced on a wide scale, would in any case be just as likely to reduce the use of cheques—that indeed is the main objective of the banks—as the use of cash.

Technical appendix

The econometric equations used to predict the demand for notes and coin relate the stock of notes and coin in circulation with the public to a measure of transactions—divided into 'real' and 'price' components—and to short-term interest rates; the impact of these influences is allowed to be spread over a considerable period of time. For example, if interest rates rise, individuals may not fully adjust to the new level immediately but only gradually. Estimation proceeded from a general model, which allowed for lags of up to six quarters on each of the explanatory variables, to a restricted form giving a more parsimonious specification. Observations from 1964, first quarter to 1981, fourth quarter were used.

It would be most appropriate to relate the demand for cash to the volume of transactions financed by cash, but suitable statistics are not available and a proxy must be used. The choice of proxy was determined by comparing how well the alternatives explained the behaviour of notes and coin over the data period. As notes and coin in circulation with the public are held mainly by the personal sector, the three alternatives tried were personal disposable income, total consumers' expenditure and consumers' expenditure on non-durable goods. The local authority three-month rate was chosen as the most freely determined market interest rate over the whole period. All variables apart from interest rates were transformed into logarithms.⁽¹⁾ The general form of the equation was taken as:

$$\log NC = \alpha + \sum_{i=1}^6 \beta_i \log NC_{t-i} + \sum_{i=0}^6 (\gamma_i \log P_{t-i} + \delta_i \log Y_{t-i} + \varphi_i r_{t-i}) + \sum_{i=1}^3 \psi_i Z_{t-i}$$

where NC = the stock of notes and coin in circulation with the public (£ million);
 Y = the measure of income/expenditure chosen, in £ millions, 1975 prices;
 P = the appropriate price deflator;
 r = the local authority three-month interest rate, per cent per annum;
 Z_i = seasonal dummies.

Data were not seasonally adjusted.

Total consumers' expenditure explained the behaviour of notes and coin best in both the general and parsimonious forms of the equation (it had the lowest within sample standard error). It was chosen as the most appropriate measure of transactions.

The most significant lags for the interest rate variable were found to be zero and four quarters, but these still had low t statistics—this was also found in equations using different measures of transactions. Furthermore, an F test (at the 5% significance level) did not reject the restriction that interest rate sensitivity was zero. Using the clearing banks' seven day deposit rate, or the average of their base rates, instead of the local authority three-month rate, produced similar interest elasticities.

Tables 1 and 2 show freely estimated equations both including and excluding interest rate terms. Estimates obtained using two different periods of data are reported—1964 Q1 to 1981 Q4 and a shorter period 1964 Q1 to 1977 Q1. Equations estimated over a number of intermediate periods, using the same explanatory variables but allowing the estimated coefficients to change, were used to produce forecasts for the demand for cash for the next four quarters.

Further restrictions on the estimated equations were tested. A restriction that in the long run a 1% rise in prices would cause cash balances to rise by 1% was not rejected (on an F test), but imposing the restriction produced implausible results elsewhere in the equations—in particular the long run impact of real consumers' expenditure became negative—so this restricted form of the equation was rejected. A restriction that, in the long run, changes in nominal expenditure have the same impact on cash holdings whether they arise from 'real' or 'price' movements was also tested and not rejected (on the basis of an F test and the signs of the elasticities). This restriction left the standard errors of the equations and \bar{R}^2 statistics virtually unchanged, hardly affected the residual autocorrelation properties, and had little impact on parameter stability. The equation without interest rate terms, and having equal long-run 'price' and 'real' elasticities, was the one used to produce the forecasts reported in the text. These forecasts, and those from alternative equations, are shown in Table 4.

The equations reported in Tables 1 and 2 over-predicted the demand for cash in the last three years: their forecasting performance had, however, been satisfactory in the three financial years 1976/77 to 1978/79.⁽²⁾

The overprediction of the equations was due to a virtual step change (downwards) in the growth of notes and coin in circulation in 1979/80. This led to an examination of possible misspecification. The following four variables, mentioned in the main article, may have been omitted.

Changes in payments habits

These are very difficult to model adequately. If the unexpected rise in the ratio of consumers' expenditure to cash has been due entirely to switching from cash to non-cash means of payment, then it means that the measure of transactions used in the equations is inappropriate. When the volume of transactions financed by cash falls (as a proportion of total consumers' expenditure) the appropriate measure of transactions to use is a correspondingly falling proportion of total consumers' expenditure. In a log-linear demand for cash equation, this development could be modelled by including a separate variable measuring the proportion of consumer payments made in cash. Unfortunately, no such (quarterly) statistics exist. The only possible way of capturing this influence was to include a time trend (either in linear or logarithmic form). This approach does, however, have the obvious weakness that it implies that cash usage changes smoothly over time, and this appears not to have been the case.

Unemployment

The narrow measure excluding school-leavers and adult students, rather than the broad measure, was used in the equation, since the aim was to obtain an estimate of the extent to which the unemployment of those who previously had a higher income may have had a depressing effect on the overall demand for cash.

(1) This implies that a *one per cent* rise in Y or P (but a *one percentage point* rise in r) produces a constant percentage change in the demand for cash. A rise in interest rates from, say, 6% to 7% per annum will have the same effect on the demand for cash as a rise from, say, 14% to 15% per annum.

(2) The forecasting performance was judged by the variance of the four quarter ahead forecasts, compared with the within sample variance of the equations, as well as by the size of the actual forecast error.

Table 1
Basic equations excluding interest rate terms

	Explanatory variables (<i>Standard errors in italics</i>)									Long-run elasticities with respect to		Summary statistics								
	CNST	NC-1	NC-2	NC-3	NC-4	CE(75)-1	CE(75)-2	PC-2	PC-3	CE(75)	PC	SEE	\bar{R}^2	d	LM(5)	Q(8)	Z(4)	T	F	
Freely estimated																				
1964 Q1 to 1981 Q4	0.45 <i>0.45</i>	0.99 <i>0.11</i>	-0.26 <i>0.14</i>	0.63 <i>0.14</i>	-0.51 <i>0.10</i>	0.40 <i>0.11</i>	-0.30 <i>0.12</i>	0.53 <i>0.16</i>	-0.40 <i>0.17</i>	0.61	0.82	0.016	0.999	2.08	2.5	5.5	n/a	72	n/a	
1964 Q1 to 1977 Q1	0.16 <i>0.49</i>	0.79 <i>0.13</i>	-0.23 <i>0.14</i>	0.63 <i>0.15</i>	-0.44 <i>0.13</i>	0.46 <i>0.14</i>	-0.25 <i>0.15</i>	0.44 <i>0.23</i>	-0.23 <i>0.23</i>	0.84	0.83	0.015	0.998	2.05	13.5	8.3	3.6	53	n/a	
Restricted(a)																				
1964 Q1 to 1981 Q4	0.17 <i>0.08</i>	0.98 <i>0.10</i>	-0.26 <i>0.14</i>	0.63 <i>0.14</i>	-0.50 <i>0.10</i>	0.40 <i>0.11</i>	-0.29 <i>0.12</i>	0.51 <i>0.16</i>	-0.39 <i>0.16</i>	0.78	0.78	0.016	0.999	2.05	2.9	5.3	n/a	72	0.38	
1964 Q1 to 1977 Q1	0.17 <i>0.15</i>	0.79 <i>0.13</i>	-0.23 <i>0.14</i>	0.63 <i>0.15</i>	-0.44 <i>0.13</i>	0.46 <i>0.14</i>	-0.25 <i>0.15</i>	0.44 <i>0.23</i>	-0.23 <i>0.23</i>	0.83	0.83	0.015	0.998	2.05	13.5	8.3	3.6	5.3	—	

Table 2
Basic equations including interest rate terms

	Explanatory variables (<i>Standard errors in italics</i>)											Long-run elasticities with respect to			Summary statistics								
	CNST	NC-1	NC-2	NC-3	NC-4	CE(75)-1	CE(75)-2	PC-2	PC-3	r-0	r-4	CE(75)	PC	r(b)	SEE	\bar{R}^2	d	LM(5)	Q(8)	Z(4)	T	F	
Freely estimated																							
1964 Q1 to 1981 Q4	-0.02 <i>0.57</i>	0.92 <i>0.11</i>	-0.25 <i>0.14</i>	0.60 <i>0.14</i>	-0.43 <i>0.11</i>	0.41 <i>0.11</i>	-0.25 <i>0.12</i>	0.66 <i>0.18</i>	-0.52 <i>0.18</i>	-0.15 <i>0.10</i>	-0.12 <i>0.10</i>	0.93	0.83	-1.63	0.016	0.999	2.02	2.5	5.1	n/a	72	n/a	
1964 Q1 to 1977 Q1	0.09 <i>0.58</i>	0.78 <i>0.14</i>	-0.23 <i>0.15</i>	0.64 <i>0.15</i>	-0.44 <i>0.14</i>	0.45 <i>0.15</i>	-0.24 <i>0.16</i>	0.34 <i>0.28</i>	-0.13 <i>0.28</i>	-0.04 <i>0.14</i>	0.09 <i>0.14</i>	0.87	0.83	+0.21	0.015	0.998	2.01	13.4	8.2	2.0	53	n/a	
Restricted(a)																							
1964 Q1 to 1981 Q4	0.12 <i>0.08</i>	0.92 <i>0.10</i>	-0.25 <i>0.13</i>	0.60 <i>0.14</i>	-0.44 <i>0.10</i>	0.41 <i>0.11</i>	-0.26 <i>0.11</i>	0.66 <i>0.18</i>	-0.52 <i>0.18</i>	-0.14 <i>0.09</i>	-0.12 <i>0.10</i>	0.84	0.84	-1.51	0.016	0.999	2.04	2.4	5.2	n/a	72	0.06	
1964 Q1 to 1977 Q1	0.16 <i>0.18</i>	0.78 <i>0.13</i>	-0.23 <i>0.14</i>	0.64 <i>0.15</i>	-0.45 <i>0.13</i>	0.45 <i>0.14</i>	0.24 <i>0.15</i>	0.34 <i>0.28</i>	-0.13 <i>0.27</i>	-0.03 <i>0.13</i>	0.09 <i>0.14</i>	0.84	0.84	+0.23	0.015	0.998	2.02	13.2	8.2	1.9	53	0.02	

Table 3
Equations incorporating terms in the unemployment rate

	Explanatory variables (<i>Standard errors in italics</i>)									Long-run elasticities with respect to				Summary statistics								
	CNST	NC-1	NC-2	NC-3	NC-4	UR-1	C(75)-1	PC-2	r-0	CE(75)	PC	r(b)	UR(b)	SEE	\bar{R}^2	d	LM(5)	Q(8)	Z(4)	T	F	
Freely estimated																						
1964 Q1 to 1981 Q4	-0.01 <i>0.58</i>	0.85 <i>0.12</i>	-0.28 <i>0.14</i>	0.58 <i>0.14</i>	-0.44 <i>0.12</i>	-0.75 <i>0.37</i>	0.27 <i>0.08</i>	0.27 <i>0.08</i>	-0.25 <i>0.11</i>	0.93	0.93	-0.86	-2.57	0.016	0.999	2.03	1.8	9.5	n/a	72	n/a	
1964 Q1 to 1977 Q1	0.11 <i>0.55</i>	0.67 <i>0.13</i>	-0.26 <i>0.14</i>	0.65 <i>0.15</i>	-0.40 <i>0.13</i>	-1.13 <i>0.57</i>	0.31 <i>0.09</i>	0.34 <i>0.09</i>	-0.24 <i>0.16</i>	0.90	0.98	-0.69	-3.25	0.015	0.998	1.99	20.4	14.6	2.7	53	n/a	
Restricted(a)																						
1964 Q1 to 1981 Q4	— <i>0.11</i>	0.85 <i>0.11</i>	-0.28 <i>0.14</i>	0.58 <i>0.14</i>	-0.44 <i>0.11</i>	-0.76 <i>0.35</i>	0.27 <i>0.07</i>	0.27 <i>0.07</i>	-0.25 <i>0.11</i>	0.93	0.93	-0.85	-2.57	0.016	0.999	2.03	1.8	9.5	n/a	72	—	
1964 Q1 to 1977 Q1	0.11 <i>0.22</i>	0.67 <i>0.13</i>	-0.26 <i>0.14</i>	0.65 <i>0.14</i>	-0.39 <i>0.13</i>	-1.04 <i>0.53</i>	0.32 <i>0.08</i>	0.32 <i>0.08</i>	-0.24 <i>0.16</i>	0.96	0.96	-0.71	-3.08	0.015	0.998	1.97	20.3	14.4	2.4	53	0.19	

n/a not applicable.

(a) Imposing the restriction that the long-run elasticities with respect to CE(75) and PC are equal.

(b) The elasticities with respect to r and UR are semi-elasticities.

Notes to tables

Variables are defined on the previous page. NC-1 etc indicates that the variable enters with a one period lag.

SEE is the standard error of the equation. d is the Durbin Watson statistic.

LM(5) is the Lagrange Multiplier statistic for residual autocorrelation: it tests the correlation of the residuals at time t with those in each of the previous 5 periods. It is distributed as χ^2 and would suggest misspecification if greater than 11.1.

Q(8) is the Ljung Box statistic for residual autocorrelation: it tests the correlation of the residuals at time t with those in each of the previous 8 periods. It is also distributed as χ^2 and would suggest misspecification if greater than 15.5.

Z(4) is the statistic for post-sample parameter stability. It compares the variance of the forecast values over four periods ahead with the within sample variance of the equation. It is also distributed as χ^2 and would suggest instability if greater than 9.5.

T is the number of observations used for estimation. F is the F statistic on imposing the restriction that the long-run price and real expenditure elasticities are equal. For the data to satisfy the restriction in Table 1, F has to be below 4.00 for the longer period and below 4.08 for the shorter period. The critical values are slightly different in the other tables but the restriction is easily satisfied for all equations.

Changes in the 'black economy'

Several alternative measures of factors thought to be closely associated with the size of the 'black economy' were considered: the marginal tax rate, and the ratios of expenditure and/or income taxes to income.

Exchange rate movement

The sterling/dollar and effective exchange rates were also considered as possible explanatory variables.

The general form of the notes and coin equation was respecified to include lags of up to four quarters on each of these additional variables, and restrictions were imposed, in the manner described above. The resulting preferred equation is reported in Table 3. The only additional explanatory variable which had a correctly signed and well determined coefficient was the unemployment rate at a lag of one quarter. The unemployment coefficient remained statistically significant over sub-periods and was fairly stable, suggesting that this variable was explaining more than just the recent coincidence of low cash holdings and high unemployment: the long run semi-elasticity with respect to the unemployment rate was, however, found to be rather high (a one percentage point rise in the unemployment rate reduced the demand for cash by about 2½% in the long run). The modified equation had, over the longest data period, an interest rate semi-elasticity of just less than unity; in earlier sub-periods this elasticity was found to be smaller and of ten statistically insignificant. Again, the restriction that the long-run elasticities with respect to prices and real expenditure were equal was not rejected by the data.

Table 4
Demand for cash compared with forecasts from three equations^(a)
Percentage changes

Financial years	Actual	Non-interest-sensitive equation			Interest-sensitive equation			Equation including unemployment rate		
		FL	FC	FU	FL	FC	FU	FL	FC	FU
1976/77	15.0	9.7	15.0	20.6	9.5	14.9	20.6	6.8	10.6	14.6
1977/78	17.1	10.0	15.1	20.5	11.0	16.4	21.9	13.5	18.2	23.1
1978/79	14.7	8.4	13.3	18.4	7.1	12.0	17.1	9.2	13.6	18.1
1979/80	6.0	9.3	14.1	19.2	8.4	13.3	18.4	8.2	12.4	16.8
1980/81	4.3	9.7	15.1	20.7	9.7	15.0	20.5	8.4	12.9	17.6
1981/82(b)	5.3	7.2	13.0	19.2	7.5	13.1	18.9	3.0	7.8	12.7

FC is the central forecast. FL and FU are the lower and upper forecasts, respectively, which would have been held with 95% confidence.

(a) All equations have equal long-run real and price elasticities.

(b) 1980 Q4/1981 Q4.

The four quarter ahead forecasts produced by the equations which included the unemployment rate were generally more accurate than those produced by the basic equations (see Table 4) and the variance of the forecasts compared with the within-sample variance of the equation (measured by the statistic for post sample parameter stability) was generally more satisfactory. Nevertheless, the modified equations still over-predicted the demand for cash in the last three years.