Spending on plastic: The potential for financial distress

1. Introduction

1966 might be remembered by many as the year that England won the football world cup. But, it was also the year when the first credit card was introduced in the UK. 1987 saw the arrival of the debit card. Today, we take for granted the use of plastic as a means of payment.

Figures from APACS[1], the UK payments association, show that in 2006 there were 142.8 million payment cards in issue. The average adult in the UK had 2.4 credit cards and 1.6 debit cards. The total spend on plastic in 2006 was £320.8 billion, of which £194.9 billion or 60.8% was on debit cards and £125.9 billion or 39.2% was on credit or charge cards.

Figures from the Office for National Statistics[2] show that total consumption by households in 2006 was £793.7 billion. Therefore, approximately 44.5% of household spending by value was conducted by plastic. Further, 24.6% of household spending by value was on debit cards and 15.9% on credit cards.

The figures from APACS show an amazing 1.9 billion transactions were made on credit or charge cards, though this figure was unchanged from 2005. While usage is of interest to policy-makers, the potential for financial stress is a major concern.

While a credit card is a convenient vehicle for smoothing consumption by providing immediate credit, it can be very expensive when balances are not paid off in full. The interest rates on credit cards are typically much higher than those on other types of loan, particularly those on a mortgage. Furthermore, when a statement's balance is not cleared in full, interest continues to be charged against all unpaid transactions.

Indebtedness can undermine economic stability. Household financial distress, or the fragility of their financial position, has the potential to impact on consumption. This is significant because household spending constitutes close to two-thirds of GDP. The impact of financial distress was readily apparent in the early 1990s when rising interest rates caused debt repayments to soar.

Indebtedness is firmly on the policy agenda. The Bank of England publishes its *Financial Stability Report* twice a year and this includes reference to the financial health of the household sector. Further, articles on this topic regularly appear in the Bank of England's publication, *Quarterly Bulletin* and once a year it presents the results of a specially commissioned survey on the state of British household finances.[3]

Meanwhile the Department for Business, Enterprise and Regulatory Reform (BERR)[4] is charged with taking forward initiatives to address consumer indebtedness. It publishes an *Annual Tackling Over-Indebtedness Report*. In its 2007 Annual Report BERR reports that between 2007Q2 and the same quarter a year earlier the write-off rate for credit card debt rose from 5.6% to 7.5%. Each write-off rate is calculated by dividing the amount written-off over the latest four quarters by the average stock of debt over the same period.

[1] The website address for APACS is http://www.apacs.org.uk/
[2] National Statistics Online can be accessed at http://www.statistics.gov.uk/
[3] Details of Bank of England publications can be found at http://www.bankofengland.co.uk/publications/index.htm
[4] The homepage of BERR is http://www.berr.gov.uk/ttp://www.dti.gov.uk/index.html

Write-off rates are increasing. At the start of 2000 the write-off rate for credit card debt was below 2%.

In a submission to the Office of Fair Trading, the consumer body *Which* claimed it had identified 12 different interest calculation methods in use by 20 of the top credit card providers.[5] In this case study, we will work through a simplified example, applying some techniques in financial mathematics, to consider the repayment of credit card debt and the issue of financial distress.

2. Mathematics of repayments

We consider a hypothetical individual with a credit card and no initial outstanding balance. They are issued with a statement at the end of each month. When the individual pays the balance off in full by the 'statement due date', no interest is applied. However, if the balance is not settled in full, interest is charged at the rate of 15.9% p.a. from the date of each transaction until the next statement date. The individual is required to make a minimum monthly payment of 3% of the statement balance.

Assume our individual purchases a holiday costing £2,500 using their card on the last day of the month. The statement is then issued, which the individual receives shortly afterwards, detailing the purchase. It contains a 'due date' for payment and informs the individual that they will need to make a minimum payment of £75 (£2,500*(3/100)).

Our individual decides only to make the minimum payment. Consequently, they are liable to pay interest on the transaction of £2,500. Given the timing of the purchase, they will be charged 1 month's interest. This requires calculating a monthly interest rate, r_m, which is equivalent to the annual percentage rate, r_a. Both interest rates are compound interest rates. This means that we get 'interest on the interest'.

Our task is to find the monthly rate that gives us the desired annual percentage rate, the so-called APR. This is achieved when the following condition is satisfied:

(1) $(1+r_m)^{12} = (1+r_a)$

Perhaps the easiest way of thinking about what the equivalence of the monthly and annual rate means is to consider somebody investing an amount of money x. The individual would be indifferent between the money attracting a monthly interest rate, r_m and interest added annually at rate, r_a. If we take the twelfth root of each side, we obtain

(2) $(1+r_m) = (1+r_a)^{1/12}$

We can now solve for the monthly rate,

(3) $r_m = (1+r_a)^{1/12} - 1$

For our individual's credit card, where the annual interest rate is 15.9% (0.159), the equivalent monthly interest rate is 1.237%.

(4) $r_m = (1+0.159)^{1/12} - 1 = 0.01237$

In calculating our individual's new credit card balance we are applying a monthly interest rate, r_m, to an initial outstanding balance, A_1, and subtracting a payment of proportion p of the balance. Hence, in general terms the amount owing the following month, A_2, will be

(5) $A_2 = A_1(1+r_m) - A_1 p$

This is equivalent to

(6) $A_2 = A_1(1+r_m - p)$

We are now in a position to enter the values from our example

(7) $A_2 = £2{,}500(1+0.01237-0.03)$

$A_2 = £2{,}500(0.98237) = £2{,}455.93$

The statement balance the following month has decreased to £2,455.93, a fall of £44.07. Hence, of the £75 paid,

[5] *Which* press release 1 April 2007. http://www.which.co.uk/press/press_home_569_64219.jsp

£30.93 is payment of interest and £44.07 is repayment of capital.

In practice an individual will have a series of transactions on their credit card statement, not just the one has in our example. A series of separate interest charges will be applied on all the transactions when the balance is not paid in full. Where the repayment of capital is sufficient to cover some transactions it is often the lowest in value that are settled first. Typically, as in our example, these charges will be dependent on the statement date and on the date of the transactions.

Consequently, we need to consider the procedure for calculating a daily interest rate. The daily rate should satisfy the following condition so as to have an equivalent APR

(8) $r_d = (1 + r_a)^{1/365} - 1$

Entering our individual's APR of 15.9% into this formula, we find that the daily equivalent rate is approximately 0.0404%.

We now repeat the calculation of the individual's second statement balance when only the minimum payment has been made in response to the first statement. Assume that the second statement is issued 30 days after the first and so 30 days after the transaction of £2,500. Interest is applied to the transaction for 30 days.

We amend (5) to allow interest to be calculated daily. The amount owing at the time of the second monthly statement is obtained by

(9) $A_2 = A_1(1 + r_d)^{30} - A_1 p$

Compound interest is applied daily for 30 days on the initial balance. A payment of proportion p of the balance is made. After factorising, we see that this is equivalent to

(10) $A_2 = A_1[(1 + r_d)^{30} - p]$

If we now enter our initial statement balance, the daily interest rate and the minimum repayment rate, we calculate the next statement balance to be £2,455.50

(11) $A_2 = £2{,}500[(1.000404)^{30} - 0.03] = £2{,}455.50$

The small difference in the statement balance is because the calendar year is not exactly equivalent to 12 months of 30 days.

To advance our examination of servicing credit card debt we continue with our example, but resume using the monthly interest rate. This will simplify the calculations and enable us to consider the important issue of the financial distress of debt.

Consider what happens to the balance owing if the individual, after receiving the second statement, decides once again to make only the minimum payment. The individual will be liable to pay interest for another month on the balance owing on the transaction. Hence, at the end of the third month the balance outstanding, A_3, will be

(12) $A_3 = A_2(1 + r_m - p)$

Substituting in for A_2 from (6)

(13) $A_3 = A_1(1 + r_m - p)(1 + r_m - p)$

This is equivalent to

(14) $A_3 = A_1(1 + r_m - p)^2$

If we now enter the numbers from our example, we find that two months after the transaction the amount owing is £2,412.64.

(15) $A_3 = £2{,}500(1 + 0.01237 - 0.03)^2 = £2{,}412.64$

Our individual's second payment of £73.68 (3% of £2,455.93) reduces the amount owing by a further £43.29. But, after 2 months and payments totalling £148.68, the balance has only fallen by £87.36.

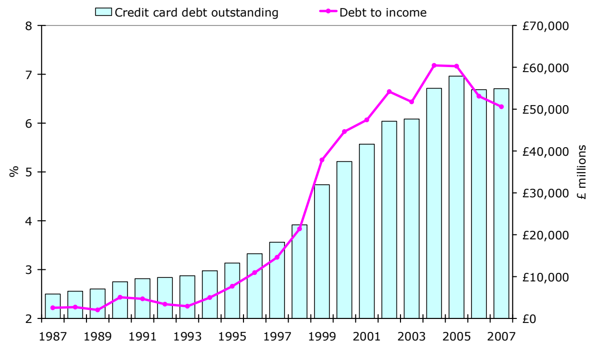
3. Credit card debt in the UK

The potential financial burden from not being able to meet credit card payments in full is clear from our example. So how much unpaid credit card debt is there? Figures from The Office for National Statistics show that the amount of credit card debt outstanding at the end of 2007 was

£54.88 billion.[6] The stock of credit card debt rose by £223 million over the year or 0.4%. Interestingly, the stock of credit card debt peaked at £57.90 billion the end of 2005.

Chart 1 displays both the level of credit card outstanding and its size relative to household disposable income. 2006 is the first year since the data series began in 1987 when a fall is recorded in the level of credit card debt. We see a marked growth in credit card debt relative to incomes from the mid-1990s. In 1995 the amount of debt outstanding was equivalent to 2.7% of the household disposable income. By 2005 the figure was 7.2%. However, it fell back to 6.5% in 2006 and, despite the small rise in the amount of credit card debt, fell further in 2007 to 6.3%.

Chart 1: Credit card debt outstanding



Source: EMLR, Office for National Statistics

It is too early to know if the upward trend in the amount of credit card debt to income has now ceased. Yet the magnitude of this debt continues to raise concerns for policy-makers as to its potential to leave households financially vulnerable.

Tasks

1. Calculate the amount of credit debt written-off over a year if the average amount of debt outstanding in the year is £55 billion and the write-off rate is 7.5%

2. Chart 1 shows the amount of credit card debt *rising* in 2007 but the amount of debt as a percentage of disposable income *falling*. How can these results be reconciled?

3. Assume an individual uses their credit card to purchase a gift for a friend. The gift is purchased on the 30th June and costs £500.

The individual's finances mean they can only afford to make the minimum necessary payment of 3% of the outstanding balance on receipt of the statement balances for June and July. But, they expect to pay the outstanding balance off in full having received the statement balance for August.

Statements are issued on the last day of the month and interest is charged at a rate of 16.9% per annum from the transaction date. Interest is payable on the outstanding balance detailed in each statement when this balance is not cleared in full.

(i) Calculate the daily rate of interest [assume a calendar year of 365 days]
(ii) What payment is made in response to the statement for June statement?
(iii) What is the balance outstanding on the statement for July? What interest charges has the individual incurred? What payment does the individual make when receiving the statement?
(iv) What payment does the individual make when receiving the statement for August so as to clear the balance?
(v) What is the total amount paid by the individual for the gift?

[6] See Table 6.6 of Economic and Labour Market Review, Office for National Statistics