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LEARNING BY DOING:

THE FAILURE OF THE 1697 MALT LOTTERY-LOAN

Georges GALLAIS-HAMONNO and Christian RIETSCH

ABSTRACT

The failure in 1697 of the 'Malt Lottery', the second Lottery-Loan, presents a beautiful case study. From a practical point of view, it tells us three things. 1) The technical features of the English State lotteries-loan were established for more than a century after only three experiments. 2) Its two components ('lottery' and 'loan') led to an abnormally poor return for investors since its expected return was 3.91% whereas its effective one was 5.84% ---- two figures in contradiction with the 6.3% advanced by Dickson (1967). 3) A most strange solution was imagined to counteract the failure: delivering the unsold tickets to the Exchequer for being used as cash. From a more theoretical point of view, the condition North and Weingast (1989) advanced for a successful financial issue proves necessary but not sufficient. The Malt Lottery failed (1,763 tickets sold out of 140,000) because it did not meet the three requirements for success: its return was too low and was lower than the return on competitive assets; its reimbursement dates were uncertain; and the economic and political environment was gloomy.

KEY WORDS: 1697 Lottery-loan; Malt lottery; Expected and actual costs of loans and lotteries. Lottery tickets as legal currency.

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According to Richards (1934-37, p. 57), 170 State lotteries were issued in London between 1694 and 1826. Lotteries were thus part of the 1690s Financial Revolution and later continued to be an important source of State financing. However, in a series of successes, the failure of the second lottery in 1697 proves exceptional. Out of the 140,000 issued, only 1,763 tickets were sold. Although financial historians mention this failure, there never was a detailed analysis of it.

There are two objectives in this paper: first to show the emergence of the technical features of 'lottery-loans' between 1693 and 1697. Second, underscoring that, in order to be sold successfully, a financial instrument should be enticing for investors[1]. North & Weingast's thesis (1989) on the importance of the State debt being backed by Parliament and no longer by an unreliable king may be considered as a necessary but not a sufficient condition for the successful launching of a financial asset. And, in that respect, the 1697 failure presents an interesting case study.

The paper is organised in the following way: Section I shows that three lotteries granted their blueprints to the technical features of English State Lottery-Loans for more than a century. Section II and III analyse the 'bond' and 'lottery' features of the 1697 Malt Lottery-loan. Section IV details the strange solution of giving the Exchequer the unsold tickets to be used as cash. Section V measures the anticipated and the expected costs of the 1697 Malt Lottery-loan. Section VI explains the failure by the absence of the three prerequisites needed for a successful issue: financial features appealing for investors, both as regards the return and

the redemption security, absence of other competing assets and an optimistic political and economic environment. Section VII summarises the findings of the paper in a brief conclusion.

I

First let us introduce a most remarkable man, Thomas Neale, a genius for new projects and ideas in a number of fields. He was a Member of Parliament for 30 years, and he served as Head of the Postal Service of America for 21 years without ever crossing the Ocean. In 1677, he was appointed Master of the Mint under Charles II and remained in office under James II and, more surprisingly, William III and Mary (with Isaac Newton as his successor). This position explains why Neale published extensively on coinage and different financial matters. He was interested in everything new, exciting and potentially profitable. Just between 1688 and his death in 1699, he was involved in no less than 39 projects, five of which concerned lotteries (Thomas, 1979, p. 269).

His involvement in lotteries may be explained by another of his numerous official functions. In 1678, he was appointed Charles II's Groom Porter, an office he would hold until his death in 1699. As such, he was responsible for the comfort of the king's apartments, including the provision of cards and dices. He would also serve as referee whenever disputes would arise on cards or bowling matches. In his quality as Groom Porter, he was entitled to licence (in or out) gambling houses and to prosecute unlicensed ones.

These were hectic times with a furious craving for gambling. According to Dickson (1967, p. 45); '[there] was the addiction of contemporaries to gambling on a massive scale

[…] This helps to explain the keen public interest in lotteries[2]. In such an age, it is no surprise that Neale would organize a private lottery (Neale, March 1693).

Neale simply copied a Venetian State lottery launched in early March 1693 for a draw three months later. This was a 'pure' lottery: with 150,000 tickets sold for 2 ducats each, 410 tickets - the 'benefits'- receiving a lot for a total of 200,000 ducats paid by the 149,590 blanks. With a meagre ratio of one benefit for 366 blanks due to the Venetian Exchequer's taking over one third of the receipts.

Neale's First Profitable Adventure[3] proved much more profitable for Adventurers. Neale kept all the features of the Venetian lottery but with a much lower intake: only 10 per cent (as against 33 per cent). His lottery offered 50,000 tickets sold for 10 shillings each with 250 benefits ranging from £20 to £3,000. Thus, one benefit for 200 tickets was more generous than the one for 366 in Venice. This led to a more favourable expected value[4] of 8.92 shillings for a 10 shilling purchase as compared to the 1.32 ducat for a 2 ducats purchase in Venice.

At least six technical features of the English State Lottery- Loans were inherited from these two experiments: 1) It was open to natives as well as foreigners; 2) How subscription books should be made and organised; 3) The fact that tickets should be presented in three parts; 4) Two urns would be used for drawing: one for tickets sold with a number, and one for benefits and blanks; 5) As would become the custom, two special draws would receive a lot: the first ticket drawn (besides the benefit which might come along with it) and the ticket drawn after the last ticket with a benefit (which terminated the draw); 6) If there were unsold tickets, the number of benefits and the total amount of prizes would be reduced in proportion.

This 1693 private lottery proved a real success. Besides its profitability, there was the respectability of the Groom Porter office and the security of eleven goldsmiths, among whom Sir Francis Child and Richard Hoare, who were responsible for collecting the purchases and

paying the lots. Adventurers came from all ranks of society: from the Evelyn's coachman (who got a £40 lot) to aristocracy and courtiers. The climax being reached with the 1,000 tickets wager of Queen Mary herself (Thomas, 1979, pp. 271-2).

In 1694, England had been at war with France for five years. 'The Augsburg League' war was very costly. Constantly increasing existing taxes and creating new ones was not sufficient and the government badly needed more money. The success of Neale's lottery and his pleading in the Commons (Thomas 1979, p. 272) led to a second venture called 'the Million Adventure', the first State Lottery-Loan which was instituted by an Act of Parliament, '5 & 6 Will and Mary- C7'.

From a technical point of view, there was little innovation in it. Sections XXXIV to LIX basically reproduced the Venetian technicalities used by Neale's private lottery. However all these technicalities are fully detailed with two very precise drawings presenting the tickets to be sold (Sect. XXXVI) and the special printed sheet for receiving annuities (Sect. XLVI).

The innovation consisted in the financial instrument itself, 'a Lottery **and** a Loan'. Indeed, the government was facing a dilemma[5]. On the one hand issuing a lottery would bring in a profit thanks to the craving of the times for gambling. On the other hand, some in society were strongly criticising private lotteries as can be seen from the draft in January 1693 of a one-clause bill intended to abolish lotteries[6]. The solution found shows Neale's ingenuity: no one would lose money, the lucky ones receiving a prize from the 'lottery' whereas the unlucky ones would receive a financial return from the 'loan'.

Being State-issued, the 'loan' granted some advantages to the subscriber. The most important one being the explicit appropriation of given taxes, here upon salt and beer (Sect. XXXI) for paying the financial returns promised by the issue. Other advantages were: 1) If all tickets were not sold, the deficiency could be borrowed (at 8 per cent per annum); 2) The

money lent was free of tax; 3) A financial advantage for quick payment (an unreasonable 14% rebate computed on the time between the subscription and the closing of the issue). Such a rate is very telling about the urgent needs of the Treasury.

The financial features of the Million Adventure were quite straightforward. 100,000 ten-pound tickets were issued. The advantages were twofold: as a 'loan', each ticket was entitled to receiving a one-pound annuity (i.e. 10 per cent) for 16 years. As a 'lottery', there were 2,500 prizes, each being a 16-years annuity ranging from £10 to £1,000. For the State, the yearly cost was £40,000 for prizes and £97,500 for blanks with a total of £137,500 during 16 years. The yield thus being **11.25 per cent.** This 11.25 per cent figure is somewhat different from the 14 per cent advanced by Dickson (1967, pp. 48-49)[7].

This scheme proved a huge success for the Treasury. Its 11.25 per cent cost was very favourable since it was much lower than the Treasury former financial operations: the sale of life-annuities at 14 per cent in 1693[8] and in 1694[9] (which eventually were reduced to 11.50 per cent by forced conversion).

Lotteries continued to be successful during the following years. In 1694 and 1695, Ann Murphy (2005, pp. 27-8) lists no less than 12 private lotteries, the prizes of which were either money or silver plates or physical goods. Between 1695 and 1696, Neale organised three successful lotteries (Thomas, 1979, p. 274). In 1697, on the verge of bankruptcy, calling in Neale's expertise was thus the obvious choice for the Treasury. The more so since he had just suggested a new lottery scheme (Neale, 1696-97) which eventually became the blue-print for the new issue.

I I

The 1697 Lottery-Loan was instituted by the Royal Assent of 16 April 1697 of '8 and 9 William III-C22' Act, voted on 10 April by the House of Commons and 15 April by the House of Lords[10].

As usual since Magna Carta, the Act consisted in two parts. The first part presenting the taxes to guarantee the loan. On the occasion, new taxes were established on sweetened drinks. "Six Pence for every Bushel of Malt' (which gave its 'The Malt Lottery' name to the Lottery)… ' for every Barrel of Mum… Ten Shilling,… for all Cyder & Perry… Four Shilling for every Hogshead…" (Sect. I). The urgency was such that the writers of the Act forgot to appropriate explicitly these taxes to the new issue. Consequently, a year later a new Act specified that the 1697 issue had priority upon the revenues from the malt tax[11].

As a further (standard) guarantee, if these amounts were not to be obtained, the "deficiency… shall be supplied and made good out of the First Aid to be granted in Parliament" (Sect. XXVI)

The second part of the Act presents the "Clause of Loan for £1,400,000" (Sect. XXVII): 140,000 tickets, £10 each, were issued. Purchases could be made either using the newly minted coins or the old ones or silver goods. Silver would be accepted at the advantageous rate of six shillings the Troy[12] ounce.

As was usual with English State loans, the subscription was open to "any p(er) son or persons Natives or Foreigners" (Sect. XXXVII). The subscribers were called either 'Contributors' or more often by a much more vivid name: 'Adventurer' – a term already used for Elisabeth I's 'General Lottery' in 1569. Speedy subscriptions were enticed by

the1694 exorbitant 14 percent annual rate of interest granted for the period between the actual subscription date and the closing day of the issue, 24 June 1697.

Just as in 1694, the instrument proved a hybrid between a bond and a lottery ticket. It had the two basic features of a bond: it bore an interest and it was redeemable. However, these characteristics were somewhat unorthodox.

Section XXVIII stipulated that blanks would earn one farthing a day until redemption, which meant 365 farthings a year or £0.38. Thus the rate of interest seemed to be £0.38 divided by the ten pounds lent or 3.80 per cent. However, there was a subtle financial trap to it: instead of being a compound interest rate – to which we are accustomed – this interest rate was a simple, not compounded one. Thus the interest would prove inversely proportional to the period of investment since the yearly interest was not added up to the principal and previous interest payments for the calculus of the interest for the present year.

Presenting this perverse effect requests two assumptions: 1) The repayment extended over a 140 months period with 1,000 ticket-blocks paid by month (as explained below); 2) The Treasury was to receive the list of persons having won a prize by the end of August; we may thus suppose these repayments started in September. As blank tickets bore interest from 24 June 1697, repayments were then to take place from 24 September 1697 to 24 April 1709.

The table below shows the compound rate of interest actually received by an Adventurer depending on the length of the period of his investment (the 'benefit', if any, not being taken into account).

PLEASE PLACE **TABLE I** NEAR HERE

The meaning of these figures is clear. Either the Adventurer was not financially educated and believed he would earn 3.80 per cent a year. Which would be abnormally low in a country at war (in which the interest rate would usually amount to about 8 per cent) and as compared to the Treasury recent borrowings at 14 per cent. Or the Adventurer would be smart enough to understand the interest would amount to less than 3.80 per cent in case his investment would not be paid off the first year. The longer the period, the smaller the interest rate.

The second component of the asset, its redemption feature, presented some other rather unusual characteristics for there was no schedule showing any precise due dates of payment. Blanks were to be reimbursed and prizes paid whenever the 1,000 tickets-block to which their numbers belonged were to be called for payment. The absence of a precise payment schedule is due to the fact payments were dependent on the taxes appropriated to this loan: ["Tickets shall be payable and be paid as soon as the same be raised and levied from and by the Fund aforesaid"]. Besides, the tax revenue had to be such as to pay for a full block of 1,000 tickets at a time: ["The said Duties upon Malt hereby granted should be applied to the Satisfaction of the said Tickets… so that as soon as there shall be sufficient to pay off the First Thousand Tickets"] (Sect. XXXIV).

This quotation seems to indicate that repayments were to take place every month. The more so as Section XXXV stipulated that the 1,000 tickets-block called for payment would be published in the press every first Monday of the month. ["Time of Payment published on the First Monday in every Month"] (Sect. XXXV)[13].

The call for payment of the 140 tickets-blocks was very ingenious, as it was by draws. Section XXXIV stipulated that before the very first draw, a preliminary draw would be made

out of 140 tickets numbered from 1 to 140 in order to determine the order in which blocks of 1,000 tickets would be paid. Indeed, on the ticket number, the thousand figures were distinguished from the rest of the number so as to indicate which of the 140 blocks of 1,000 the ticket belonged to, the other figures indicating the number of the ticket within that block.

III

The second feature of the 1697 asset is its 'Lottery' characteristic. There were 3,500 prizes ('benefits') for the 140,000 tickets, which meant a one to 40 ratio[14]. The table below shows the prizes distribution.

		PLEASE PLACE **TABLE II** NEAR HERE			

Section XXXIII distinguished two groups of 'Fortunate Ticketts'.'Large' prizes, over £20, received their prizes without redemption or interest. 'Small' prizes of £20 and £10 received their prizes plus their ticket redemption and the interest due. (It is to be noted that this scheme granted the £20 prizes a better benefit than the £30 prizes: the prize plus redemption adding up to £30 to which the interest due was added. Thus, the repayment on the 140th month meant a maximum of 4 ½ pounds interest). Besides, two

'gratuities' of Venetian origin were kept: the first and last tickets drawn received an extra prize (respectively £150 and £100).

Section XXXIII stipulated that "The said Lottery (was) to be drawn on the 10 August 1697" (Section XXXII) and set forth how to proceed.

The text of the Act describing the management of the lottery followed the rules established by the The Million Adventure Act, the self same rules which were kept in force until the end of lottery-loans in 1826. During these 136 years, only minor changes were made in view of a better efficiency. In the Malt Lottery case, there was one single change. It concerned Box B which contained the Fortunate tickets (i.e. those granting a prize) and the blanks. In 1694, Box B contained as many tickets as had been subscribed, i.e. 100,000 tickets. The draw proved awfully long, twelve days according to Murphy (2005, p. 12) in the presence of an excited crowd of people. In 1697, to reduce drawing time, Section XXX established that Box B would contain only 5,000 tickets: the 3,500 Fortunate tickets and 1,500 blanks whereas Box A would contain the 140,000 tickets sold.

On 24 June 1697, the subscription closed and the situation proved dramatic: only **1763 tickets out of 140,000 had been purchased**. Just over one per cent of the loan was covered…

The lottery directors organised the lottery drawing based on 121,763 tickets, 120,000 tickets being delivered to the Exchequer plus the 1,763 which had actually been purchased[15]. It represented 86.97 per cent of the objective, the deficit being 18,237 tickets[16].

IV

Due to the unfavourable political and economic situation (as seen below), the possibility of deficiency had been considered but never to an extent which makes of the 1697 issue one of the largest failure – if not the largest – in financial history. So, contrarily to the 1694 issue, for which only a 8 per cent loan was to cover any sale deficiency, Section XXVIII introduced an amazing solution whereby unsold lottery tickets would be handed over to the Treasury to be used as **legal currency**. Neale may have been at the origin of that strange solution as a variant for his former idea of issuing short-term bonds bearing interest and guaranteed on a tax on malt[17].

As regards the financial statute of these 'cash tickets', it was clear for the writers of the Act: "The Owners or Bearers of such Tickets […] be esteemed Contributors or Adventurers as if such Owners or Bearers had originally paid to the said Receivers…"
In short, the Exchequer received these tickets and used them to pay its creditors who became **forced Malt Lottery subscribers**.
In practice, things did not prove that easy. Reimbursement with interest according to the draw order of payment did not raise technical problems. But the lottery-prizes did. Fairness would have requested all cash-tickets to be distributed before drawing in order to give each paid creditor an equal chance. But it does not seem to have always been the case. The Calendar of Treasury Books (1697, pp. 303-13) gives detailed information on how these cash-tickets were used as money for paying services rendered or salaries. Some were used before the draw. The Calendar thus gives lists of names of creditors who were paid with that 'notional' money. For instance, on 16 July 1697 (just before the drawing on 10 August) the Exchequer paid £106,100, some of it going to the Secret Service. However, most of the payments seem to have been made early in 1698, after the drawing. For instance, on 12 February 1698 Percival

Brunskill received £20 under the form of two £10 cash-tickets; on 15 February Nicho Baker received £1,000 (100 tickets) "for Crown Law costs"; on 18 February Mr Corbett and Mr Doddington each received £20,000 "in Malt tickets for money". Orders of payments (warrants) were issued in cash-tickets. On 20 January 1698, the dukes of Southampton, Grafton and Northumberland received £1,250 each, whereas the "Master of the Horse for extraordinaries of the Stables" received £3,000. As for remunerations, on 14 January 1697, £1,825 were paid to the Lord of the Privy Seal and 702£ 12sh 6d were paid to seven sergeants-at-arms…

On 9 and 10 September 1697, William Lowndes, Secretary of the Treasury sent two letters to the Earl of Ranelagh ordering him to issue Malt Lottery tickets and explaining the reason for using these cash-tickets "as [they] are in the remotest course of payment and have no benefits attending them"[18].

Of course, lottery tickets used as legal currency were highly unpopular. Thus, the Wynn Papers (2007, p. 5) says how dissatisfied officers on the battlefield on the Continent were when, in July 1697, they received these strange 'bank notes'. The inn holders of Middlesex, who quartered the Earl of Oxford's horse regiment complained but eventually accepted these tickets only with a heavy 40 to 60 per cent discount. The 'Navy Victualling Board' refused to take them" (Ewen, 1932, p. 133). The only persons who were happy with them were speculators. The detailed analysis of the ledgers of Sir Francis Child by Quinn (2001, pp. 604-5) shows very profitable (and rapid) operations on Malt tickets. Otherwise, it is rather surprising that a spontaneous market for so many blank tickets seem not to have emerged as had been the case for the Million Adventure's blank tickets (Murphy, 2005, p.26).

Indeed, the best financial operation of the time was to buy a blank ticket with a heavy discount and hoard it until redemption. As the following table shows, the result was highly dependent on the time of redemption. Computations were made for four

periods: the 35th payment, the 70th, 105th and 140th (the last one). Such figures need no comment: – the nearer the payment, the larger the return.

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PLEASE PLACE **TABLE III** NEAR HERE				

As the Act stipulated, on Tuesday 10 August 1697, the managers brought the three necessary boxes ('sold' tickets, benefits and special tickets for establishing the course of payments) into the Guildhall in the City of London.

The British Library possesses a pamphlet published by the City of London Corporation in 1697 which lists all the Fortunate numbers. It provides invaluable first-hand information. Despite its bearing on only 5,000 tickets, the draw requested seven days. The following table shows the number of prizes drawn on each day.

PLEASE PLACE **TABLE IV** NEAR HERE			

As can be noted, only some 3,046 benefit tickets were drawn instead of the announced 3,500. Thus, as stated in the 1694 Lottery- Loan Act, the number and the amount of benefit tickets were reduced in due proportion to the sums collected. The reduction of 13.03 per cent suppressed 454 tickets.

V

Thanks to the figures at hand it is possible to measure the two main characteristics of the Lottery-Loan: its **expected** cost for the Treasury – or its equivalent, its **expected** return for the Adventurers – and its **effective** cost.

However, in both cases, there is the problem of a lack of payment schedule. The computation of a yield to maturity (as opposed to a return) requests knowing the precise dates for each payment. Since Section XXXV stated that each month "what Thousand Tickets are to be paid that Month" would be published, we induce that each month one single 1,000 tickets-block would be paid (payment of prizes, redemption of capital plus interest due).

According to our second assumption, monthly payments started on 24 September 1697, three months after 24 June, the date interest began to run.

Based on these two assumptions, measuring the expected cost of the "loan" component is a straightforward matter. 136,500 blanks paid £1m365. A monthly repayment of the principal over 140 months means 975 tickets or £9,750. To which must be added interest which increased with the number of passing months (but decreased with the redemption of tickets).

The yield obtained is **3.39 per cent** over a 12 years period. This yield is far from the nominal rate of return of 3.80 per cent for the first year, the difference coming from the decrease in the compounded interest over time.

Measuring the expected cost of the "lottery' component is another story. Only estimates can be made due to two factors. First, the dates of prizes payments are not known since they depended on the order of payment of the blocks they belonged to. Second, and more importantly, the computation of the interest poses a problem. The interest of one farthing per day is computed on the purchase price of the ticket (ten pounds) and not on the prize obtained. Thus the interest due would be the same whatever the prize obtained. Further, 'large' prizes did not receive an interest, so that the Treasury would save the more as it paid them the later. For instance, if some 'large' prize was paid during the first month, the Treasury saved only 30 farthings whereas if payment took place on the last 140th month, saving would amount to 4,322 farthings or four and a half pounds.

This may serve as a clue for estimating the two extreme figures of the Lottery-Loan cost: making three simulations as to the dates upon which 'large' and 'small' prizes might have been paid[19]. The process is as follows: 1) The 136,500 blanks are supposed to be redeemed (principal plus interest) by groups of 1,000 tickets-blocks over 140 months, excluding the months in which the prizes were paid in priority. 2) The 3,500 prizes were organised in 1,000 tickets-blocks and paid over three and a half months.

The results of the three simulations are the following ones: 1) The most favourable situation for the Treasury would be if all prizes were paid during the last months, practically from the 137th to 140th months. In that case, the yield would be 3.81 per cent; 2) The worst situation would be if all prizes were paid the first three and a half months. The yield would then be 4.05 per cent; 3) The more probable result – on which

more sophisticated mathematical simulation methods would converge – would be that obtained when all prizes would be paid at mid-schedule and in a well-balanced way on five (and not three) months, from the 69th to the 73rd months. The yield would then be 3.91 per cent. The following table summarizes these results, to which is added the cost of the 'loan' component which can be used as a benchmark.

PLEASE PLACE **TABLE V** NEAR HERE	

From these figures we can infer three things. First, the span of the spread which ranges from a minimum of 3.81 per cent to a maximum of 4.05 per cent, equal to 24 basis points, is surprisingly small. Second, the most probable cost for the Treasury must have been **3.91** per cent. This estimate is the most plausible due to the smallness of the spread. Third, this 3.91 per cent estimate is in total contradiction with the 6.3 per cent figure advanced by Dickson (1967, pp. 48-49), a figure which is obviously erroneous. Paradoxically, the 1697 yield did not come from the relatively small amount of prizes used as an inducement for subscribing to the Lottery-Loan but from the amount of 'simple' interest.

The **effective** cost of this unsuccessful operation can also be measured thanks to the Parliamentary Report on the National Debt (1898). The table below shows the annual payments relative to the principal alone, i.e. the payments of the prizes and the tickets redemption. The figures relative to interest payments had to be estimated.

	PLEASE PLACE **TABLE VI** NEAR HERE				
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This table is rich both in information and in unknowns. First, the Treasury seems not to have paid blocks of 1,000 tickets since no figure is a multiple of 1,000. The £180 annual payments in 1702 are unexplained and one may wonder if they represent a unique payment of three prizes: £100, £50 and £30? Besides, annual payments were uneven. During the first two years, payments were considerable and amounted to half the debt whereas there were years during which almost nothing was paid, before a complete stop in payments for four years, from 1703 to1707, due to the heavy expenditures of the war of the Spanish Succession. The second remaining half of the debt was repaid at an annual rate of 10-11 per cent from 1707 to 1710, with the balance finally paid in 1711. Thus, the total payment of the prizes and redemption of the blanks were spread over 14 years, a little more than the 11 and a half years originally considered by William III's Act.

An estimate of the effective cost of this Lottery-Loan can be made using some reasonable assumptions. The process used was as follows: 1) The prizes were reduced by 13 per cent. Such a reduction was applied to the amounts to be paid to the four types of tickets, 'large' prizes, £20 and £10 prizes and blanks; 2) The percentage effectively paid each year (columns three and six above) was applied to the four kinds of tickets. It provided the annual amount of payments the different tickets benefited from; 3) These

annual amounts were divided by 12 in order to estimate the monthly payments; 4) The number of tickets eligible for interest payment was deducted from the monthly payments; 5) Computations were made separately for the four types of tickets. Then the four totals were added up and the yield was computed based on the effective time-schedule. (Two results were estimated due to an important change in the interest rate. The 10 William III – C10 Act doubled the interest: from 25 March 1699 onwards the interest became two farthings a day[20]. This measure may have been due to the complaints of subscribers who, not being able to get rapid repayment, required being granted a more decent remuneration; a generosity favoured by the Ryswick Peace. With such a doubling of interest, the total effective cost of the Malt Lottery-Loan can be estimated at £ 1,823,774 over 14 years, representing a **5.84 per cent** yield to maturity.

Relatively to the cost of competing financial instruments, this 1697 Lottery-Loan was a real bargain for the Treasury. It would even have been cheaper had not the interest been doubled: 3.55 per cent. This yield is quite different and much smaller than the apparent nominal return of 3.80 per cent. Such 3.55 per cent yield is the direct consequence of the perverse effect of a remuneration based on a 'simple' rate of interest and not on a 'compound' one. A feature which makes of the 1697 loan a beautiful case study.

VI

The reasons for this complete failure deserve to be explained. Dickson (1967, p. 57) says that it 'showed how desperate a financial crisis the government had stumbled into'. Murphy (2009, p. 63) says almost the same: '[it] was a powerful expression of the public's discontent'. We consider these two statements as too limited. Launching any large issue is always a delicate matter demanding at least three requirements, namely: a)

offering appealing financial features (return and redemption); b) with an absence of competitive assets; c) and, psychologically, a surge for trust in the future amidst troubled times.

When the return on a financial asset is not proportional to its risks, the asset cannot be sold. As Ashton (1893) said in the foreword of his book: "With bad paper, one's best is impossible". Such was the case with the Malt Lottery. Both its 'bond' and its 'lottery' components offered too low a return.

The 'flag' of a lottery is its first prize. The £1,000 of the 1697 Lottery-Loan is a very poor prize compared to the first prizes of the two previous lotteries. Neale's 1693 lottery gave a prize immediately to be paid of £3,000 for a 10 shilling ticket, and the 1694 Lottery-Loan £1,000 during 16 years. Besides, the 1697 winner had to wait for a more or less long period of time before receiving his due[21].

In order to measure the relative attractiveness of lotteries, it is possible to compute their 'expected value' which is the sum of the prizes obtainable (including zero) weighted by their respective probability. The Million Adventure expected value was £1- 45sh-10d for 16 years, adding up to a cumulative nominal total of £22 for tickets costing £10. This would have appeared a good bargain making for success; but not so in 1697. The Malt Lottery expected value was only 12£ 11sh 2d, i.e. the redemption amount (£10) and a meagre £21/2 as interest[22].

As for the 'bond' component of the Malt 'loan', considering that the third rule for the success of an issue is to offer more than other available assets, the 1697 issue offered less, a very low 3.39 per cent (3.91 per cent if the lottery component was taken into account)[23]. Both yields being very low as compared to recent offerings by the Treasury: a tontine-loan at 10 per

cent in 1693[24] whereas the Crown borrowed at 8 per cent in 1694 from the newly founded Bank of England and while the Goldsmiths lent money at 12 per cent and The Million Adventure yielded 11.25 per cent. More importantly, just before the Malt Lottery Act (Chapter XXII), Parliament had voted an Act (Chapter XX) specifying that the tallies accepted at par for the subscription to the Bank of England capital (for the four fifth of the subscription) had a 8 per cent rate of interest[25]. This 8 per cent figure can thus be used as a benchmark.

However, the actual rate of interest was much higher. Two contemporaries, Sir Francis Child (Customers Ledgers…) and Oldmixton (1735, p.150) both say that bank-notes were valued with a 20 per cent discount and that some English funds bore a 40 to 60 per cent discount. With such investment opportunities, a paper yielding less than 4 per cent would have some difficulty being willingly purchased.

The third reason for the Malt Lottery failure was the uncertainty as to redemption dates. On this account, we consider North and Weingast (1989) are basically right – the transfer of the financial power authority from the King to Parliament was revolutionary –but this must not be considered as the whole story since the actual features of an issue are of paramount importance for its success.

The uncertainty as to redemption dates was due to four factors, the major one being the fact that the Million Adventure subscribers were not receiving their annuities and were petitioning Parliament. The Chancellor of the Exchequer, Charles Montagu, wrote to his friend William Blathwayt: "I was always fearful of the success of a new Lottery when the old tickets were not pay'd but wee must make the best wee can of it" (Murphy, 2005, p. 9). This was an awkward situation[26]owing to the fact that Parliament had suppressed the King's power to renege his financial commitments but was not able to enforce its Own[27]. In fact (and

this was the second uncertainty factor), the Million Adventurers were not the sole investors not being paid. Actually just before the Malt Lottery issue, Parliament had been faced with the fact that estimates of tax revenue made for 15 previous issues proved largely overestimated, leading to a deficit of £5 million (*cf.* note 25 above).Therefore it was not to be considered a good omen for the Malt Lottery guarantee and it forced Parliament to legislate again at the beginning of 1698, although too late since the draw had already taken place. The 8 and 9 William III-C8 Act ordered once more that any revenue coming from the tax upon malt be used in priority for payments to the Malt Lottery and, as mentioned above, it increased its interest from 1 to 2 farthings a day.

The third uncertainty factor concerned more astute investors. The Malt Act specified that the new malt tax was to be in force for (only) 2 years and 3 months (Sect. I). It was thus obvious that the State could not collect £1,400,000 in 27 months. Had it been possible, the State would have had no need for issuing a Lottery-Loan. This calendar may have resulted from the Parliament's reluctance for long-term financing which probably was a way to control the King's expenditures[28]. Practically, it meant that the 1697 investors had to trust Parliament would extend the collection of the taxes appropriated to them.

The fourth uncertainty factor – though a minor one – was the lack of a precise redemption schedule due to its being dependent on tax revenue.

Our third requirement for a successful issue is linked to the economic and political environment. States launch large issues because they need ready money (most often due to the waging of wars). Thus, issues are made in times of crisis which, by definition, are not favourable to subscriptions. So, two things are needed: first and foremost an appeal to patriotic feelings, and second, a surge of optimism for the near future.

Such was not the situation in England in 1697 since it was a time of economic crisis and of gloomy political atmosphere. D.W. Jones cited by Murphy (2009, p. 56) concisely summarizes the situation as 'the gravest economic crisis of the century'[29]. It had two main causes, namely: the 'Great Recoinage' and the 'Augsburg League War'. The Great Recoinage took place from December 1695 to 4 May 1696. Horsefield (1956, p. 234) concludes that 'the years 1695 and 1696 showed a real, though mild, inflation, followed by an equally real, though briefer, deflation'. Hence, the 1697 Lottery-Loan was launched in the middle of a credit crunch and at a time people were hoarding the new minted coins.

In 1697, 'the Augsburg League War' had been going on for eight years. It was unexpectedly costly since England had to finance both its allies and its own troops fighting on the Continent. For Englishmen, it meant a continuous increase in existing taxes and the introduction of new ones. This did not prevent belligerents from being financially exhausted. Secret peace talks were underway at the very same time the Lottery-Loan was announced. Had they been known, the result might have been different. Though this is not certain since the Peace Conference had convened in Ryswick on 9 May, before the closing of the subscription which was on 24 June 1697 and that good news had, obviously, no incentive effect on investors. The political environment remained gloomy, certainly due to the constant increase in taxes, and to the fact that King William III had not inherited the popularity of Queen Mary (who died in 1694) whereas there was a growing feeling he was favouring his native country[30].

VII

Instead of acknowledging the inadequate design of the Malt Lottery, which was not fit for the general economic conditions of the day and for the needs of potential subscribers, it was private lotteries as such which came under attack and criticisms bore not only on those who had organised them but also on those who had participated:

'Whereas severall evill-disposed Persons ……. have sett up many mischievous and unlawfull Games called Lotteries ….. have thereby most unjustly and fraudulently gott to themselves great Sums of Money from the Children and Servants of severall Gentlemen Traders and Merchants …. to the utter Ruine and Impoverishment of many Families ……..…. Be it enacted …That all such Lotteries and all other Lotteries are common and publick Nuisances (and are) against Law'.

This is the preamble of the 10 William III-.C 23 Act which forbade private and State lotteries at the end of 1698[31].

This virtuous stance was not to last. In 1710 when, due to the 'Spanish Succession War', the financial situation became once more tight, the 8 Ann-C4 Act issued a new Lottery-Loan[32]. This type of financial asset was to be used until the new prohibition a century later in 1826, only to reappear in modern times and still be in use to-day under the name of 'Premium bonds'.

x x

x

The aim of this paper is to demonstrate how the technical features of State Lottery-Loans, in use for more than a century, emerged from a Venetian lottery, then from a private lottery in 1693 and from the Million Adventure in 1694. However, whatever the technicalities

adopted, what are paramount are the financial characteristics which are required to appeal to potential investors. And this is not an easy task as shown by the 1697 failure: its 3.91 per cent expected return was lower than other investment opportunities, and its reimbursement was uncertain. Moreover, the country was facing a major economic crisis and political environment was gloomy. Thus the Malt issue presented none of the three necessary conditions for the successful issue of a financial asset. No wonder that it failed.

FOOTNOTES

[1] This is the underlying theme of an article by COHEN (1953) [who is one of the few authors having forgotten to cite the 1697 issue].

[2] Cf. also Murphy [2009, pp.34-35]. C. L'Estrange Ewen (1932) (referred as "Ewen") presents the most comprehensive survey on lotteries in Great-Britain. He devotes no less than 34 pages (pp. 93-126) to presenting 16 private lotteries launched between 1660 (Restoration) and 1693.

[3] Title of the announcement published in the London Gazette on 23-31 August 1693 (Ewen, 1932, p. 214).

[4] The "expected value" of a lottery is the sum of the prizes obtainable (including zero) weighted by their respective probability.

[5] Murphy (2009) raised the dilemma. We follow her argument. She thinks its author was Neale himself.

[6] Ewen (2009, p. 125) says about this tentative bill "Probably as a step to clearing the way for a State Lottery rather than from any great virtue". We have doubts about it because this drafting was anterior to Neale's 1693 success.

[7] The difference with Dickson comes from a confusion between nominal cost ($140 000 - constituting the yearly fund – divided by £ one million) and the yield cost figure we arrive at when taking into account the precise date for each payment and the actual cost: $137 500 and not $140 000.
A similar mistake was made by Cohen (1953, p. 24) who advanced 11.50% because he too used £140,000 as annual annuity payments.

[8] Act: 4 William and Mary-C3 (Cf. Sect. XXII).

[9] Act: 5 William and Mary-C5 and 5 William and Mary-C20.

[10] A 3-pages-tract published by the Treasury (G.-B Treasury, 1697) is useful for its details on the Lottery-Loan.

[11] Act: 9 William III - C8: "An Act for explaining and Act made the last Session of Parliament for granting H.M. certain Duties upon Malt, Mum, Sweets, Cyder and Perry".

[12] This may certainly be linked with the Great Recoinage – of which Neale was responsible as Director of the Mint- which had started in December 1695.

[13] Consequently, for computing the expected cost of the 1697 issue, we will assume that 1 000 tickets are reimbursed every month.

[14] This was the 1694 ratio which was to become the standard.

[15] The official figure is £1,217,639 collected by the State (Parliamentary Papers…, 1898).

[16] About the deficit of 18,237 tickets, two outcomes were probably used: 1) Part of them (9,778) was delivered to the Exchequer in 1698 (Public Income and Expenditure, 1898, p. 483); 2) The remaining 8,459 tickets were 'annulled' and were replaced by tallies at 8% (Act, Sect. XLIV).

[17] The Chancellor of the Exchequer, Montagu, took that idea (and the full credit for it) for himself under the form of Exchequers Bills – the first issue of which proved a failure (*cf.* www. historyofparliamantonline.org/volume/1690-1715/member/neale-thomas 1641-99).

[18] Letters in Calendar of Treasury Books, 1697 (1933, pp. 303-313). These two letters totaled 11,034£ 18sh 4d to be paid representing 1,103 lottery tickets. With a 1 Fortunate for 40 tickets ratio, these 1,103 tickets should have produced around 27 Fortunate tickets. Where they were?

[19] For the sake of shortness, Appendix 1 detailing the three processes was suppressed. It is available from the authors.

[20] Act: 10 William-C10.

[21] The only technical way for comparing these two "First prizes" is to compute their "present value" – i.e. the sum of their discounted cash-flows. In 1697 the alternative was to subscribe to tallies at 8%, the rate used for discounting the cash-flows. The 1694 prize present value was £8,851. The 1697 present value was a function of the moment the prize was received: 1st payment: £ 981; 35th: £799; 70th: £638; 105th: £510; 140th: £ 407.

[22] The expected value was computed on the assumption that the total redemption and interest payments of the blanks and £20 and £10 prizes took place in the middle of the time-schedule, i.e. at the end of the 70th month.

[23] Considering the majority of potential investors did not make a difference between a compound and a simple rate of interest and thought the rate of interest was 3.80 per cent does not change the argument: 3.80 % was too low.

[24] The 1693 Tontine-loan's annuities were 10% until 1700 and 7% thereafter [Act: 4 Will. and Mary-C3].

[25] Act (1696-97): 8 and 9 William III - C20: "An Act for making good the Deficiencies of several Funds therein mentioned and for enlarging the Capital Stock of the Bank of England and for raising the Publick Creditt".

[26] It is a counter-example of North and Weingast's thesis.

[27] Murphy (2009, p.55sq) is highly critical of the Parliament's inexperience and mismanagement of the financial affairs during the 1690's.

[28] Professor Felix (University of Reading) told us that the Parliament systematically granted the Navy's subsidies lower than her known needs. According to him, it was "to keep a hand over the King's budget".
The same in Dickson (1967 , p.348) and Murphy (2009, p 56 sq).

[29] Cf. Horsefield J.K. (1960). British Monetary Experiments, 1650-1710. G. Bell & Sons. (Especially Chapter 20); Dickson (1967, pp. 46-47); Murphy (2009, Chapter 2).

[30] One of his first Acts was, at the least, a psychological blunder: 1 W&M – C28: 'An Act for appropriating certain Duties for Paying the States General of the United Provinces their Charges for His Majesty' Expedition into this Kingdom'.

[31] Act (1698): 10 William III - C23: "An Act for suppressing of Lotteries".

[32] Act (1709): 8 Annae - C10: 'An Act for continuing Part of the Duties upon Coal, Culm & Cyder… to raise the sum of Fifteen Hundred Thousand Pounds by way of a Lottery for the Service of the Year One Thousand and Ten'.

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TABLES

Table I: Rate of interest as function of the length of the investment period

Date 24 June	Number of months since 24 June 97	Number of farthings since 24 June 97	Annual Yield %	Date 24 June	Number of months since 24 June 97	Number of farthings since 24 June 97	Annual Yield %
1698	12	365	**3,80**	1704	84	2 555	3,43
1699	24	730	3,73	1705	96	2 920	3,37
1700	36	1 095	3,67	1706	108	3 285	3,32
1701	48	1 460	3,60	1707	120	3 650	3,27
1702	60	1 825	3,54	1708	132	4 015	3,23
1703	72	2 190	3,48	1709 * *24 April	142	4 319	**3,19**

Source: The authors. It is the yield on the fixed income part of any 1697LL tickets.
The annual compound rate of interest is the solution of the compound rate formula:
[K * (I + x)^n = (K+I)]
With K=£10 (subscription price), x is the yield, n= the exact number of days divided by 365; I= number of farthings earned transformed in pounds.

Table 2: Distribution of the prizes in the Malt lottery

Number of prizes	Amount of each prize £	Total cost for the Crown £	Number of prizes	Amount of each prize £	Total cost for the Crown £
1	1 000	1 000	400	20	8 000
2	500	1 000	2800	10	28 000
3	400	1 200	*First	150	150
4	300	1 200	*Last	100	100
6	200	1 200	**3 502**	**Total**	**56 000**
51	100	5 100	300	**Large	20 000
103	50	5 150	3 200	**Small	36 000
130	30	3 900			

Sources: authors from Section xxx.

*First and Last ticket drawn. ** Large = Prizes over £20. Small: £20 and £10 prizes

Table 3: Annual rate of return* on the purchase at discount

of a blank ticket to be kept until redemption.

Payment number (Time delay)**	35th 3 years + 1 month	70th 6 years	105th 8 years + 11 months	140th 11 years + 10 months
Capital and interest received :	£ 11,17	£ 12,28	£ 13,39	£ 14,50
Rate of return if purchase at :	%	%	%	%
£ 4	42,19	21,20	14,80	11,66
£ 5	31,17	16,66	11,91	9,55
£ 6	23,74	13,00	9,60	7,85
£ 10	3,87	3,60	3,39	3,23

Source: the authors.

* Yield to maturity is computed on the exact number of days.

** The payments are assumed to have started on 24 September 1697, three months after 24 June when interest began to run. So, for instance, the 35th payment means 37 months of interest.

Table 4: Drawing schedule of the Malt lottery

1st day	Tuesday 10	220	4th day	Friday 13	592
2nd day	Wednesday11		5th day	Saturday 14	402
	Morning	304	6th day	Monday 16	300
	Afternoon	(309)*	7th day	Tuesday 17	327
3rd day	Thursday 12	592			
				Total	**3 046**

Source : From City of London Corporation (1697)

*Missing information. It is estimated by the difference between the total benefit tickets drawn and the number of known tickets drawn.

Table 5: Summary of the possible expected costs of the Malt Lottery
(Yields to maturity)

- Pure loan:	3,39 %
- Loan with prizes paid the **first** months:	4,05 %
- Loan with prizes paid in the **middle** of the schedule:	**3,91 %**
- Loan with prizes paid in the **last** months:	3,81 %
Source: the authors	

Table 6: Effective yearly payments relative to the principal and the prizes of the Malt Lottery (£)

Year	Amount	%	Year	Amount	%
1698	299 240	24	1707	133 830	10,7
1699	299 180	24	1708	112 790	9.0
1700	49 660	4	1709	130 750	10,7
1701	9 970	0.8	1710	170 730	13.7
1702	180	0	1711	41 500	3.3
1703 to 1706	**NOTHING**			**1 247 830**	100
Source: British Parliamentary Papers (1698), pp.284-287.					