Tontines, Public Finance, and Revolution in France and England, 1688–1789

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Tontines were used more extensively by France than Britain. Comparative tontine history illuminates the differing evolution of public finance in the two countries and its political consequences. Archival materials establish the number of participants in French tontines. Internal rates of return on tontines and alternatives show subsidy of tontines by the French government. Repudiation in 1770 contributed to the political attitudes of life annuitants, the most important class of state creditors, during the fiscal crisis of the late 1780s.

In 1688 England's bloodless Glorious Revolution ushered in a new king and a new era of cooperation between Parliament and monarch. One of the first and most profound consequences was the development of a funded public debt.[1] In 1789 an ongoing crisis in French public finance led to the convocation of the Estates General and from there to a political revolution. Choosing these years to bracket the present study serves as a useful reminder that political structure and economic policy were inseparable parts of the development of national states in the late stages of mercantilism. France and England were locked in a superpower struggle throughout the period. Including the years to 1815, they were actively at war about one year in two.[2]

Prior to 1688 France under Louis XIV held the upper hand in its ability to raise money for political ambitions. The ensuing century marked a dramatic reversal in the relative strength of public finance and in military fortunes.[3] England also used its public debt to expand and integrate its banking sector. Some historians credit this financial revo-

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[1] See Alice Clare Carter, *The English Public Debt in the Eighteenth Century* (London, 1968), pp. 5–7, for a discussion of the Revolution as a prerequisite. P. G. M. Dickson, *The Financial Revolution in England* (London, 1967), pp. 3–14, emphasizes that Dutch society was the model for English economic reformers even before William of Orange was offered the throne in 1688.

[2] The War of the Grand Alliance (League of Augsburg), 1689–1697; The War of the Spanish Succession, 1702–1713; The War of the Austrian Succession, 1740–1748; The Seven Years' War (French and Indian War), 1756–1763; The American War of Independence, 1776–1783; The French Revolutionary War, 1793–1801; The Napoleonic Wars, 1803–1815. Each country also fought other battles with less direct involvement of the other.

[3] Paul Kennedy, *The Rise and Fall of the Great Powers* (New York, 1987), pp. 76–86, credits the financial revolution in Britain as the determining factor in Britain's emerging military supremacy over France.

lution with a vital role in England's industrial revolution of the eighteenth century, and contrast it with the debilitating effects of French financial backwardness.[4]

The years also enclose the heyday of the tontine as a form of government borrowing. France offered the first national tontine in 1689, England the last in 1789.[5] Tontines are a form of life annuity in which survivors benefit from the deaths of other participants. In simple life annuity loans the government borrowed by taking in lump-sum payments in exchange for providing a stream of payments during the lifetime of a nominee. Tontines were a variant in which payments forfeited by deceased subscribers within some prespecified group were redistributed among survivors. The government's obligation ended only with the death of the last member of the group. National tontines have little in common with tontine life insurance as it developed in the late nineteenth century.[6] Plans varied in important details and are considered more fully below.

This article seeks to explore the development of public finance in France and Britain, and with it, the origins of the French Revolution. Two strands connect the fiscal crisis to the Revolution. One is the political impasse over budget reform that led Louis XVI to call the Estates General. The other is the rapid radicalization of the Third Estate, particularly its assertion of control over public finance.[7] It is sometimes convenient to attribute both to the burden of the debt. But, as the next section shows, France's debt burden was surely lower than Britain's.[8] We cannot predict the Revolution from the *state* of the system in 1789; we need to seek its origins in the path by which that state was reached, that is, in the evolution of policy.

The first strand will not be unravelled here. The annual deficit in

[4] Charles Kindleberger, *The Financial History of Western Europe* (London, 1984), pp. 158–59.

[5] The French government resolved in 1763 never again to raise its own funds directly by means of a tontine. During the Revolution the government nationalized a private tontine organized for the duc d'Orléans in 1785. In 1790 the Constituent Assembly rejected a complex plan by Lafarge, a mathematician, who established it anyway. It, too, was eventually nationalized. The *Convention Nationale* in 1795 established a plan for a *tontine nationale* (accepting *assignats* as principal) but revoked it before collecting funds. See A. Vührer, *Histoire de la dette publique en France* (Paris, 1886), pp. 304–10, 376–77.

[6] The nineteenth-century private life insurance plans based on the "tontine" principle redistributed funds forfeited by nonrenewals of premiums as well as death. Subscribers paid in to private companies on an installment basis, receiving a lump-sum payment at the end of a term (if they survived), or a payment to their heirs (if they died before the end of term), or nothing (if they failed to keep up the payments). On the nineteenth century, see Richard Sutch and Roger Ransom, "Tontine Insurance and the Armstrong Investigation: A Case of Stifled Innovation, 1868–1905," this JOURNAL, 47 (June 1987), pp. 379–90.

[7] J. F. Bosher, *French Finances, 1770–1795: From Business to Bureaucracy* (Cambridge, 1970), is especially informative on the revolutionary desire to reform the process of public finance.

[8] Even the most virulent critic of the monarchy's indebtedness, Marcel Marion, *Histoire financière de la France depuis 1715* (Paris, 1914), acknowledges that Britain was worse in purely quantitative terms (vol. 1., pp. 460–61).

peacetime, still as much a subject of debate today as it was for Necker and Calonne, was more peculiarly French.[9] The political obstacles to raising taxes remain an important area for research. This article takes up the second strand. It traces the development of life-contingent debt and the evolution of policy regarding it. By 1789 it was the largest and most politically volatile component of the French debt. Both the size and political sensitivity were uniquely French, and can be seen as the logical consequences of French government policies that were distinctly different from British. The focus in this article is on the early formation of that policy in tontine loans.

Tontines were a minor, though not insignificant fraction of total French government borrowing. What makes them interesting is the clear insight they give into the emergence of different styles of public finance in the two countries. From the confused beginnings in the 1690s, tontine policy evolved in a way that clearly defined each country's increasingly distinctive approach to public finance: market orientation in Britain, and market avoidance and political coalition-building in France. The life annuities (*rentes viagères*) that emerged both as a major component of French debt by 1789 and a highly controversial issue in Revolutionary politics can be seen as the logical continuation of policies begun with the tontines. The experience gained by French *rentiers* in the tontine "reforms" of 1770 prepared them for mobilization in defense of their interests in the fiscal crisis of the 1780s.

PUBLIC DEBT AND POLITICAL REVOLUTION

Table 1 shows the economic and financial situation in France, Britain, and the United States at about the time of the French Revolution. Debt service consumed about 60 percent of tax revenues in all three countries.[10] But the debt-to-GNP ratio was approaching two in Britain and was closer to one-half in France and the United States. Obviously, the countries differed widely in the burden of taxation as a fraction of GNP and in the ratio of debt service to debt capital.

At a rate of 2 percent of GNP, the fledgling American Republic imposed much lower taxes than the European superpowers. As Peter Mathias and Patrick O'Brien have emphasized, Britain carried a heavier

[9] See Robert D. Harris, *Necker: Reform Statesman of the Ancien Régime* (Berkeley, 1979), for a recent rehabilitation of Necker's position that the deficit was not of his making.

[10] The figure for French debt service in Table 1 differs from the total of 318.3 million given by F. Braesch, *Finances et monnaies révolutionnaires* (Paris, 1936), vol. 2, p. 202, because I excluded 27.2 million in pensions, 7.8 million in overdue expenses of the *maison du roi*, and 3.1 million in operating expenses, but added 12 million in *rentes viagères* (annual life annuity payments) from the loan of November, 1787. I have retained another 11.4 million in *acquisitions* and *liquidations* (payments to members of the aristocracy) that might be interpreted as something other than debt service since the capital received by the king in exchange is not always evident.

TABLE 1
DEBTS, TAXES, AND THE ECONOMY IN FRANCE, BRITAIN, AND THE UNITED STATES IN THE LATE EIGHTEENTH CENTURY

	France 1788	Britain 1788	United States 1792–94
Nominal GNP	6,977.0 l	£134.80	$254.00
Central Government Revenues	472.4	16.78	4.97
Annual Government Debt Service	292.2	9.41	3.16
Government Debt	3,877.8	245.10	79.85
Population (thousands)	26,596	9,369	4,299
Nominal GNP per capita	262.3	14.39	$59.08
Ratio of:			
Debt Service to Tax Revenues	61.9%	56.1%	63.5%
Debt to GNP	55.6	181.8	31.4
Taxes to GNP	6.8	12.4	2.0
Debt Service to Debt	7.5	3.8	4.0

Notes: All economic and financial data are reported in millions of domestic currency (French livres tournois, British pounds sterling, American dollars).
Sources: Items requiring extensive calculations are described in the text and footnotes: British nominal GNP, French debt, and French debt service. Jean Marczewski, "Le produit physique de l'économie française de 1789 à 1913 (comparaison avec la Grande Bretagne)," *Cahiers de l'Institut de Science Economique Appliquée* AF4 (Paris, 1965), table 3, provides a commodity output total for France of 5,097 million livres, to which has been added 1,880 million livres in services output from Jean Marczewski, "The Take-Off Hypothesis and French Experience," in W. W. Rostow, ed., *The Stages of Economic Growth* (Cambridge, 1971), table 1. Patrick O'Brien and Caglar Keyder, *Economic Growth in Britain and France: Two Paths to the Twentieth Century* (London, 1978), p. 58, provide population totals for France and Britain about 1785. B. R. Mitchell and Phyllis Deane, *Abstract of British Historical Statistics* (Cambridge, 1962), provide British tax revenues (p. 388), debt charges (p. 391), and debt (p. 402). U.S. Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970*, 2 vols. (Washington, D.C., 1975), provides U.S. debt service (series Y461), debt (Y338), and taxes (Y335). Thomas S. Berry, "Production and Population since 1789," Bostwick Paper No. 6 (Richmond, 1988), table 9 for U.S. GNP, and table 6 for U.S. population.

tax burden than France.[11] The comparison is less striking here and the overall burdens lower because of differences in the national output measure.

Mathias and O'Brien used commodity output—excluding service output, which was a larger share of GNP in Britain than France. The comparison here is made even more favorable to Britain by a new calculation of nominal GNP for Britain circa 1785 that is substantially larger than, for example, Jeffrey Williamson's estimate of 107 million pounds.[12] The higher estimate seems plausible, at least for purposes of

[11] Peter Mathias and Patrick O'Brien, "Taxation in Britain and France, 1715–1810: A Comparison of the Social and Economic Incidence of Taxes Collected for the Central Governments," *Journal of European Economic History*, 5 (Winter 1976), pp. 601–50.

[12] Jeffrey G. Williamson, "Why Was British Growth So Slow During the Industrial Revolution," this JOURNAL, 44 (Sept. 1984), table 1, used an 1801 nominal GNP estimate by Phyllis Deane and W. A. Cole, *British Economic Growth, 1688–1959* (Cambridge, 1962), table 37, back-extrapolated at ten-year intervals using the real output growth rates from the same source (table 19), and adjusted to current prices using the price index in Mathias and O'Brien, "Taxation" (table 2, p.

comparison with the French data, because it yields a per capita income figure for Britain that is about 31 percent higher than the French at market exchange rates—a figure consistent with a comparison of real wages.[13] American per capita income falls between the two.[14]

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605). The figure of 107.1 million for 1781–90 is an average of estimates for 1780 and 1790. Two objections can be raised. The year 1801 is a poor choice of benchmark because it was a period of rapid change in both relative and absolute prices, when Britain was off the gold standard. It is difficult to know what level of prices corresponds to the nominal income data, and the results of back-extrapolation are highly sensitive to the choice. Mathias and O'Brien's price index is a decennial average and therefore very unlikely to provide an exact match. Second, Nicholas Crafts, *British Economic Growth During the Industrial Revolution* (Oxford, 1985), has compiled a set of important revisions to Deane and Cole's real output growth rates.

I begin instead with Deane and Cole's (table 37) estimate for 1831, separated into an agricultural and a nonagricultural component (79.5 and 260.5 million, respectively). Crafts, *British Economic Growth* gives estimates of real output growth for agriculture (p. 42) and total output (p. 45) for 1780–1801 and 1801–1831, and the share of agriculture in each period (p. 45), from which a nonagricultural growth rate can be calculated. Assuming the growth rate constant within the first period, I obtain estimates of real output in 1780 and 1790 relative to the 1831 level for both sectors. B. R. Mitchell and Phyllis Deane, *Abstract of British Historical Statistics* (Cambridge, 1962), pp. 468–71, provide the necessary price data. The Schumpeter-Gilboy series (1696–1823) was spliced at 1815–19 to the Rousseaux series (1800–1913). For agriculture, the Schumpeter-Gilboy "Consumers' Goods(a)" series was spliced to the Rousseaux "Total Agricultural Products" series. For nonagricultural prices, the Schumpeter-Gilboy "Consumers' Goods other than Cereals(b)" series was spliced to the Rousseaux "Overall Index." Prices in 1780, 1790, and 1831 were measured as three-year centered averages.

The 1780 level of nominal agricultural output is then calculated as the product of 1831 nominal agricultural output times the ratio of real output in 1780 to that in 1831, times the ratio of agricultural prices in 1780 to 1831, or 79.5 times 0.6012 times 0.7977 equals 38.1 million pounds. The real output and price level multipliers for 1790 agriculture are (0.6479, 0.8597); for nonagricultural output in 1780: (0.3767, 0.8514), and in 1790: (0.4442, 0.8955). Total nominal output in 1780 and 1790 is estimated at 121.7 and 147.9 million pounds, and the mid-decade average at 134.8.

[13] I take 24 French livres to the pound as a reasonable estimate of currency exchange rates in the 1780s. Both countries adhered to fixed specie content of their currency. Following the French monetary stabilization of 1726, par of exchange was 29.2d of English money per French écu (24.66 French livres tournois per pound sterling), according to John J. McCusker, *Money and Exchange in Europe and America, 1660–1775: A Handbook* (Chapel Hill, 1978), who finds market rates in London between 30 and 32d in most years up to 1775. Jean Bouchary, *Les Marchés de change de Paris à la fin du XVIIIe siècle* (Paris, 1937), finds the rate lower, around 29d per écu, in the mid-1780s (pp. 107–8). The two alternative purchasing power parity exchange rates for the 1780s calculated by Patrick O'Brien and Caglar Keyder, *Economic Growth in Britain and France, 1780–1914* (London, 1978), p. 47, were 20.2 and 24.2 livres per pound. This is close to the currency market rate, although their own estimate of the market rate (29 livres to the pound) is inconsistent with Bouchary and McCusker.

In any event, the consistency of the higher British nominal per capita GNP estimate with the nominal wage data is independent of the exchange rate chosen. E. H. Phelps-Brown and Sheila Hopkins, "Seven Centuries of Building Wages," *Economica* (1955), reprinted in E. M. Carus-Wilson, ed. *Essays in Economic History* (London, 1962), vol. 2, p. 178, give daily wages of 19 pence per day for laborers in the building trades around 1785. Yves Durand, "Recherches sur les salaires des maçons à Paris au XVIIIe siècle," *Revue d'histoire économique et sociale*, 44 (1966), pp. 468–80, shows summer daily wages of 28 sous for laborers. At 240 pence to the pound, 20 sous to the livre, and 24 French livres to the pound, the British wages were equivalent to 38 sous. Laborers' wages were therefore 36 percent higher in Britain than in France at currency exchange rates.

[14] Crudely, at 5 dollars to the pound and 24 livres to the pound, American per capita GNP is 283 livres versus 262 in France and 345 in Britain.

A tax rate of over 12 percent of GNP for Britain versus nearly 7 percent for France results in a ratio of debt service to GNP similarly higher in Britain (7 percent versus 4 percent). Equally important in explaining the vastly higher British debt-to-GNP ratio is the ratio of annual charges for debt service to the debt capital. The outlier here is France, with annual charges equal to 7.5 percent of the debt in contrast with Britain and the United States at under 4 percent. The two main reasons are that at least 30 percent of French debt service was for amortization, whereas Britain was not redeeming any of its debt, and the rate of interest was higher on French borrowing.[15]

There were differences in definition and accounting for debt, but they should not be of great importance to the comparison. In Britain, lenders to the government were credited with a stock of capital corresponding to their annual interest payments at the official interest rate. The government kept records of these sums. Most bonds were sold at a discount, however, so the official nominal debt exceeds the sums raised by the government. In 1786 it also exceeded the market valuation of the stock of debt.[16] In France, the government did not keep equivalent records, so estimates of the debt are generally based on an evaluation of the debt charges.[17]

The evidence about debt burden has some bearing on issues outside the limits of this article. James Riley has suggested that French

[15] Of the 292.2 million livres in French debt service, 65.8 million were explicitly for debt redemption (*remboursement*), mostly for short-term loans contracted during the American War. See Braesch, *Finances*, vol. 2, pp. 192–203. That is about 36.5 percent of the non-life annuity portion of the debt service. In addition, the 102.3 million in annual payments on life annuities and tontines, mostly bought at 8 to 10 percent interest, contain a substantial fraction of amortization in addition to a high rate of interest. It is difficult to separate the two. If 20 percent is taken as a probable lower bound on the share of amortization, the life annuity interest rate is between 6 and 8 percent and amortization is not less than 30 percent of total debt service.

[16] The nominal consol yield was 5.15 percent in 1785, 4.26 percent in 1786, and around 4 percent to 1790 (Carol Heim and Philip Mirowski, "Interest Rates and Crowding-Out During Britain's Industrial Revolution," this JOURNAL, 47 [Mar. 1987], table 1). The total annual interest of 9.229 million pounds would therefore have been evaluated at around 217 million pounds in 1786.

[17] My estimates agree with Braesch, *Finances*, vol. 2, with regard to the floating and short-term debt plus the acquisitions and liquidations, that is, everything except perpetual rents, life annuities, and tontines. Annual interest charges were assessed by the government at 5 percent, so the corresponding capital is estimated here at 20 times the annual interest, or 1,420.66 million livres. Braesch inappropriately used the same multiplier for perpetuals and life annuity rents after taxes. For each life annuity loan (including tontines), I calculated the fraction of original rents extinguished as of 1789 from the summary table in Marion, *Histoire financière*, applied that fraction to the original capital raised, and subtracted it from the original capital to get the surviving capital. Summed over all loans, that left 1,117.694 million livres in capital. An analogous procedure for the perpetual rents (some of which had been redeemed) suggests 2,042.054 million livres in capital by 1789, for a total debt of 4,580 million. Over half the perpetual debt (1,190.214 million) was attributable to two huge loans in 1720 associated with the liquidation of Law's system, at interest rates of 1 percent and 2.5 percent, for which much of the capital provided was depreciated paper. Reevaluating those two loans at 5 percent interest, the remaining perpetual capital would be 1,339.408 million and the total debt 3,877.8 million.

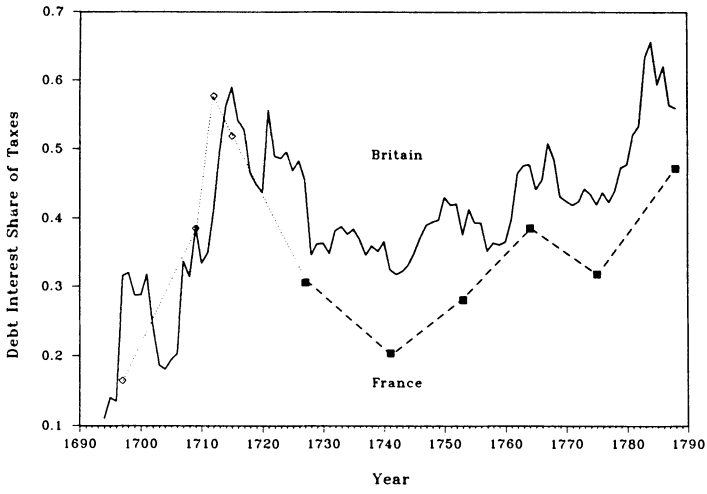

FIGURE 1

DEBT INTEREST AS A SHARE OF TAXES IN BRITAIN AND FRANCE, 1690–1790

Sources: See text and Tables 1 and 2.

government debt was bad for economic growth.[18] Williamson has made the same claim for England.[19] But the fact that the debt burden was heavier in Britain, where economic growth was faster, would seem to pose a problem. A simple answer is that the underlying forces making for growth in Britain were sufficiently stronger as to outweigh the ill effects of crowding-out. A more interesting answer would explore structural differences in the two economies for reasons why crowding-out might operate more strongly in France. And the fact that England generally won the wars financed by debt could also be significant.

The debt burden in 1788 cannot explain why France had a revolution. The past history of the debt burden itself cannot either. Figure 1 shows the course of debt interest charges as a share of taxes in Britain and France over the century between the Glorious Revolution and the collapse of the Ancien Régime.[20] France apparently mirrored Britain in trend and in cycles of war and peace, while maintaining a consistently lower burden of debt interest on its tax revenues. The last years of Louis XIV may be an exception, but the quality of data sources before 1726

[18] James C. Riley, *The Seven Years War and the Old Regime in France: The Economic and Financial Toll* (Princeton, 1986), and developed further in James C. Riley, "The Seven Years War and the French Revolution," unpublished manuscript, Indiana University, 1983.

[19] Williamson, "British Growth," has been challenged by Heim and Mirowski, "Interest Rates and Crowding-Out," and reassessed by Joel Mokyr, "Has the Industrial Revolution Been Crowded Out?," *Explorations in Economic History*, 24 (July 1987), pp. 293–319.

[20] Interest charges as defined here exclude *remboursements*, but include the total of life annuity charges, which include some amortization. As a general rule, interest on offices is also excluded where possible.

should not inspire confidence.[21] The point is not that France and Britain pursued identical policies: Britain paid for debt by raising taxes, while France contained debt by partial defaults. The point is that to understand the revolutionary implications of the history of public finance one has to look beyond simple aggregates.

Table 2 shows the evolution of debt charges in France and Britain by major category of debt. In contrast to Britain, where the funded debt (almost exclusively perpetual rents) held a fairly constant 85 percent share of the government debt, France relied more and more on a variety of short-term and life-contingent borrowings.[22] Perpetual rents fell from 51 to 24 percent of interest charges between 1740 and 1788. By 1788, life-contingent loans accounted for 46 percent, and short-term debt for 13 percent of interest charges.

Life annuities, especially the tontines, drew on a much broader spectrum of the population than did British consols. The evolution of French government policy regarding its life-contingent debt alerted this large group of creditors to the warning signs of strategic default.

TONTINES: THE HISTORICAL BACKGROUND

The tontine takes its name from Lorenzo Tonti, an expatriate Neapolitan banker who first proposed the scheme to Cardinal Mazarin of France in 1652.[23] Although the plan was never enacted, its structure and the reasons for its rejection provide a useful introduction to the institution.

Tonti proposed to group subscribers into ten age classes of seven years each (0 to 7, 7 to 14, . . . , 63 to 70). Each subscriber was to pay the government 300 livres as a one-time lump-sum payment. The government would then make an annual payment equal to 5 percent of the total capital raised. The total annual payment would be divided among the survivors. Payments would cease at the death of the last

[21] Among other problems, the sources do not provide a consistent accounting of amortization, or interest on floating debt, or of changes in the *gages* paid to the private financiers of the government in exchange for their loans (a mechanism favored by Louis XIV and virtually abandoned by his successors). Annual gross tax receipts for 1690 to 1715 are reported by Alain Guéry, "Les Finances de la monarchie française sous l'Ancien Régime," *Annales: Economies, Sociétés, Civilisations*, 33 (Mar.-Apr. 1978), pp. 216–39, p. 237. Debt charge observations for 1712 (65.4 million in perpetual rents only) from Riley, *Seven Years War*, p. 166. Marion, *Histoire financière*, vol. 1, p. 63, gives 45 million in rents and 40 million in other charges in 1715. Vührer, *Dette publique*, cites 11.7 million in rents in 1689. J. J. Clamageran, *Histoire de l'impôt* (Paris, 1876), vol. 3, gives 24 million in rents in 1699 (p. 111), 68 million in 1734 (p. 279), and 71 million in rents and charges in 1725 against taxes of 204 million (p. 232).

[22] J. J. Grellier, *The National Debt* (London, 1810), pp. 343–44, reports details of the funded and non-funded debt, showing a total of 77,097 pounds per year in payments on all types of life annuities in 1786, out of a total debt charge of 9.5 million, that is, less than one percent. Fixed-term annuities amounted to 1.26 million, and short-term debt interest 208,749.

[23] See Julien Coudy, "La Tontine royal sous le règne de Louis XIV," *Revue historique de droit français et étranger*, 4ème série, 35 (1957), pp. 128–33.

TABLE 2
DEBTS AND TAXES IN FRANCE AND BRITAIN, 1740–1788

	Britain			France							
					Debt Payments						
		Debt Payments					Miscel-				
Year	Taxes	Total	Funded	Taxes	Total	Repay-ments	laneous Loans	Floating Debt	Per-petual	Lives	Ton-tines
1740	5,745	2,102	1,790	211	57		8		29	18	2.5
1753	7,338	2,762	2,394	257	72		25		26	15	5.0
1764	10,221	4,887	4,230	322	124		14	19	56	26	9.5
1775	11,112	4,674	4,010	377	155	35	7	19	47	39	6.6
1788	16,779	9,407	7,894	472	292	69	42	28	53	99	3.4

Notes: British data in thousands of pounds sterling, French in millions of livres tournois. "Repayments" is amortization on the non-life-contingent debt. Miscellaneous loans consist primarily of debts contracted through third parties and short-term lotteries and loans. Interest on the floating debt includes interest charges for anticipations of future revenue, advances from the tax farms, and so forth.

Sources: Britain. B. R. Mitchell and Phyllis Deane, *Abstract of British Historical Statistics* (Cambridge, 1962) for tax revenues (pp. 386–88), and debt charges, both total and funded (pp. 389–91). France. 1740: Tax revenues are from James C. Riley, "French Finances, 1727–1768," *Journal of Modern History* 59 (June, 1987), table 2. Figures for perpetual rents, life-contingent debt, and Indies dividends are from J. J. Clamageran, *Histoire de l'impôt en France* (Paris, 1876) vol. 3, p. 279. My own calculations suggest the split between tontines and simple life annuities. Michel Morineau, "Budgets de l'état et gestion des finances royales en France au dix-huitième siècle," *Revue historique*, 264 (1980), pp. 293–95, for 1741 gives revenues of 202 million livres tournois, and a total of 46.5 million in "rentes" of various kinds. No data are available on anticipations and other advances. 1753: Riley, "French Finances," table 2, lists revenues of 256.5 million, which is close to the 258.5 million shown by Morineau, "Budgets," p. 314, for 1751. James C. Riley, *The Seven Years War and the Old Regime in France: The Economic and Financial Toll* (Princeton, 1986), gives figures for perpetuals (p. 177), a total for life annuities and tontines (p. 178), a variety of fixed-term debts (including *rentes passagères*, lottery loans, and debts to the *Compagnie des Indes*), and 11.4 million in interest and scheduled amortization on debts with other branches of government (p. 179). The total debt service of 72 million is close to Morineau's estimate for 1751 of 71.8 million (p. 315). 1764: Riley, "French Finances," table 2, gives revenues of 322 million livres tournois. Mathon de la Cour, *Collection de comptes-rendus* (Lausanne, 1788), pp. 50–51, gives an incomplete account of debt charges, listing only perpetual rents of 56 million, and interest on anticipations and loans from the pays d'Etats and other intermediaries. I have interpolated life annuity and tontine rents, taking account of new issues and probable mortality. 1775: Turgot's fairly detailed compte-rendu in Mathon de la Cour, *Collection*, gives revenues of 377 million and total debt payments of 155 million. Some 35 million of debt payments were for amortization (pp. 162–63). The same source gives separate accounts for life annuities and tontines (p. 146), perpetuals (p. 164), and others, including 4.9 million in Indies bonds (p. 151). 1788: Loménie de Brienne, *Compte-rendu au Roi au mois de mars* (Paris, 1788), gives ordinary revenues of 472 million (p. 180). He lists debt payments on life annuities, tontines, and perpetual rents (p. 127), as well as fixed-term payments (p. 144) and the other categories (pp. 141–44, 183). His life annuity totals evidently exclude the 12 million in rents created in November of 1787, so that sum has been added to both the life annuities and the total. F. Braesch, *Finances et monnaies révolutionnaires* (Paris, 1936), provides a summary of amortization payments based on Brienne.

survivor in the class. An additional 1,250 livres would be paid to one member of each class (or an adult substitute) to handle payments and verifications.

There are three roles involved in a tontine contract, not counting the

government. I will define "subscriber" to mean the person providing the initial capital, "shareholder" to be the person entitled to receive the annual income, and "nominee" to be the person on whose life the contract is contingent. These three roles can each be filled by a different person, though in practice two forms dominated. The most common was for one person to fill all three. The second was for one person (typically a parent) to act as subscriber and as shareholder during his own lifetime, with the shareholder rights passing to the nominee (typically a child) at the death of the subscriber.

Besides the name and the general economic structure, two important administrative features of the original tontine appear in all the later French versions. The first is a distinct separation of its administration from the royal treasury and a guarantee that the payments would not be violated by even the most extreme royal necessities. This was clearly designed to appeal to a financially astute bourgeoisie that was distrustful of royal administration. The second is a complicated set of verification procedures for the age of the nominee on whose life the revenues were contingent and the dates of their subsequent deaths.[24] Three mechanisms were used: an annual notarized stamp for which proof of survival was needed to obtain payments, penalties for fraudulent receipt of payments, and, as a small incentive for honesty, the right of heirs to collect payments for the year in which the nominee died, providing the death was reported in a timely fashion.

Tonti's projections were ambitious. Each class was scheduled to receive 101,250 livres in rents plus 1,250 in overhead. That would have required 67,500 subscriptions, and netted 20,253,000 livres in capital. When the plan was put to the Parlement of Paris for approval in 1653, it was turned down for two main reasons. They found it too difficult to calculate its actual cost to the state, and they found its initial interest rates (5 percent at all ages) too low in comparison with rates on life annuities. These issues of pricing and cost also reappear in future plans.

Table 3 compares the subsequent history of tontines in France and England.[25] French tontines were more successful in several respects. Most of them succeeded in raising at least the sum of revenues sought by the government, whereas the English never did. France raised more money overall—on the order of nine times as much.[26] French tontines

[24] Placing administration in the hands of the subscribers is not unrelated to the verification issue. Subscribers had a strong interest in preventing fraudulent receipts because they would reduce the payments to true survivors. The government's payout did not depend on number of survivors, so it had no incentive for verification until the very end when costs were low.

[25] An excellent summary work is Robert M. Jennings and Andrew P. Trout, *The Tontine: From the Reign of Louis XIV to the French Revolutionary Era* (Homewood, IL. 1982).

[26] Assuming the exchange rate to have been 13 livres to the pound in 1689 and 1696, and 23 after 1726 (McCusker, *Money and Exchange*, pp. 93–97), the 108 million livres raised in the ten tontines was equivalent to 5 million pounds. The English raised 2,548,000. The Irish tontine was designed and implemented by the Irish Parliament and raised the equivalent of 928,000 pounds sterling.

TABLE 3
TONTINES IN FRANCE AND BRITAIN, 1689–1789

	Year	Number of Age Classes	Number of Nominees	Capital Sought	Capital Raised	Shares per Nominee	Percent Under 25
			French Tontines				
1	1689	14	5,912	19.600 l	3.611 l	2.04	22.4%
2	1696	15	4,105	14.320	2.928	2.38	20.9
3	1709	16	2,642	3.000	2.996	3.78	28.2
4	1733	7	14,270	12.000	11.126	2.60	27.0
5	1734	15	12,653	15.000	15.365	4.05	22.7
6	1743	15	4,275	6.300	[6.300]	4.91	48.9
7	1743	15	3,822	6.300	[6.300]	5.49	44.8
8	1744	15	7,131	9.000	9.000	4.21	43.5
9	1745	15	10,397	9.000	8.820	2.83	22.0
10	1759	8	49,463	30.000	46.870	4.74	21.3
			British Tontines				
1	1693	1	1,002	£1,000.0	£108.1	1.08	93.8%
2	1757	5		2,500.0	[cancelled]		
3	1765		900	300.0	18.0	[1.0]	
4	1773–77 (Irish)	3	3,384	928.0	928.0	2.97	77.
5	1789	6	3,495	1,000.0	421.9	1.21	77.1

Notes: French capital is given in millions of livres tournois; English in thousands of pounds sterling. See text for calculation of number of nominees in French tontines. Figures in brackets are imputed by assumption (see text). Capital sums in lottery-tontines have not been reduced for other prizes paid out.

Sources: For France, Robert M. Jennings and Andrew P. Trout, *The Tontine: From the Reign of Louis XIV to the French Revolutionary Era* (Homewood, IL, 1982), pp. 19, 23, 39–44; Marcel Marion, *Histoire financière de la France depuis 1715* (Paris, 1914), vol. 1, p. 473; A. Vührer, *Histoire de la dette publique en France* (Paris, 1886), pp. 118–19, 197–201; J. Wyler, *Die Tontinen in Frankreich* (Munich, 1916), pp. 118–20. For England, P. G. M. Dickson, *The Financial Revolution in England* (London, 1967), pp. 52–54; John G. Finlaison, *Report on the Evidence and Elementary Facts on which the Tables of Life Annuities are Founded* (London, 1829), pp. 20–21; Alexander Glen Finlaison, *Report and Observations on the Mortality of the Government Life Annuities* (London, 1860), pp. 79–86, J. J. Grellier, *The History of the National Debt* (London, 1810), pp. 26–28, 237–38, 266–68, 353–57.

also attracted a far greater number of participants, although the actual number has been overstated by other authors.

The figures in Table 3 for number of individuals purchasing shares are new estimates for the fourth through tenth French tontines. Earlier estimates overlooked important changes in tontine rules. Subscribers could always buy multiple shares in their age group class. The tontines after 1730 introduced a new twist. Age classes were subdivided into many divisions. The tontine principle applied within each division, that is, the government payments ended division by division with the death of the last survivor within each division. Subscribers could purchase shares in as many divisions of their age class as they wished. For reasons discussed below, multiple share purchasers earned better returns by buying shares in different divisions than by holding many shares in a single division. Unfortunately, the published data report the

number of divisions and the number of persons and shares within each division, but take no account of the much more frequent practice of buying shares in several divisions.[27] Previous estimates based on the published data therefore overcount the number of individuals involved.

To correct them, we need an estimate of the number of divisions entered per subscriber in each age class for each tontine (a total of ninety groups). This was done by sampling the original receipt books preserved in the *Archives Nationales*.[28] The books contain one receipt for each nominee, listing all the divisions to which he or she was assigned. Receipts for each age class were bound separately. Beyond that, there was no apparent order in the receipt books. Small and large purchases, nobles and spinsters, were all intermingled, so a simple random selection of about 150 subscribers was taken for each group.

The average number of divisions entered by each nominee was typically between two and three.[29] That substantially reduces the total number of participants: less than half the number reported by J. Wyler or Robert Jennings and Andrew Trout. On the other hand it does not alter the fact that the vast majority of tontine participants were small investors. A single tontine share sold for 300 livres (200 in the 1759 tontine), and single-share purchasers were always the most common category. Over the whole period 1733 to 1759 France raised 104 million livres in capital from about 102,000 individuals, or about a thousand livres per person.

The relevance of tontines to mercantilist public finance can be seen in their timing. French tontines coincided with the peaks in resource demands by the government in times of war. Ten thousand persons contributed 6.5 million livres during the War of the Grand Alliance, twenty-five thousand persons contributed 26 million livres during the War of the Polish Succession, a similar number of persons contributed 30 million livres during the War of the Austrian Succession, and nearly fifty thousand persons in one tontine contributed 47 million livres during the Seven Years' War.

[27] The *Bibliothèque Nationale* has the published annual reports for some years between 1741 and 1769: *Listes des rentes viagères dites Tontines* (Paris, various years). These form the basis of the work by Julius Wyler, *Die Tontinen in Frankreich* (Munich, 1916), and Jennings and Trout, *The Tontine*. The number of original subscribers in each active division of each existing tontine is reported each year, along with the number of survivors and deaths of the past year, and the value of that year's payout. A life table based on this data will be reported at some later date.

[28] *Archives Nationales de la France, Série P. Chambre des Comptes*, P5875-P5932, appears to be complete for the fourth through tenth tontines.

[29] The exact rates, for the fourth through tenth tontines were: 2.289, 2.877, 3.035, 3.101, 3.022, 2.177, and 3.231. The rates were higher in older age groups than in younger, indicating more multiple purchases at higher ages, except in the lottery-tontines of 1743, where they were nearly equal. Note that these rates indicate number of divisions per nominee. Subscribers could invest on several lives other than their own. In practice, this seems to have been infrequent and generally confined to other family members, who would then inherit the shares on their own lives. It seems reasonable to consider these eventual owners as creditors of the government.

Two periods of direct military confrontation with England permit direct comparison of the governments' success in raising money on tontines. In the 1690s, England failed miserably on one, raising barely a tenth of the desired million pounds in capital. The English failure in the tontine of 1693 was immediately followed by an offer to charter the Bank of England, if its founders could lend the government a million pounds at 8 percent.[30] Again in the early years of the Seven Years' War England had to revoke a proposed tontine for lack of support. Two years later France raised nearly 47 million livres for its war effort.

Why were tontines such a success in France and such a failure in Britain? Most of the relevant hypotheses can be classed as either demand-side differences (consumer preferences) or supply-side differences (government behavior).

Victorian England knew the reason: "they were always more popular on the continent than in this country, where benefits for the entire solace of his own old age are generally neglected by the Englishman in favor of a provision for his immediate successors."[31] More recently, Vivian Rotman-Zelizer has speculated that the greater French preference for old-age security over intergenerational transfers explains not only its high demand for tontines but also its hostility to life insurance.[32] The age patterns of tontine nominations lend some support. In England the vast majority of nominees were minor children; in France they were adults (see Table 3). When they did buy tontines, the English placed them on their children's heads.

Demographic historians might be especially interested in this hypothesis. France began limiting family size at the end of the eighteenth century; England not until after 1870. One popular theory of fertility transition claims it begins when parents sense that "intergenerational wealth flows" have reversed direction to flow downward.[33] If French parents were less concerned with their children's future, it might explain why they began to see children as an economic burden before the rest of Europe did.

Differences in tastes are only one way to explain different patterns of demand, and not the one favored by most economists. There is the question of substitutes and complements. Under primogeniture of landed wealth, tontines may have been a way of equalizing wealth among children. In France, partible inheritance had become the norm in many regions even before the Revolution. Children were already taken

[30] Dickson speculates that William Paterson, the author of the Bank of England charter, was also the architect of the tontine plan (*Financial Revolution*, p. 52).

[31] Alexander Glen Finlaison, *Report and Observations on the Mortality of the Government Life Annuities*. Ordered, by the House of Commons, to be Printed, 1860, p. 10.

[32] Vivian Rotman-Zelizer, *Morals and Markets: The Development of Life Insurance in the United States* (New York, 1979).

[33] John C. Caldwell, *The Theory of Fertility Decline* (New York, 1982).

care of. This could explain the different age patterns, but not the greater overall popularity in France.

The alternative explanation is that the French government may have offered tontines on more favorable terms. Diderot's *Encyclopédie*, that enormous compendium of Enlightenment wisdom, judged tontines to be excessively expensive to the government: "mais de tous les expédiens de finance, les tontines sont peut-être les plus onéreuses à l'état."[34] That judgment, published only six years after the largest of French tontines, has been repeated many times. It is not always clear whether critics of the tontine mean to criticize the institution per se, or the particular pricing policies of the French government.

Resolving disputes about demand versus supply explanations requires information on prices. To make sense of the price information, and then to interpret the policies that set the prices, we need first to consider the economics of tontines in the abstract.

TONTINE ECONOMICS

To begin, we need a measure of the price of a tontine that can be compared with other investments in which private lenders trade capital sums to the government in exchange for future income streams. Present discounted value is a widely used measure, but it requires making an assumption about the discount rate used by lenders.[35] The internal rate of return is a better choice. We can then consider how preferences might affect the choice of asset for a given internal rate of return.

All the major eighteenth-century debt instruments can be described as special cases of a general type. In exchange for lending a capital sum (K), lenders receive an annual rent (R), for a term of years (T). The rent may be augmented or diminished in some years by a multiplier (A_t), and its receipt may be conditional on some other factors with probability p_t. In the absence of inflation, the present value of a conditional stream of future payments is

$$K = R \cdot \sum_{t=1}^{T} \frac{(A_t \cdot p_t)}{(1 + i)^t} \tag{1}$$

where K equals the capital sum in year 0 that is equivalent in value to the future payments, R is the rent paid in the first year, T is the term of the loan, A_t is the fraction (or multiple) of R that is paid in year t, p_t is the probability that the payment $R \cdot A_t$ is paid, and i is the discount rate.

[34] *Encyclopédie, ou Dictionnaire Raisonné des Sciences, des Arts, et des Métiers* (Neuchâtel, 1765), vol. 16.

[35] See George Alter and James C. Riley, "How to Bet on Lives: A Guide to Life Contingent Contracts in Early Modern Europe," *Research in Economic History*, 10 (1986), pp. 1–53, for comparisons of many forms of contracts, including tontines, using the present discounted-value approach.

Investments were often priced in terms of combinations of parameters such as years' purchase (K/R) or the initial interest rate (R/K). Investors were well aware, however, that the true rate of return was also influenced by the term and any other contingencies affecting the probability and size of payments. When all the other parameters are known, the value of i that satisfies the present value identity is known as the internal rate of return. It offers a way to compare very different investments.

In the case of a perpetual rent, sometimes called a "consol," the rent R is paid in each year, so $A_t = p_t = 1$ for all t.[36] As T goes to infinity, we have

$$i = R/K$$

The internal rate of return is equal to the initial interest rate for a perpetual rent. Britain's funded debt after 1750 was almost wholly of this type.

In the early part of the eighteenth century Britain frequently used long annuities for fixed terms, the most common being 99-year annuities. These instruments were very similar to perpetual rents except that the term (T) was 99 years and not infinite. At nontrivial rates of interest, 99 years is not much different from forever, and the internal rate of return was only slightly less than the initial interest rate (R/K). France occasionally offered short-term annuities, often in the form of lotteries in which each year's income might be augmented by a lucky draw.[37] The rate of return on short-term annuities could be very different from the initial interest rate.[38]

Annuities were also issued on lives. Typically, the lender would receive a fixed income until the death of the person on whose life the claim was based. In most of the eighteenth-century government life annuities, the nominee could be someone other than the owner of the annuity and the annuity could be sold to a third party. In eighteenth-century Britain, life annuities were most often issued as supplemental

[36] In 1751 Britain consolidated various 3 percent perpetual annuities into one general stock. The term consol is an abbreviation of the *Three per cent. Consolidated Annuities* created in that year. To avoid confusion between a historically specific government security and a general type of asset, the term "consol" will be reserved for British 3 percents after 1751.

[37] See Vührer, *Dette publique*, pp. 191–96, 263–69, for descriptions. They were especially popular in the 1740s and again under Necker. Lotteries were often used in both countries to introduce variance into an average rate of return on any form of loan. In Britain they appear to have been the rule rather than the exception; see J. J. Grellier, *The Terms of All the Loans* (London, 1805). Although we now think of higher variance as requiring a premium on the expected return, they evidently thought that the lure of a gamble would draw in funds at a lower average rate.

[38] James C. Riley, *Seven Years War*, pp. 174–75, shows that in at least one case the government actually offered to borrow at zero interest while listing the (initial) interest rate at 3 percent.

payments on other rents.[39] In France they were the largest share of government debt payments in most years.

In a life annuity, A_t is constant but p_t, the probability of receiving the fixed payment R, is the probability of surviving t years from the date of purchase. If we define l_x as the probability of surviving from birth to age x, then

$$p_t = \frac{l_{(a+t)}}{l_a}, \text{ where } a = \text{age at purchase of the annuity.}$$

Thus payments are constant as long as one is alive to receive them, but expected income falls over time. The cost to the government depends on the mortality schedule of the participants. Younger participants generally have longer life expectancies and are thus more costly to the government at any given initial interest rate (R/K).

A tontine is a life annuity with benefit of survivorship. The probability of receiving payment is exactly the same as for a life annuity, but the size of the payment depends on the mortality experience of the other members of the tontine class. In its classic form all payments are distributed among the surviving members. The government's obligation therefore remains constant until the last nominee dies. From the government's perspective, a tontine is approximately equivalent to a term annuity, with the length of term equal to the expected age of extinction of the class of nominees, minus its age at nomination.

Under certain circumstances the expected income stream to the purchaser will mirror the government's perspective. In the simplest case of a large tontine class of single shareholders, all of whom are the same age at purchase (a), the annual multiplier on the base payment for survivors is

$$A_t = \frac{N \cdot l_a}{N \cdot l_{(a+t)}}, \text{ where } N \text{ is the number of nominees.}$$

The size of payment grows in inverse proportion to the probability of survival. Income rises if one survives to collect. When all participants have the same mortality schedule, A_t is just the inverse of p_t. The two effects (A_t and p_t) exactly cancel, so the expected payment stream is constant. In expected value terms, the tontine is equivalent to a long annuity with a term equal to the expected age at extinction of the class.

The internal rate of return, formula 1, does not take into account inflation, risk aversion, or the elasticities of intertemporal substitution at different ages or points in time. Because perpetual rents, annuities,

[39] They were known as *douceurs* in English financial discussions. To my knowledge, no one has speculated on why English financiers chose a French word to describe subsidized interest payments. The British government began issuing life annuities more widely after 1808.

and tontines had different time paths of income, the expected utility of one type of investment might be different from another even if the internal rate of return (calculated from formula 1) were the same. We need to consider these other motivations, as well.

Several important factors differentiate between perpetual rents on the one hand and life-contingent rents on the other. The most obvious is the value placed on bequests. The internal rate of return for a perpetual rent values income equally before and after the death of an investor. Investors who placed no value on bequests would prefer life-contingent loans at the same internal rate of return. If governments were indifferent they could sell life-contingent annuities at a discount to "selfish" investors. Governments might not be indifferent because life-contingent loans require a higher payment stream in the near term, with payments eventually disappearing.

Life-contingent contracts like tontines and life annuities were sometimes criticized as robbing children of their inheritance. Selfish parents could use life-contingent contracts in this way, but there were many other ways to rob children of their inheritance, and, more importantly, perfectly altruistic families might also wish to use them. Life-contingent annuities provide insurance against the risk of living longer than expected. They could spare children the burden of supporting a long-lived parent. The life-contingent nature of the contract creates no inherent intergenerational conflict.

The main disadvantage of life-contingent contracts is their limited resale potential. They constitute a classic example of a market for "lemons." Prospective buyers will have far less information about survival prospects than the seller of an annuity on his own life and are likely to be suspicious. The costs of providing proof of survival from year to year are much higher for a third party. The same problems make it difficult to borrow against life annuity income. Governments might care about resale markets, too. Britain built its financial system on easily traded government debt. Some authors claim that France preferred inalienable life-contingent debt because there was no resale market to reflect the state of confidence in the government.

There are some important differences between tontines and life annuities. Tontine income rises rapidly at older ages, when mortality is high, while life annuity income is constant. If labor productivity is also declining at those ages, tontine income streams might provide better life-cycle insurance. In both cases those who die early lose and those who live long gain relative to the average. In tontines the differential is wider. For the same ex ante expected internal rate of return, annuities will turn out to be a better deal for the lowest 80 percent of the longevity distribution, while the 20 percent longest-lived investors would do better with tontines.

The greater riskiness of tontines has led some observers to consider

them a form of gambling. It takes a very long time to "win" the gamble of a tontine—not the sort of game likely to appeal to thrill-seekers. Eighteenth-century governments exploited the gambling instincts of investors through lottery schemes in which loan subscriptions carried a guaranteed minimum rate of return and a chance at a much higher return. Many English loans of the eighteenth century were of this type.[40]

Somewhat paradoxically, tontine costs are much easier for a government to project than are life annuities. Calculating the actuarially fair price of a life annuity requires fairly precise knowledge of the whole life table, and of the mathematics of how to do the calculation. Small errors in the life table can lead to big financial losses. Tontines are just a fixed-term annuity. Tontine costs are affected only by the expected age at extinction of the class, which depends to some extent on the number of persons in the class and hardly at all on the level of mortality. It was around 92 in most of the French tontines. Even a dramatic change in mortality adds only a few years of payments onto the end of a long stream. At nontrivial discount rates this counts for little in calculating expected values at purchase.

From the shareholder's perspective, tontine income is sensitive to two factors that play no role in any of the other debt instruments: the life expectancy of other subscribers and the percentage of total shares one holds. If the other subscribers have higher life expectancy than a given potential investor, then that investor's income will not rise as fast as his probability of survival will fall. If none of the others died, the tontine just replicates a life annuity. Similarly, if one investor holds all the shares in a tontine class it will be just an annuity on his life.

To evaluate the importance of these factors, I made some calculations of the internal rate of return (i) corresponding to different values of the initial interest rate (R/K) for tontines and annuities. The calculations are based on an investor aged 42 at the start, and use the mortality rates of tontine subscribers from the first two French tontines to estimate the probability of survival.[41] For the same initial interest rate, tontines always yield a higher internal rate of return by two to three percentage points. A tontine designed for an internal rate of return of 3 percent would yield zero to a 42-year-old investor holding the entire stock. Tontine investors should therefore be very concerned with the age composition of their co-participants, and should be inclined not to make large purchases within a tontine group.

[40] See J. J. Grellier *The Terms of All the Loans*.

[41] The mortality data are reported in Antoine Deparcieux, *Essai sur les probabilités de la durée de la vie humaine* (Paris, 1746).

TABLE 4
INTERNAL RATES OF RETURN ON TONTINES

	British				French			
Age	1693	1757	Irish	1789	1696	1733	1745	1759
2	8.25	4.10	7.49	4.24	7.13	7.13	6.65	6.99
7	8.55	4.00	7.49	4.16	7.13	7.13	6.98	6.98
12	8.39	3.75	7.39	3.92	7.12	7.12	7.31	7.48
17	8.12	3.46	7.21	3.64	7.11	7.11	7.64	7.48
22	7.84	4.25	7.47	4.27	7.10	8.31	7.97	7.97
27	7.54	3.68	7.26	3.72	7.08	8.30	8.30	7.96
32	7.17	4.56	7.02	4.48	7.05	8.28	8.96	8.96
37	6.71	3.63	6.68	3.53	7.01	8.26	9.62	8.94
42	6.11	4.70	7.37	4.61	8.22	9.94	9.94	9.94
47	5.26	3.21	6.36	3.11	8.15	9.90	10.25	9.90
52	4.05	5.34	5.20	4.94	9.84	9.84	10.54	10.36
57	2.34	2.83	3.72	2.44	9.73	9.73	11.15	10.27
62	−0.04	0.20	1.74	5.11	12.26	12.26	11.72	10.65
67	−3.24	−3.03	−0.95	0.86	12.04	12.04	11.86	10.37
72	−7.55	−7.21	−4.61	−3.81	13.62	11.60	12.18	11.03
Total	8.28		7.35	4.08	9.48	9.19	9.64	9.53

Notes: For calculation of internal rate of return, see text. The total internal rate of return takes into account the age distribution of enrollment. No calculation is made for the total in 1757 because it was cancelled. Rates for 1757 ignore the truncation of the tontine.
Sources: See Table 3.

TONTINE RATES OF RETURN

Table 4 shows the estimated internal rates of return by age at nomination for representative tontines. The estimates apply to single share purchases. For tontines in which nominees were sorted by five-year age groups, the estimates assume that the life table effects cancel out in calculating the expected income stream.[42] For plans with larger age groupings, the actual age distribution of enrollments was used to calculate the proportion of the class surviving to each payment period (the inverse of A_t).[43] The life table for the age group under consideration was then used to calculate the probability of receipt of payment (p_t).

Figure 2 plots the rate of return by age for several representative French and English tontines. Two points stand out most clearly. French tontines offered a higher rate of return at all ages and they were especially favorable to older investors. The higher participation rates and the higher average age of participants in French tontines are thus perfectly consistent with the pattern of prices. The British 1693 tontine has the most unusual pattern of prices by age because it did not offer

[42] Five-year classes were used in the French tontines of 1689, 1696, 1709, 1734, 1743, 1744, and 1745. In 1733 and 1759 the classes were grouped by ten-year intervals, but each class had many subdivisions within which the tontine principle applied. I have assumed that the subdivisions sorted by age. Thus, all the French tontine internal rates of return assume that life table effects cancel out.

[43] All the English and Irish tontines were in this category. For the cancelled tontine of 1757, the age distribution of the (very similar) tontine of 1789 was used.

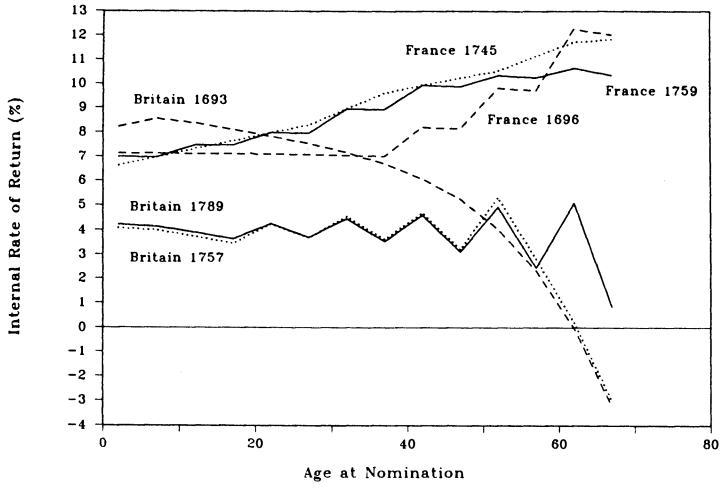

FIGURE 2

INTERNAL RATES OF RETURN ON TONTINES IN BRITAIN AND FRANCE

Sources: Table 4.

separate classes by age, thus raising the expected returns for younger nominees and lowering them for older.

Despite the high expected returns in 1693, enrollments were low. We can see the reason by comparing tontine returns with alternatives. In France, tontine loans were often issued shortly before or after life annuity loans. In England, each tontine plan was paired with an alternative.[44] Figure 3 shows the premium paid to tontine lenders, measured as the simple difference between the tontine internal rate of return and that of the alternative. The tontine premia enhance the findings of the simple price comparisons. French tontines offered a considerable premium over alternatives, especially for older investors. English tontines were barely fair to even the youngest nominees. The alternatives in 1693 were much more rewarding than the tontine, at all ages. We do not need to probe the psyches of French investors to understand why they bought more tontines than the English.

ECONOMIC POLITICS AND THE TONTINE

More people bought tontines in France because the government offered them at more attractive rates of return than did the English, and more often. The question, then, is why. We can better understand French policy by comparing it with the English. As noted earlier,

[44] In 1693 the alternative was a 14 percent life annuity for any age. In 1757 the tontine plan offered an alternative fixed-term annuity without survivorship benefits. The entire plan was then displaced with a mixed offering of life annuities and consols. In 1789 the alternatives was a 4.25 percent annuity for 69 years.

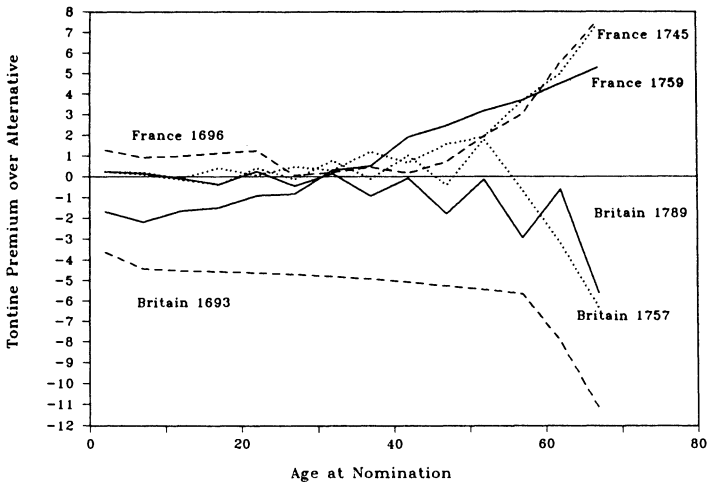

FIGURE 3

TONTINE PREMIA OVER ALTERNATIVE INVESTMENTS

Sources: See text and Table 4.

Tonti's original plan was rejected by the Parlement of Paris for two reasons: they couldn't calculate its costs, and they thought its prices too low relative to life annuities. England, after its failure with the 1693 tontine, learned how to calculate the cost of tontines more accurately. Their subsequent efforts at raising money on tontines offered market rates of return. In France the second issue dominated price formation. Tontine prices (in years' purchase) were set close to the prices of life annuities.

In the tontines of the 1690s the French and English governments paid approximately the same overall rate of return of 8.5 to 9 percent. This was about the same rate paid on other loans.[45] Neither did as well as hoped, but the French plan fared better because it grouped participants by age and adjusted the initial rents by age to smooth the rates of return. The English tontine of 1693 was designed for self-destruction. By pooling all participants, it effectively offered above-market rates of return only for younger nominees but then offered them an even better option in the 14 percent life annuities. Neither country shows clear evidence of understanding the true costs involved in tontines.

During the Seven Years' War both countries again offered tontines. The English plan of 1757 shows clearly that the government had by that time mastered the basic economics of the tontine. They understood that it was, from their perspective, a term annuity.

The 1757 plan offered five different initial rents for a capital payment

[45] In 1694 the English government chartered the Bank of England in exchange for a 1.2 million pound loan at 8 percent. The New East India Company charter went for the same terms in 1698.

TABLE 5
ENGLISH TONTINE LIST PRICES

Age	1757 Annual Rents (in sterling)	1757 Fixed Term (years)	1757 Tontine Term (years)	1789 Annual Rents (in sterling)
0–20	£4 0s	66	60	£4 3s 0d
20–30	4 5	54	50	4 5 6
30–40	4 10	56.5	43.5	4 8 6
40–50	4 15	41	38.5	4 13 6
50–60	5 0	36.75	35	5 1 6
60+				5 12 0

Notes: The 1693 tontine had only one age class, earning 10 percent interest for 7 years, then 7 percent until only seven persons survived.
Sources: J. J. Grellier, *The History of the National Debt* (London, 1810), pp. 237–39, 353–59.

of 100 pounds, each corresponding to a different tontine age group. The tontines were scheduled to convert to life annuities after a stated term of years. Investors could opt instead for a fixed term annuity at any of the five rates. The length of the fixed term annuity varied with the rate and corresponded roughly to the expected time to extinction of the matching tontine class.

The basic plan is shown in Table 5. The actuaries evidently began with the initial rents, which vary in smooth discrete grades. They then calculated durations for the tontines and the fixed-term annuities. These are odd-looking and quite precise—especially the 36.75 years for the highest rents. Considering that payments were made half-yearly, it seems excessively precise. In fact, the terms for each age group are exactly consistent with an internal rate of return of 3.5 percent and a capital payment (present value) of 100 pounds for the tontine, and 102.5 pounds for the fixed-term alternative. Evidently, they attributed a present value of 2.5 pounds to the life annuity extension of the tontine plan and adjusted the fixed-term annuity durations accordingly. That is not precisely accurate, but makes very little difference to the rate-of-return calculations. The "saw-tooth" pattern that appears in Figure 2 results from my calculations based on five-year age groups. Rates of return calculated for midpoint ages of the ranges used by the tontine planners are close to 3.5 percent for each age group.

The 1757 loan was intended to raise 2.5 million pounds, but initial subscriptions amounted to only 313,000 pounds.[46] A replacement bill sought 3 million pounds on a combination of 3 percent consols and a 1.125 percent life annuity on any age. Subscribers to the tontine plan were allowed to transfer. Since the net rate of return was slightly higher

[46] *Statutes at Large*, 32 George II, c. 19, establishes the replacement bill and notes the history of the attempted tontine. Since a 15 percent deposit was all that was required initially, it is unclear whether the 12.5 percent raised by May was a nearly complete deposit or a woefully short total contribution.

under the new plan, they did, and the tontine was cancelled. Thus the English government again undercut its own tontine plan.

In 1789 a new tontine was launched.[47] English actuaries had gained even more confidence at fixing tontine prices to match market rates of return. The baseline annual rents, shown in Table 5, were obviously chosen for reasons other than aesthetics. Recall my earlier observation that market interest rates on consols were around 4 percent at the end of the 1780s. Calculating an initial interest rate for each age class by treating it as a term annuity with the term set as the number of years from the midpoint age of the class to age 95, using 4 percent as the discount rate, we solve for initial interest within 3p of the listed rates in each case. Since prices were quoted in half-shilling (6p) intervals, this is within rounding error.

The underwriters of the 1789 tontine evidently had difficulty selling the tontine shares, and William Pitt argued in the House of Commons that their interests must be preserved. He proposed that they be allowed to transfer into a long annuity at 4.25 percent annual interest having 69.25 years left to run—an alternative with an internal rate of return almost exactly equal to 4 percent.

This second-guessing was by now traditional, but Pitt introduced some new wrinkles. The alternative was not a higher rate of return but an equivalent one. In addition, the government attempted to protect those who held onto tontines, "to keep them on the same footing" as if the plan had been filled. To do this the government nominated 4,345 lives to replace those who left. The government kept the payments due to its nominees. Evidently the government attempted to counteract the fact that it was the older nominees within each class that were most likely to leave. Thus government nominees accounted for 61 percent of the older halves of all classes and 54 percent of the younger halves.

English tontine policy had evolved over the eighteenth century into sound, "textbook" financial practice. Given an assessment of the market discount rate, tontines could be constructed to offer that rate.[48]

[47] The 1765 tontine was an optional *douceur* on a larger loan. Again the tontine was priced to pay the same returns as the alternative annuities. Evidently only a fraction of those eligible for the tontine actually subscribed. English financial expertise does not seem to have influenced the Irish Parliament in constructing its three tontines in 1773, 1775, and 1777, nor did the successful French plans based on many age classes. The Irish tontines had a uniform interest rate of 7.5 percent in three age classes: 0–20, 20–40, and 40 and above. Not surprisingly, enrollment was heavily skewed to the youngest class and to the younger ages within classes.

[48] It is unclear whether this expertise extended fully into the pricing of life annuities. When Britain began to sell life annuities in 1808, it adopted the Northampton life table constructed by the renowned Dr. Richard Price in the 1770s. As subsequent government actuaries showed (A. G. Finlaison, *Report and Observation on the Mortality of the Government Life Annuities*), the Northampton table greatly overstated mortality for annuity purchasers in the early years of the nineteenth century (it is unclear how much of the difference was due to class, region, or time period). That was good for life insurance company profits, but bad for government debt service.

TABLE 6
FRENCH TONTINE LIST PRICES

	Years' Purchase					Initial Rent in Livres				
Ages	1689	1696	1733	1745	1759	1689	1696	1733	1745	1759
0–5	20	14	14	15.00	14.29	15.00	21.43	21.43	20	14
5–10	20	14	14	14.29	14.29	15.00	21.43	21.43	21	14
10–15	18	14	14	13.64	13.33	16.67	21.43	21.43	22	15
15–20	18	14	14	13.04	13.33	16.67	21.43	21.43	23	15
20–25	16	14	12	12.50	12.50	18.75	21.43	25.00	24	16
25–30	16	14	12	12.00	12.50	18.75	21.43	25.00	25	16
30–35	14	14	12	11.11	11.11	21.43	21.43	25.00	27	18
35–40	14	14	12	10.34	11.11	21.43	21.43	25.00	29	18
40–45	12	12	10	10.00	10.00	25.00	25.00	30.00	30	20
45–50	12	12	10	9.68	10.00	25.00	25.00	30.00	31	20
50–55	10	10	10	9.38	9.52	30.00	30.00	30.00	32	21
55–60	10	10	10	8.82	9.52	30.00	30.00	30.00	34	21
60–65	8	8	8	8.33	9.09	37.50	37.50	37.50	36	22
65–70	8	8	8	8.11	9.09	37.50	37.50	37.50	37	22
70–	8	8	8	7.69	8.33	37.50	37.50	37.50	39	24

Notes: Tontine shares were sold for a capital sum of 300 livres tournois until 1759, when shares sold for 200 livres tournois. Years' purchase is share price divided by initial rent.
Sources: Robert M. Jennings and Andrew P. Trout, *The Tontine: From the Reign of Louis XIV to the French Revolutionary Era* (Homewood, IL., 1982), pp. 19–44; A. Vührer, *Histoire de la dette publique en France* (Paris, 1886), pp. 118–19, 197–201.

If the public chose not to purchase them at "fair value," then alternative sources of funds would be sought. Had the governments of 1693 and 1756 paid as much attention to the intra-class competitive aspects as William Pitt, they might have managed to raise more funds. But since the government rarely had trouble raising funds on simpler schemes at the same or lower rate of return, there was little to be gained.

FRANCE

Despite the fact that French scholars were among the pioneers in the empirical study of actuarial science, French policy does not seem to have incorporated their findings as rapidly as the English.[49] The structure and prices of the tontines of Louis XIV were preserved with modest variation up to 1759. French tontine prices are shown in Table 6. The contrast with English pricing is obvious. Up to 1744 interest rates

National vanity may well have prevented them from using Deparcieux's tables, which would have been much closer to the mark.

[49] Deparcieux's *Essai sur les probabilités*, in addition to setting out the mathematics of present-value calculations for various investments, constructed life tables based on 9,000 nominees in the first two French tontines. Dutch writers had constructed life tables on much smaller samples, and the English astronomer Halley built his on death registers from the town of Breslau in Silesia; hardly a sound basis for the bourgeois investors of London or Paris.

TABLE 7
FRENCH LIFE ANNUITY PRICES

	Years' Purchase				
Ages	1698	1740	1744	1754	1758
0–5	14	14	13.0	15	10.00
5–10	14	14	13.0	15	10.00
10–15	14	14	12.0	15	10.00
15–20	14	14	12.0	14	10.00
20–25	14	14	11.0	14	10.00
25–30	12	14	11.0	14	10.00
30–35	12	12	10.0	13	10.00
35–40	12	12	10.0	13	10.00
40–45	10	11	9.0	12	10.00
45–50	10	11	9.0	12	10.00
50–55	9	10	8.5	11	9.52
55–60	9	10	8.5	11	9.09
60–65	8	9	8.0	10	8.33
65–70	8	9	8.0	10	7.69
70–	7	8	7.0	9	7.14

Sources: Marcel Marion, *Histoire financière de la France depuis 1715* (Paris, 1914), vol. 1, p. 179; A. Vührer, *Histoire de la dette publique en France* (Paris, 1886), pp. 121, 191, 199, 212.

were established by discrete gradations in years' purchase. The decimal fractions on years' purchase after 1744 did not arise from a textbook calculation based on expected term and a market interest rate. The baseline annual payment became the basis on which prices were quoted, and it progressed in neat discrete steps in 1744/45 and 1759.

As shown in Figure 2, the internal rates of return produced by these prices were both high and increasing with age of nominee. France was clearly not exploiting selfish parents or families looking for life-cycle smoothing. Nor were they targeting the market discount rate. They were offering above-market rates of interest, at least for adult nominees, and thereby subsidizing retirements.

As a mechanical matter, it appears that tontine prices were set by small markups over the prices (in years' purchase) of life annuities offered by the government. Table 7 shows annuity prices from periods adjacent to the tontines. No simple rule governs the transformation, but the government had evidently taken to heart the complaint of the Parlement of Paris in 1653 that tontines, as a variety of life annuity, could not be priced much above other annuities.

Maintaining a pricing policy based on this actuarial error would seem to confirm Riley's verdict that "French financial authorities were inept in mathematics and failed to learn what Dutch and British predecessors had about the actual costs of life annuity loans."[50] He suggests that the French did not understand the actuarial principles, they did not know

[50] Riley, *Seven Years War*, p. 174.

the correct life table, and they did not understand the difference between interest and amortization.

Inability seems plausible for the 1690s, for both countries. But most of the subsequent French life annuity offerings before the Seven Years' War carried graded interest, except for the tumultuous period from 1715 to 1726.[51] Indeed, the 1740 prices are not far from a correct schedule based on Antoine Deparcieux's life table and a discount rate of 6 percent. The government was moving in the direction of actuarially fair annuity pricing.

After the publication of Deparcieux's book in 1746, establishing tables for pricing life annuities and tontines, one might have expected the French government, like the British, to improve further. They did not. It is hard to believe that there was a diminution of ability. Many of the later French finance ministers were men with training in economics or experience in banking. Certainly Necker, the leading purveyor of flat-rate 10 percent life annuities, had eminent credentials as a banker and economic author.[52] He later acknowledged that flat-rate annuities were a bad deal made by a desperate government.[53]

There is no evidence on which to judge whether or not the government was able to calculate its life-contingent debt costs at different points in the eighteenth century. The fact that the technology existed and was not used by men with adequate training and intelligence to use it forces us at least to consider possible motives for avoiding its use.

Two such reasons seem particularly compelling. The government seems to have had an aversion to paying rates above 5 percent on perpetual debt. Riley places the wartime peak market interest rate at about 6.5 percent in 1760.[54] Necker cited the same market rate for 1776. The government added little new perpetual debt from the end of the Seven Years' War to the Revolution, probably because it could not have done so at 5 percent or less. The government needed money, and was constrained by the market to pay competitive rates, but desired to disguise the true rate.

That does not explain why the government paid rates of return well above 7 percent for tontines and life annuities. If that premium reflected the public's preference for other assets, then the government was paying a stiff penalty to hide its true cost of borrowing. Alternatively, the government was subsidizing some lenders. Since most tontines and life annuities sold out quickly, it seems plausible that the return was above the market rate, even for life-contingent loans.

[51] France issued vast quantities of life annuities in 1717, 1720, 1722, 1723, and 1724. All were at a constant interest rate for all ages. The nominal initial interest rates were low, but capital could be furnished in depreciated *billets d'Etat*. A. Vührer, *Dette publique*, p. 185–87.

[52] Vührer thinks Necker must have known how to calculate the costs of life annuities (*Dette publique*, p. 273).

[53] Jacques Necker, *Oeuvres*, vol. 5, p. 491.

[54] Riley, *Seven Years War*, based on selling prices of bonds on the Compagnie des Indes.

The result was subsidized loans to, among others, the urban middle class. Intentional or not, that had beneficial consequences. The French government before 1789 traded in privilege. Tax exemptions were sold, as were the rights to collect taxes. The urban middle classes benefited little from such privileges and paid a large share of the taxes. It would have upset the principles on which the privileges of the nobility rested publicly to accord similar privileges to commoners. But the numerous and economically powerful urban bourgeoisie needed to be included in any stable political coalition. Subsidizing retirements and the pensioning off of relatives through generous tontines and annuities might ally the urban middle classes with the government.

Some support for this interpretation can be found in the wording of tontine edicts. They often referred to the great public demand for tontines and to the happy reception of previous issues. The inviolability of tontine income was guaranteed in the strongest possible terms. Such self-promotion by the government is not uncommon in official documents. In the case of tontines the facts support it, until Terray.

THE CONVERSION: FROM TONTINES TO LIFE ANNUITIES

In November of 1763 a royal edict banned any future government tontines, citing their enormous expense.[55] The tontine was finally brought to an end in 1770 by the abbé Terray, recently appointed Controller General. For Marcel Marion, the tontine was the most onerous form of public borrowing and Terray was the first man since Colbert with the courage to face up to the financial pressures on the monarchy.[56]

As part of a general program of reform and repudiation begun in January 1770, Terray froze tontine payments to all subscribers at the 1769 levels and converted them to life annuities.[57] In other words the future benefits of survivorship which ought to have gone to the surviving subscribers were instead transferred to the State. It is noteworthy that even here tontine lenders fared rather better than others. Unlike holders of other forms of debt, no tontine lender suffered an actual decline in income. What they lost was the potential for future income growth but what they were left with was in most cases a life annuity on good terms (a 10 percent minimum was applied to all tontine classes).

Tontine reform had little consequence for the budgetary problems of 1770. The intriguing feature of Terray's plan is its concern with long-run solvency rather than short-run expediency. Terray claimed that his conversion would save 150 million livres over the life of the tontines.

[55] Fachan, *Historique de la rente française*, p. 63.

[56] Marion, *Histoire financière*, vol. 1, pp. 248–51.

[57] On Terray's reforms, see Vührer, *Dette publique*, pp. 241–51, and Marion, *Histoire financière*, vol. 1, pp. 247–79. The other main changes were a reduction of perpetual rents by about 11 million annually and the conversion of floating short-term paper (*rescriptions*) into long-term debt at 5 percent with an annual lottery for reimbursement.

My own projections suggest cumulative savings of 162 million livres.[58] Discounted to 1770 at 4 percent, the savings amount to only 61 million.

Terray also initiated a conversion from tontines to life annuities in another, less literal but more important sense. When the short-run needs of 1770 demanded an immediate solution, Terray chose to sell nine million livres in annual life annuity rents to the Dutch at a rate of return easily as high as the "onerous" tontines.[59] Needless to say, robbing French families to pay wealthy Dutch investors did not make Terray any more popular.[60]

The rapid growth in life annuity rents after 1770 is documented in Table 2. They replaced some of the opportunities taken away by closing off tontines. But they did not restore the income lost to tontine-holders, nor the faith of the urban bourgeoisie in the Crown. The tontine experience may have made the holders of annuities wary that the government's renewed concern with debt might lead to a repudiation of their investments.

At a flat 10 percent interest at all ages, life annuities were just as expensive as the tontines they replaced. There was one important distinction. The life annuities offered the best returns on young nominees, not adults. This encouraged the development of the "Genevan formula," in which bankers bought annuities on selected lives, pooled them, and sold shares to private investors.[61] Some of the elements of political coalition-building were therefore weakened.

The government evidently needed some institution in which it could borrow vast sums without acknowledging its depreciating credit rating. Wittingly or unwittingly, it needed the urban middle class to support the loans. After 1770 the holders of life-contingent debt could no longer depend on the government to keep its side of the implicit bargain.

TONTINES AND THE FALL OF THE ANCIEN RÉGIME

As many historians have recently reaffirmed, the French Revolution was essentially political in both cause and consequence.[62] One possible

[58] Terray converted tontine rents in which the government's obligation is constant until the last death to life annuity rents in which the rents due each individual end with his or her death. For each of the tontine classes under age 95 in 1770, I projected forward for each year to 1850 the fraction of the total rents to be extinguished due to mortality from its age in 1770. I used a single-year-of-age life table derived from Deparcieux's data to project mortality. Had tontines stayed in force the cumulative total would have been 297 million; as life annuities, 135 million.

[59] Although they were nominally at 8 percent initial interest, Terray proposed to accept depreciated government paper for half the capital, boosting the effective rate above 10 percent.

[60] In 1776 Terray's "memoirs" were written by Jean-Jacques Coquereau (*Mémoires de l'abbé Terrai*) as a virulent attack. They included some of the popular jokes about him circulating in Paris.

[61] Herbert Lüthy, *La banque protestante en France de la révocation de l'Edit de Nantes à la Révolution*, 2 vols. (Paris, 1959–1961), describes the development of the scheme. Thirty young girls was the typical pool. These were primarily used in the French life annuities after 1770 and not in the earlier tontines (vol. 2, pp. 464–591).

[62] See François Furet, *Interpreting the French Revolution* (Cambridge, 1977), and Lynn Hunt, *Politics, Culture, and Class in the French Revolution* (Berkeley, 1984).

rationale for tontine borrowing at above-market rates of return and low minimum purchases was to forge a link of common interest between the monarchy and the urban middle class. Terray's reforms broke that link.

There were perhaps 75,000 holders of tontine shares in 1769—as many as owned all of England's public debt in 1760—and probably about 30,000 of them surviving in 1789. Add in their families and the families of tontine-holders who died in the intervening years, and the number of persons with active grievances becomes impressively large. It would not be hard to justify a feeling of betrayal. They were earning about 3 million livres per year less than they had expected. When the government's books were opened after 1789, the Third Estate found the government was paying 30 million in pensions to friends of the court, ostensibly for services rendered.[63] Three million livres per year was also the amount paid the top class of pensioners: a total of 86 persons.

The Revolution was made by people enlightened by a set of principles for fair government and a recognition that the Ancien Régime did not live up to them. Those whose lives were affected by the tontine reforms would likely have come to that recognition sooner and more convincingly. Future research might explore the records of who bought tontines to help explain puzzling differences in political attitudes on the part of apparently similar individuals or groups.

Direct measures of economic self-interest rarely do well at explaining political behavior. It would not be surprising to discover little correlation between tontine losses and political attitudes at an individual level. The more important consequence was the implication of the tontine default for the political expectations of life annuitants.

If investors knew that there was very little difference in rates of return between the old tontines and the new annuities, then they must have viewed cynically Terray's claims that tontine obligations should be repudiated because they were expensive. They saw a government using actuarial information in a selective and strategic way, to repudiate some obligations while leaving open an option to raise future funds. The tontine experience alerted them to the possibility that the same sort of revelation about the cost of life annuities might lead to a repudiation of those obligations in the crisis of the 1780s.

Necker's great popularity with the early revolutionaries is no doubt partly attributable to the popularity of the annuities, and to the belief that he would oppose default on them. But here, too, one must be careful to avoid oversimplification. One famous figure of the early Revolution, the Comte de Mirabeau, was a vigorous opponent of

[63] France. Assemblée Nationale Constituante. Comité des pensions, *Etat Nominatif des Pensions sur le Trésor Royal*, 1789.

Necker's annuities.[64] The problem was that the subsidized retirement of French adults had been intermingled with profitable speculation by bankers. Thus when Robespierre argued for leniency for life annuitants on the grounds that they were ordinary Parisians, he was condemned by Cambon, the author of the reform plan, who sought to reduce the payments to speculating bankers.[65]

In these years, described by J. F. Bosher as a period of transition to a bureaucratic system of public finance, the government failed to reconcile with a critical political group through a redistribution of privilege, yet did not complete the transition to a new culture of public finance in which privilege was the exception rather than the rule.[66]

CONCLUSIONS

Britain offered tontines at market rates of return and found the demand to be low. The French government's greater success at raising money on tontine loans in the eighteenth century can be attributed mainly to the high level of interest rates offered, especially for older nominees. If French investors had any cultural preference for life-contingent loans, the government did not take advantage of it. The tontine's reputation in France as an onerous form of borrowing for the state was therefore deserved. Public recognition of this fact by the government led to abandonment of tontines and eventually to partial repudiation of tontine obligations. It did not lead to a rationalization of public debt, because the life annuities offered in replacement were, at a flat 10 percent interest rate, just as onerous.

In eighteenth-century Britain the government scrupulously avoided differential treatment of investors by pricing all its loans at market rates of return and by maintaining payments. As a result, fiscal pressure did not lead to rivalrous competition over the system of government. In France, by contrast, public finance consisted of a series of subsidizations and strategic defaults. Until Terray, the interests of the predominantly middle-class subscribers to tontines had been ardently preserved. His reforms taught them and others like them that in periods of fiscal crisis they were powerless to defend their interests within the structure of the monarchy. They were therefore prepared to contend for control of the system of government when fiscal crisis created the opportunity in 1789.

[64] In his *Dénonciation de l'agiotage* (Paris, 1787). It is one of history's ironies that government profligacy should be condemned by Mirabeau, a man who had been imprisoned by his father, the Physiocratic economist, for nonpayment of debts, and who fell from grace after it was revealed posthumously that he had conspired with the king in exchange for relief of debts.

[65] Lüthy, *La banque protestante*, vol. 2, p. 561.

[66] J. F. Bosher, *French Finances, 1770–1795: From Business to Bureaucracy*.