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THREAT OF A CAPITAL LEVY, EXPECTED DEVALUATION AND INTEREST RATES IN FRANCE DURING THE INTERWAR PERIOD

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Threat of a capital levy, expected devaluation and interest rates in France during the interwar period

by

Pierre-Cyrille Hautcoeur* and Pierre Sicsic**

I. Introduction

The interwar period has been one of great political and economic unrest, especially in continental Europe. In the case of France, much debate exists among scholars about its mainly political or economic origins and solutions. At the very center of these debates, the long process toward the stabilization of the franc as well as the long reluctance before the abandon of the gold standard have been interpreted in political or in purely economic terms. In this paper we try to isolate and measure the respective importance of political and economic aspects in these two critical episodes by separating expectations of taxation and devaluation implicitly measured in the capital markets. Broadly, our assessment of the debate is the following: the delay in the stabilization of the franc from 1924 to 1926 may be attributed either to a political struggle over taxation or to the need for more macro-economic stabilization. The examination of likely taxation and the measure of exchange rate expectation would allow a choice between these two interpretations. Similarly, the delay in the devaluation of the franc in the 1930s resulted from a deflationary policy which credibility required increased taxation and so possibly renewed distributive struggles. The absence of that credibility would be reflected in anticipations of devaluation.These questions may be examined by looking at market interest rates, since changes in taxation, in inflation and in exchange rates are reflected as well as their anticipations in market prices (at least in efficient markets which, we argue, was the case during that period).

Unfortunately there is in France no recorded medium term (say up to five years) rates, which would be the most useful to look at the troubled times we are interested in. The only observable interest rates are the rates of return calculated on the *rentes* (the French consols). Yet, these returns are of limited usefulness because they are averages of rates during these troubled times and of rates expected to prevail afterwards, once stability would have been reached again. The paper seeks to fill this gap by computing implied medium term interest rates from the prices of the *rentes*, assuming that the expected long term interest rate was close to the usual nineteenth century level. This

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assumption is proved to be reasonable by looking at the US yield structure and at *rentes* which could be redeemed after 1931.

After these technical requirements have been fulfilled, the paper pursues two converging objectives. First, it presents a description of the political and economic situation of the period, focusing on some frequently overlooked episodes of critical interest for our experience. Second, it tries to evaluate the relative importance of the various policies at work or anticipated. It does this by comparing various kinds of bonds differing from each other only by their responses to these policies and under the hypothesis that market participants used perfect interest rates arbitrage to equalize the returns on these bonds. An example may help to understand the method: the variations of the spread between the returns on French public and private bonds can give an evaluation of the existence of anticipations of government default. Two important factors contribute to explain the difference between the gross returns on French and British government bonds: taxation and devaluation (or inflation, which will be supposed to be the same). We estimate anticipations of taxation directly from the political debate in 1925. The existence after 1925 of a French government debt quasi-denominated in pounds allows us to measure the anticipations of exchange rate since the difference between the usual and the exchange-rate guaranteed French *rentes* results only of expected exchange rate movements.

Using these comparisons, we are able to give a new interpretation of the evolution of interest rates during the two periods of great instability of 1925-1926 and 1934-1936, and also to shed some new light on the respective situations of France and Great Britain during the period of relative stability from 1927 to 1931.

This paper is organized as follows: section II presents the various interpretations given for the main events we are interested in. Section III explains the methodology used in order to construct medium term interests rates and justifies the hypotheses we made. Section IV presents the derived market interest rates. Section V compares the rate of return on public and private bonds to show that the premium on private debt did not decline between 1924 and 1926, so that there was no particular scare of government default. This also confirms the validity of using the rate on public debt as the representative interest rate in France. Section VI looks at the impact of a possible taxation on interest rates. It is shown that the 20% capital levy contemplated in 1925 explains an increase of 3.5 points in French interest rates from mid-1925 to mid-1926. During this year, the five year implied market rates were 16.1% in France and 7.4% in Great Britain. Therefore 40% (3.5 out of 8.7) of the difference in interest rates can be accounted for by the capital levy threat. The Laval policy of forced cut in the coupons paid on government bonds, assuming this cut would have been understood as long lasting, could explain a 2.4 point increase in the implied market interest rate in 1935. Section VII uses the prices on the Caillaux *rentes* issued with exchange rate guarantee to assess the exchange rate expectations. It is shown that the high French interest rates in 1926 cannot have been the result of an exchange rate premium, but that the low French interest rates of 1930 and 1931 were the result

of a premium on French francs denominated assets. After the pound left gold in September 1931, there was an expected depreciation of the franc which accounts for most of the rise in French interest rates in the 1930s.

II. The debate

The two periods of great instability of 1925-1926 and 1934-1936 have both been the object of a considerable litterature, although economic historians have until now concentrated much more heavily on the Poincaré stabilization than on the 1930s.

During the first of these periods, France experienced simultaneously capital flights, an inflationary and a political crisis, all ending in the exchange rate crisis of the spring of 1926. Many interpretations were given for this episode: Sargent (1983) considers that the fundamental reason was the budget deficit. More recent works consider that the problems resulted more from the accumulated debt than from the budget, since the deficit was decreasing sharply during the last years and the equilibrium was almost reached in 1925 because of the 20% rise in taxes decided by Poincaré in March 1924 (the so-called "*double-décime*"). The most recent data by Villa (1993, pages 70 and 90) confirm that the debt/GDP ratio was still 1.17 in 1924 and 1.11 in 1925 when the deficit was only 2.9% of GDP in 1925 (actually there was a primary surplus of 2.5%). Prati (1991) considers that people feared a default on public debt, provoking a run on long term public bonds. Other observers contend that the main problem was the term structure of the debt, since holders of short term government bills were always able to put the government credit in danger by refusing to renew their bills. Many contemporaries considered that the main problem was the capital flight resulting from fears of taxation on capital or on income.

Alesina (1988) claims to broaden and synthesize preceding interpretations in a model of political economy of this period. He takes seriously the political crisis, which was characterized by the succession of many governments within a short time, and sees it as the reason for the economic loss of confidence, arguing that it resulted from the impossibility to reach a political agreement on the payment for the debt. He considers that three groups have conflicting interests when a solution is searched for a high-debt problem, which can be solved either by government default, by rising taxes or by inflation. Businessmen prefer inflation to taxes, proportional taxes to progressive ones, and reject capital levies unless it relies mostly on public debt. Workers would choose progressive taxes or capital taxes, and prefer inflation to indirect taxes. *Rentiers* would choose indirect taxes or a reduction of public expenses, and they prefer direct taxes or even a capital levy to inflation.

Alesina argues that no group was able to impose its preferred policy during the *Cartel des gauches* period since that left wing coalition was divided between the Socialists and part of the *Radicaux* defending the workers and the remaining *Radicaux* defending the *rentiers*. The result was the economic as well as political crisis of 1925-1926. He contrasts this crisis with the success of

Poincaré, who was called to head a *gouvernement d'Union Nationale* in July 1926, which actually meant the recognition of the defeat of the left and a coalition of *rentiers* and businessmen. He concludes like most other writers: "In the summer of 1926, France was on the edge of a hyperinflation. The success of Poincaré's stabilization is due greatly to psychological effects" (p. 58). One of the aims of our paper is to refuse such a renunciation to give a precise economic assessment of the period, and to furnish a more common economic explanation of the evolution of that moment.

The great depression produces in France a quite similar situation in 1934-1936. It entails budget deficits and a rising public debt which could have been reflected in rising interest rates. They, in turn, probably impeded the recovery of investment that occurred during the same period in Great Britain. Like in the 1920s, the rise of interest rates can be interpreted mostly in terms of internal political problems or in terms of expectations of a devaluation of the franc since international rates were not going up. A credible deflationary policy required a balanced budget, or at least no monetary financing of the budget. This was likely to impose new taxes. With a Parliament dominated by the left (since the 1932 elections), such new taxes would probably affect capital income first. And any debate about increased taxation would renew the political struggle of the mid-1920s.

Political historians show that conflicts between right and left increase sharply from 1934 to 1936, endangering policital stability at some moments. Mouré (1991) explains in details the process of deteriorating confidence in public finance resulting from a growing if hidden reliance on money issuance in order to finance the budget. Eichengreen and Sachs (1985) consider in a normative rather than positive paper that the main problem of France was the overvaluation of the franc and that the deflationary policy could not succeed because of the size of the price gap with France’s trading partners. Our purpose is to examine whether the rise in French interest rates resulted from a growing political struggle or from an an increasingly uncredible deflationary policy conducting to anticipations of devaluation.

III. Expected long term rates.

The usual way to look at returns on long term unredeemable *rentes* is to compute the ratio of the nominal coupon to the price. The price being equal to the infinite discounted value of the coupons, with a discount factor by definition equal to one plus the rate of return, the infinite sum equals the coupon divided by this rate of return. Such simple computations applied to the different French *rentes* give a puzzling result as shown in Figure 1. In fact the *rentes* issued during and just after the first World War (1915 and 1916 5%, 1917 and 1918 4%, and the 1920 6%) could be paid back. The 5% and 6% *rentes* could be reimbursed after January 1931, and were eventually converted into a 4.5% *rente* in November 1932. That is why the curves corresponding to them disappear on the Figure 1 at the end of 1932, and why their yield measured as the coupon divided by their prices

converges to the coupon since their price was going toward the par when one was going closer to the redemption date (T5 and T6 in Figure 1). The 4% *rentes* could be reimbursed in 1942 and 1943.

Making an hypothesis on the long term interest rate that the market supposes will prevail for the long term, we can compute the medium term, say five years, interest rates implied by the actual prices of the *rentes*. This expected long term rate is the rate expected for horizon further away than 6 years. The long term interest rate in the late nineteenth century was very stable around 3%. No tax was then paid on coupon. Allowing for a 15% income tax during the interwar period (see below) leads to a gross rate between 3 and 4%. Another piece of information to fix the forward long term rate can be found in the US term structures of interest rates computed by Baum and Thies and Cecchetti. Their data make possible to compute forward interest rates that we interpret as the expected long term interest rates we need. Given 5 years and 15 years rates, one gets the implied forward 10 years rates for an investment starting in 5 years (see Appendix I). Assuming no term premium after 5 years, these forward rates are the long term (10 years) rates in 5 years. They are drawn on Figure 2, along with the spot 5 and 15 years US rates. The expected long term rates are much more stable than the spot rates. The level difference between the two sets of rates comes from the risk premium on Railroad Aaa bonds used in the 1920s. The mean of the expected long term rate on government bonds over the period 1929-1938 is 3.38%.

We can discriminate between various hypothesis on the level of the expected long term rate by checking their consistency with the price of the *rentes* which could be redeemed. The price of a redeemable *rente* is a function of the market interest rate, up to the conversion, the expected long term interest rate (which will occur after the conversion), and the probability of this conversion (see Appendix II). The price of the unredeemable *rente* is a function of the market interest rate and the expected long term interest rate. Given the expected rate one gets the market rate up to the conversion with the unredeemable *rente*, then the probability of conversion.[1] Allowing for a probability of conversion permits to explain the low prices of the 6% *rentes* relative to the price of the unredeemable 3%. The computed probability, deriving from a gross long rate of 3.75%, is plotted in Figure 3. A higher expected long rate would lead to some computed probabilities larger than one.[2]

The British war debt made up of the war loan stock issued in 1917 with a 5% coupon has been

[1]We did not attempt to model the option value stemming from the choice of redemption given to the government because it depends on the process of interest rate which, in our case, is very different from the usually assumed Brownian motion. As the government owns the option, the price of the callable bonds should be lower that the expected present value of the coupons and the converted capital. Increasing the quoted value of the redeemable bond, to offset this option effect, would decrease the probability of conversion.

[2] The same kind of computation using the price of the 5% redeemable *rente* led to implausible probabilities. It is visible from Figure 1 that the coupon/price ratios for the 5% and 6% redeemable *rentes* were the same until 1927, which is impossible with any probability of conversion.

converted in September 1932 into a "3.5% war loan 1952 or after" (Capie *et alii*, 1986). Using quotations of the 5% war loan and the 2.5% consol we have derived the probability of conversion (Figure 3). Anticipations of conversion of War debts were at least a fourth in England, and much larger in France after 1926.[3]

These computed probabilities of conversion show that the assumption of a long term rate between of 3.75% is reasonable.

Using the same gross of taxes expected long term rate in France and in Great Britain is consistent with a slightly lower net of taxes rate in Great Britain since taxation was heavier in Great Britain: 20 to 25% compared to about 15% in France (see below). At the end of the XIXth century, while taxation did not drive a wedge between gross and net rates of returns, the rate of return on the 2.5% British consols had been slightly lower than the rate on the 3% French *rente*.

There had been a major change in monetary policy regime about one year after the pound left gold (Eichengreen, 1992). Without taking a strong position on the influence of the war debt conversion on long term interest rates (Capie *et alii*, 1986 and Sayers, 1976), it is likely that there have been a downward shift in expected long term rate after 1932.[4] Therefore we have computed implied French and British medium term market rates with gross long term expected rates of 3.75 and 3.25% (Figures 4 and 5). An expected gross long term rate of 3.25% leads to a British net medium term market rate about 10% during the 1920s which is not consistent with other pieces of information about British market rates.[5] Therefore we consider that 3.75% (which leads to a more reasonable British implied market rate of 7%) was the world expected long term gross rate in the 1920s. In the mid 1930s, an expected rate of 3.75% leads to a negative British implied market rate, so we consider 3.25% to be the expected long term rate from 1934 onwards.

IV. Market rates

Once it has been established that 3.75% is a reasonable expected long term rate for the 1920s, one can look at the French implied medium term market rates (Figure 4). This rate is the discount rate in the next five years which, with the expected long rate used as discount rate for years further away in the future, equalize the observed price of the 3% *rente* with the present value of the infinite flow of coupon (Appendix III).

These implied rates are much higher than usually reported yields on government bonds (as depicted on Figure 1). However, it also appears that French *financiers* did never believe that their country was on the brink of hyperinflation since they held assets with rates of return for the next five

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[3] Capie *et al*. (1986, p. 1119, note 9) do not see anticipation of the conversion in the time-process of the price. They do not compare prices of 2.5% consol and 5% War loan at a given date.

[4] Our framework excludes that a conversion can have an effect on the expected long term rate.

[5] For instance, the 4% Tresury Bonds, 1931-1933 quoted around 93 in 1925, which leads to a yield rate from 1925 to 1931 of 5.5% (Pember and Boyle, 1950, p. 261).

years always smaller than 20%.

In 1927, the market medium term interest rate for public debt was still about 12%. It might seem contradictory with the reported rate of return on the 6% *rentes* with 50 years for maturity issued in 1927 (after the *de facto* stabilization) which according to Haig (1929, p. 266) was 6.98%. In fact this rate was not the expected rate of return on these bonds since they could be redeemed in 1931. The rate on the *rente* 6% 1927 as reported by Haig was close to the coupon/price ratio for the 6% 1920 *rente* plotted in Figure 1.[6]

Before turning to the explanations of the evolution of the implied market interest rate, a remark on the lack of alternative methods must be made. One may think that short term interest rate could be used in order to analyse that period. Before the Poincaré stabilization, the short term interest rate defined as the interest paid on short term public debt (*Bons de la Défense Nationale*) was pegged. Their return was maintained at 5% from 1923 to 1925. Makinen and Woodward (1989) argue that when this return was below the market rate these bills were not renewed, which led to monetization of the public debt. Actually, the important rise in the medium term rate which occurred during 1924 and 1925 when it is correctly measured should incite holders to make an arbitrage from short term *Bons* in favor of *rentes*, unless they favor very highly the liquidity of the *Bons* and fear enormously the possible capital losses on *rentes*.

Eichengreen (1992, p. 179) does not agree with Makinen and Woodward; using short term interest rates on "commercial paper," he argues that market rates were not above pegged rates on public debt. Actually, there was no market for short term private debt, and what *escompte hors-banque* was, even translated as commercial paper, remains unclear to us. So we can imagine that private individuals owning *Bons de la Défense* were not in a position to make an arbitrage between these *Bons* and "commercial paper." They had to choose only between owning the *Bons* and money. At the end of 1925, they did not renew their *Bons* or sold them to the banks (what can be shown from the great upsurge in the private money supply: see Sicsic, 1992, p. 72, Figure 1). But if many banks accepted to maintain a large amount of *Bons* in their portfolios, it is not only because they had to maintain a sufficient liquidity ratio, but also because they could not obtain higher yields by lending to private firms. One solution to the apparent contradiction between individuals selling their *Bons* and firms refusing to get into debt at similar rates could be an anticipation of forced consolidation of the *Bons de la Défense*. Such a solution to the problem of short term debt was contemplated at some crucial moments during 1925.[7] Another explanation is a high level of intermediation costs by banks.

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[6]This is not surprising since the rates reported by Haig are computed as if the capital will be paid back at maturity, after 50 years, and it means that the price of the 6% 1920 and 6% 1927 were about the same.

[7] The forced consolidation was examined by the government at the end of June 1925. Even the *régents* of the Bank of France were almost accepting a moratorium at that date (Jeanneney, 1976, p. 244). Some rumours on this solution survived the all summer, even after the decision to issue the Caillaux consolidation loan (see below). At least, that opinion was reflected by the bankers who were responsible for the issue of that loan, as is shown by their questions during their meetings with top officials of the Ministry of Finance (see the report of the meeting of August 21, 1925 n°618 signed E. Enders, file DAF374/1 at the archives of the Crédit Lyonnais; see also the file "propagandes diverses contre l'emprunt", file B 33.042 at the archives

It has some appeal since there was no market for *escompte hors-banque*. In any case, the absence of such a market as well as the difficulties in mimicking it incited us to prefer a study based on medium term rates.

V. There was no run on public debt in 1925.

The first solution to the debt problem faced by the governments in 1925 and 1926 is a simple default on the public debt. Prati (1991) claims that there was a run on the public debt motivated by the anticipation of such a default. As we will later use the internal rate of return on the 3% *rentes* as representative of market interest rate in general, it is important to check that the hierarchy between public and private bond rates has not changed during the *Cartel* governments.

Prati (1991, pp. 231-32) quotes *Le Temps* from August 11, 1924, and August 10, 1925 where one can read "à l'heure actuelle, la rente se capitalise en Bourse à un taux plus élevé que celui d'obligations industrielles" (nowadays, the yield on the rente is higher than those on industrial bonds) and the next year "le taux de capitalisation des fonds français jouissant de la garantie de l'Etat [a] été cependant supérieur à celui d'un très grand nombre d'obligations industrielles" (the yield rate on French bonds with government guarantee has nevertheless been higher than the rates on many industrial bonds). Prati, following *Le Temps*, interpreted these quotations as a proof of a premium the government debt had to pay because it was considered more risky than private bonds.

We have compiled prices of 14 utility bonds, and we have computed the implied 5 year rates of return on this private bonds, taking great care in the influence of the capital reimbursement (which was carried out by drawing) and correcting for the influence of taxes (see Appendix IV, and below for the tax rules). As shown on Figure 6, we found that the returns on government bonds had always been smaller than the average of the returns on the 14 utility bonds. There is no sign of a premium that should have been paid by government debt. We can definitely conclude that there was no such thing as an anticipation of government default or a run on public debt since the rates on government bonds were smaller than those on private utility bonds, and because the private premium actually increased in 1925 and 1926.

There is therefore no inconvenient for looking only at the derived internal rate of return for the next five years from the 3% *rente* price and interpret it as representative of market rates. These market rates are not adjusted for the effects of either the increase in expected taxation ot the franc depreciation, effects which will be dealt with in the remaining parts of this paper.

VI. Taxation

VI. 1. Official and actual tax systems

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of the Ministry of Finance, quoted below as SAEF). On November 22, a bill proposing a compulsory renewal of the *Bons de la Défense* was rejected in Parliament by only three votes.

Taxation of the income drawn from securities presents two main characteristics during the interwar period: first, it is very complex, combining many different taxes, paid by different securities, with different bases, to different administrations; second, this taxation increased quickly.

Two types of securities existed: bearer and nominative. Since bearer securities was the most widely held type, and since stock exchange transactions (and then the prices we will use) were carried on with such securities, we focus here on their tax regime. Every bearer security except French *rentes* had to pay two taxes directly paid by the issuer (*prélevés à la source*): first an income tax, called *impôt sur le revenu des valeurs mobilières* (tax on the income from securities, IRVM later)[8], which is one of the *impôts cédulaires* composing the proportional (not-progressive) part of the direct taxes (with taxes on wages and profits); and second a tax called *droit de transmission*, which was based on the mean value of the security during the previous year and was intended as a way to balance the fact that transactions on bearer securities could not be registered and taxed if they occurred outside of the stock exchange.[9] Moreover, every personal income, including those from the *rentes*, was included in the base for the progressive income tax called *impôt général sur le revenu* (IGR later).

The rates of all these taxes were quite small before the War (for example, it was 4% for the proportional IRVM, and there was no progressive income tax). They increased quickly, at first until 1926 and then from 1933 to the second World War (Table 1). In 1925, excluding the progressive IGR, about a fourth of the nominal coupon of private bonds was taxed. If we add to this rate the maximum marginal rate of the IGR (which peaked at 60% from 1923 to 1925), really high rates are reached. In fact, these rates were probably never paid since tax evasion at the IGR was very easy on bearer securities, because coupons were paid to the bearer without any requirement allowing a control of his future declaration to the IGR.[10] Only wealthy people who were known as living from securities income (*rentiers*) had to declare at least a part of their income.

Evaluations of the importance of the evasion are difficult because income from securities are not separated in aggregate figures for the IGR base. But contemporary accounts give high evaluations: Mouchet (1934, pp. 26-27), Battiglini (1923, p. 110), Couderc (1923, p. 29) or Cottin (1938, p. 6) all consider evasion very easy (without being socialist). They summarize the evaluations of IGR-evasion given in Parliament by Bokanovsky (on November 12, 1922), Pietri (on February 17, 1933) and Auriol (on December 31, 1936), all estimating evasion as at least half the income from securities.[11] Given the high inequality of income during that period (Morrisson, 1991), and the likely

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[8] We should add that stocks supported also indirectly the profit tax, which was not deductible from the income tax. The level of this *impôt sur les bénéfices industriels et commerciaux* is given in Table 2.

[9] Although this tax was called a transaction tax, it was in fact an income tax, and should be distinguished from another tax on transactions called *impôt sur les opérations de Bourse* that was always paid only in case of effective transactions, and that we will neglect here.

[10] This situation was almost officially accepted, since the rate on the *droit de transmission* on bearer securities was raised relatively to that on nominative securities on the basis on this tax evasion probability.

[11] Couderc (p. 35) cites the speech of Bokanovsky at the Chambre des députés on November 12, 1922,

role of securities income in that inequality, the low mean level of taxation at IGR is also an argument in favor of a high level of evasion. We may conclude that the effective rate paid on securities income at IGR was at most half the official rate.[12]

Table 1: Tax rates on securities

	dtr	IRVM	IGR	IGRm	BIC
1914	0.29	4	0.62	0.17	0
1921	0.15	10	50	37.7	8
1922	0.15	10	50	37.2	8
1923	0.55	10	60	46.2	8
1924	0.69	12	60	47.9	9.6
1925	0.815	12	60	48.8	9.6
1926	0.699	18	30	25.6	10
1927	0.5	18	30	25.8	15
1928	0.5	18	33.3	28.5	15
1929	0.5	18	33.3	28.6	15
1930	0.3	16	33.3	28.7	15
1931	0.25	16	33.3	28.5	15
1932	0.25	16	33.3	28	15
1933	0.292	17	36.3	30.4	15
1934	0.3	17	33.3	27.5	15
1935	0.3	24	36	28.4	12
1936	0.3	18	40	27.1	12
1937	0.35	24	48	35.7	14

Note: dtr is the *droit de transmission* on bearer securities, in percentage of the mean price of the security during the previous year (when the rate was changed during a year, we calculated the mean rate by weighting each rate with its duration). IGR is the maximum marginal rate of IGR. IGRm is the mean rate paid on IGR by a tax-payer with an income equal, in constant francs, to the limit of the maximum marginal rate in 1936 (1.332 million francs). BIC is the rate of the profit tax.
Source: Hautcoeur (1994, pp. 228-229).

In 1925 the *Cartel* was not willing to increase indirect taxes, and could not raise direct taxes since the tax rates had already been tremendously raised during the previous decade. There were then two ways to increase government receipts in order to pay back the public debt, either a capital levy or an attack against fiscal evasion. Tax evasion at IGR was thought by many deputies of the left as the main inequality in the tax-system, and its elimination was thought as the solution to the budget

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which evaluates income from securities to 21.5 billions franc, from which a maximum of 10 billion are legally tax-free. As only 3.5 billion are found by the tax administration in the IGR declarations, the evasion is at least two-thirds of the taxable amount. Mouchet reports (p. 35) the evaluations presented by Pietri, according to which securities income reaches 30 billions in 1930, on which 5 are tax-free and 12 evades the IGR. Cottin (p. 2) cites Auriol who evaluates the securities income at 26 billion, on which 10 were tax-free and 8 evade the IGR. These two last evaluation correspond to a tax evasion rate of one half, except if we suppose that security holders had total income below the minimal level necessary to be taxed at the IGR.

[12] In 1922, when the IGR tax rate was 50%, admitting a 2/3 evasion rate leads to an effective tax rate about 15%; When the IGR tax rate was 30%, the evasion rate being 1/2, the effective tax rate was also 15%.

problem. The attempts made to limit this evasion did not succeed during the interwar period. From 1920 to 1924, the rightist majority resisted almost all proposals intending to limit the evasion on bearer securities (accepting only a few advantages to be given to nominative securities). The compulsory declaration of all coupons via the *bordereau de coupons* imposed by Poincaré in 1924 was given up (paradoxically) by Herriot in 1925. The similar *carnet de coupons* voted by the Parliament in December 1925, had the same fate in 1926, as had the *carte d'identité fiscale* voted in late 1933. Many other propositions were made without getting Parliament support, from a provisory payment made by the issuer (and refundable for non-IGR payers) proposed by Pasquet, a senator, in 1924, and then by Blum in 1924 and Pietri in 1933, to the prohibition of bearer securities (which was the profound desire of the parliamentary left in late 1925 but did not get government support).[13]

VI. 2. Politics and the capital levy

Another solution contemplated in 1924-1926 was the capital tax, which was thought as a way to "take the money where it is."[14] The mere idea of a tax based on property and not on income was an ancient one, and it had been supported by many progressist proposals before World War I (no less than 23 bills from 1882 to 1914, including one by Caillaux, Finance minister in 1914[15]). The specificity of the period 1924-1926 is that the proposal of a capital tax was now defended as a "one shot" tax at a high level, with the purpose of reducing radically the level of the public debt. This reason allowed the Socialists, who were the traditional supporters of such a proposal for distributive purposes, to defend its opportunity as a radical and definitive solution to the financial problems caused by the war. The title of the act proposal presented by 22 members of Parliament in July 1924 shows perfectly how the capital tax "*extraordinaire et unique*" was for the socialists the ideal solution, allowing both "*l'amortissement rapide et total des avances de la Banque de France à l'Etat, des Bons et obligations de la Défense nationale, des Bons du Trésor à trois, six et dix ans*" (to pay back the short and medium term public debt) and "*la suppression de la taxe sur le chiffre d'affaire, de la taxe de luxe et des impôts cédulaires sur les revenus*" (decrease direct taxation, maintaining almost only the IRVM and the progressive IGR from the previous direct tax system). The rate proposed was 15% for lands and 20% for other assets. The capital levy was not contemplated then by the leaders of the majority nor by the government.

In March 1925, the project reappeared, probably on the influence of Blum (who presented on April 7 a bill proposing a tax on capital at a 10% rate). Herriot seems to have been convinced, since he asked the Finance minister Clémentel to study the problem. As Clémentel opposed the project, he resigned when Herriot insisted to include the capital levy in the finance bill for 1925 (not yet voted at that date). His successor Monzie proposed to the Parliament on April 10 a capital tax disguised in a

[13] On these points, see Sauvy (1984, vol. III, ch. 5).
[14] This is a Blum's expression.
[15] The list with some details on many proposals can be found in the SAEF file B 43.281.

forced loan at a flat rate of 3% (and subject to all taxes), that all tax payers would have to subscribe up to an amount of 10% of their wealth. Both projects increased the fears of the right, particularly when a parliamentary amendment to the Monzie bill proposed an annual tax on capital and the creation of an extraordinary tax on enrichment since the war.[16] In spite of this, it seems that the probability of a capital tax to be voted was quite small at this date, since a part of the radical-socialist party, necessary to get a majority at the Chambre des députés, opposed it. Finally, it seems that it ended as a mere pretext by Herriot who wanted to "fall on the left", when the scandal of the violation of the issuing-limit of the Bank of France began (Jeanneney, 1977; Bonnefous, 1960).

After Herriot resigned, the Painlevé government included Caillaux as a Finance minister. Caillaux opposed the idea of a high level capital tax, but was probably favourable to a low-level tax on "unproductive capital".[17] The budget bill for 1925, which was finally passed on July 12, 1925, did not include the capital tax, and it gained the support of a majority of center-left (without the Socialists and a part of the Radical party) which was not the *Cartel* majority. But the *Cartel* was not dead: when the Socialist party's congress of August 1925 decided to break off with the government on the basis of the refusal of the capital tax, that problem became the center of the discussions with the Radical party. The capital levy became then the litmus test for the political alliance between the Socialist and Radical parties. At the Radical party congress held in Nice in October, Herriot (who could only hope to come back from the left) convinced the party to rebuild the *Cartel*. Caillaux had then to resign, and the new Painlevé government (with himself as Finance minister) was then supposed to have the capital tax as its priority. In fact, Painlevé proposed an extraordinary national contribution in November, which gave the choice to the holder of securities between a one-time payment of 150% of the income and 14 annual payments of 15%. Another proposal was made by two deputies (Bibié and Falcoz) for a progressive capital tax with rates from 5 to 25% (for fortunes larger than 45 millions francs), with an advantage to payment in public debt. By then, the divisions inside the Radical party allowed the opposition of the right-wing Senate to become powerful. All projects implying radical tax measures against securities were rejected, and the resulting government instability blocked the resolution of the fiscal problem until the definitive change of the majority and the appointment of Poincaré as *Président du Conseil*.

Three conclusions emerge from this review of the history of the *Cartel*. During 1925 the capital levy was the most seriously studied of the radical solutions to the debt problem, much more than the forced consolidation of the floating debt or than the suppression of the bearer securities.[18] Secondly,

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[16] Note that an extraordinary tax on corporate war profits, at very high rates, had been voted during the war by a large majority.

[17] This tax was included in the first draft of its finance bill for 1926 presented in October, 1925, but it had not been voted when he resigned. The idea was not from Caillaux, as is shown by the existence of similar projects at the Finance ministry from 1924 at least. Note that the same method (a very low rate) had been used by Caillaux himself in order to obtain the approval of the income tax in 1914. The rapid increase of the rate of the income tax in the following years made that method much more difficult to use in the case of the capital tax. The fact that this tax was seen as "inquisitorial" and as allowing the creation of a wealth registration (*cadastre des fortunes*) did not help.

[18] The fact that the capital levy was almost voted does not mean that it would have solved the debt

the probability of a capital-tax to be implemented rose from July 1924 to a maximum in November 1925. Lastly, the capital levy that was under discussion was a unique event, at a high rate (something like 20%), but could be paid in a few years.

VI. 3. A measure of the influence of the expected capital levy on market interest rate

The influence of taxation on domestic assets on their prices is different under flexible or fixed exchange rate. The basic mechanism is an arbitrage between a taxed domestic asset and an untaxed foreign asset, assuming that there is no capital control and that domestic arbitrageurs can hold untaxed foreign assets. The return on both assets net of taxation and expressed in the same currency should be the same. For a perpetual taxed French *rente* with a coupon of *cp* francs, the arbitrage equation is: $\frac{P}{e} = \sum_{i=1}^{N} \frac{cp - \varphi_i}{e^a \left(1 + r^*\right)^i} + \frac{cp / r^*}{e^a \left(1 + r^*\right)^{N+1}}$, where r^* is the rate of return in the untaxed asset in the foreign country, e is the exchange rate (one pound equals e francs), and e^a is the expected exchange rate relevant for the payment of all the future coupons and the future taxes. A pure capital levy corresponds to a tax to be paid only once (say next year, so that N=1), which amount φ_1 is proportional to the price of the asset before the taxation was announced.

If the exchange rate is flexible the price of the domestic asset in domestic currency does not have to move when the tax rate moves, the exchange rate could adjust below the expected longer term exchange rate ($\frac{e^a}{e}$ goes down) when the tax becomes expected. If the exchange rate is fixed, or if there is no room for expected appreciation, actual and expected exchange rate moving by the same amount, the price P had to adjust. This simple model has no implication on the expected exchange rate which will be used to convert the coupon payments, independently of the actual exchange rate.

These basic principles show that a movement in the taxation on domestic asset does not necessarily lead to a movement in the exchange rate. Conversely a capital flight which depreciates immediately the exchange rate, permitting a further expected appreciation, allows the domestic price to move less than the tax rate. We will, in the remaining part of this section, assume that the taxation had no impact on the expected movement of the exchange rate, and is fully reflected in the asset price in domestic currency.

To measure the influence of a possible capital levy on French interest rate, we have first estimated what would be the flows of taxes to be paid for somebody holding a 3% *rente*. Assuming that the tax base would be fixed at a price of this *rente* of 50, and that the rate was 20% to be paid in five years, the taxes to be paid would be 2 francs per *rente* in the next five years.[19] We have computed, using the second equation of Appendix III, the implied internal rate of return consistent

problem. For the difficulties in implementing such a tax during that period, see Eichengreen (1990).

[19]The price of the 3% *rente* before the 1924 elections was about 55. It reached 50 (see Figure 1, coupon/price is about 6%) at the end of 1924.

with observed prices, assuming that in the next five years only 0.55 franc would be paid, net of taxes (3 francs of coupon minus 15% of income tax minus 2 francs of capital tax). This rate of return is the rate of return net of expected taxation, that is the rate of return, admitting that the quoted prices of *rentes* (gross of taxation) had been driven down because people were convinced that there will be such a capital levy of 20% to be paid in five years. The resulting rate is plotted as RI_375 on Figure 7, while RA3_375 is the internal rate computed with the first equation in Appendix III, without expected capital levy (but with a 15% income tax) and with a gross long term rate at 3.75% (net rate equals .85 times 3.75). The measured influence of expected taxation could seem to be maximized, in the sense that applying a probability less than one to the possibility of paying two francs per *rente* in the next five years would give a rate between RI_375 and RA3_375. On the other hand, the threat of taxation could be larger than the 20% of capital levy, if one is willing to accept that if applied the *bordereau de coupons* would induce an increase in the paid general income tax.

We explain the increase in the market rate RA3_375 observed from mid-1924 to mid-1925 to the threat of a capital levy. It appears from Figure 7 that the difference in interest rates between France and Great Britain from 1923 to 1927 probably reflects some expectations of depreciation of the franc. The difference between the French rate of return net of expected capital levy and the British rate (RI_375-RCO_375) from mid-1925 to mid-1926 was on average 5.1 % while the difference between the French and British rates (RA3_375-RCO_375) was on average in 1923 5.3%, and rose to 8.6% in the year from July 1925 to June 1926.

The rise in the French market interest rates in the second half of 1924 can be explained by a threat of capital levy. It should be noticed that the exchange rate did not move a lot during the period of rising fears of a capital levy. The franc began to drift in the fall of 1925, and the flight on the franc occurred during the first half of 1926. Furthermore the exchange rate movements are not of the reasonable order of magnitude of 20% which is relevant for capital taxation.

Another economic policy measure akin to a change in *rente* taxation had been the deflation policy of the Laval government in 1935 which imposed a cut in the coupon paid on *rentes* as part of the compulsory decrease of 10% for all expenditures items of the budget (including civil servant salaries).

The measure of the influence on interest rates of the 10% cut on the coupons paid on *rentes* is similar to a rise in the tax rate on the *rente* holder income. It is based upon the internal rate of return on the 3% *rente* admitting that it will forever pay a coupon of 2.7 francs (3 times .9). This rate (noted RLA_325) is the solution of the first equation of Appendix III with *cp*=2.7, instead of *cp*=3 when the solution is RA3_325). As shown in Figure 8, the *de facto* conversion of the *rente* 3% by a *rente* 2.7% implied a rise of 2.4 percentage points in the rate of return.[20] The French market rate did not rise by this amount from 1934 to 1935-36 because there were two offsetting effects. First the British rate declined by 1.2 point (from 3.3 to 2.1%), and secondly the expected depreciation became

[20] The means from July 1935 to June 1936 of RA3_325 and RLA_325 were 8.8% and 6.4%.

smaller.[21]

VII. Interest rates and expected movement in exchange rate

VII.1 The Caillaux loan with exchange rate guarantee

Before the stabilization of the franc, inflation and devaluation were, with the threat of a capital levy, the second fear of bond holders. The issue of the Caillaux loan in the summer of 1925 was conceived as a response to this fear. Caillaux had a reputation of being a good *financier*. He tried to find a solution to the main short term financial problem faced by the governments of the *Cartel*: the renewal of the *Bons de la Défense Nationale*. As it was said that people sold their *Bons* in order to export capital, he proposed a consolidation loan (so he could not be criticized as rising the debt) offering a small interest rate (4% nominal, actually 4.3%[22]) in exchange for an exchange rate guarantee (both for income and capital) and an exemption from the general income tax.[23] This was generally considered to be a good idea both in France and abroad, were people saw that issue as offering good conditions to investors and as the first step toward the stabilization of the franc[24].

However, the issue was not successful, since only 5.9 billions francs of *Bons de la Défense Nationale* were consolidated, to be compared with a total of 50 billions of outstanding *Bons*. Many reasons have been proposed to explain this relative failure: the *rente* was issued in late July, when many investors were in vacations; a long lasting bank strike made the negotiations of the loan difficult; peasants, who were said to hoard much money in these troubled times, did not subscribe because of the harvest or because they did not understand the complex functioning of the exchange rate guarantee; finally, many firms or banks hold *Bons de la Défense* as liquid assets and could not transform them into long term investment. All these reasons are not appealing, and a somewhat closer look suggests other explanations.

The tax advantages given to investors, mostly to rich ones, was apparently important, although it could be justified by arguing that the *rente* proceeded from the consolidation of *Bons* that did not pay

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[21] The 1934 mean of RA3_325 was 8.4%; the average expected exchange rate was 111 francs per pound in 1934 and 104 francs from mid-1935 to mid-1936 (see below for details).

[22] This takes into account the fact that the exchange rate on which the return was indexed was inferior to the prevailing rate at the date of issuance (see "*l'emprunt de libération nationale*", SAEF file B 33.042).

[23] Jeanneney (1976, p. 255) reports that the idea was suggested to Caillaux by a group of influent financiers and industrialists including Wendel and Rothschild.

[24] The Rothschild bank praised highly (and much more than for most government issues) the conditions of the issue in the letter announcing it to its clients on July 20, and also in direct letters to clients (see Archives nationales 132 AQ 36, file "Emprunt 4% 1925", and AN 132 AQ 4218 the letter of July 7 to Miss Peltier). However, contrary to what Jeanneney (1976, p. 261) reports, the Rothschild bank only subscribed for their own account 0.64 million francs of the new *rente*, to be compared with at least 17 millions for every issue of *rentes* from 1915 to 1928 (see "Tableau général sur opérations lors d'émission de rentes françaises", AN 132 AQ 36). For the opinion prevailing in the United States, see the report by the French ambassador in the US in SAEF file B 33.042.

the IGR. In fact, that advantage was not so important since, as we have shown previously, most bearer securities did not pay the IGR, particularly the foreign securities the loan had to compete with.[25]

A closer look at the issuing period gives another important reason: commentaries, including the most independent ones (in the foreign press) are confident in the success of the loan until the Socialist party congress in August 1925. After that date, the growing concern about a capital levy coincides with a decrease in the subscriptions, paradoxically just at the moment when they should have grown. It seems logical that the perspective of a new tax which was the only one against which the loan was not protected was largely responsible for its failure. It was seen just as a suppression of the advantage that had just been promised.

Above all, the most likely explanation of the failure of the issue is a proposed interest rate which was very low in comparison with the yield on other *rentes*. It had been chosen with reference to the yield in foreign currencies of foreign securities quoted in Paris, for instance the British consol.[26] We will argue below that the par on this loan was consistent with a large expected depreciation of the franc, expectation contradictory with the stabilization aim.

Some more details are requested in order to understand the fluctuations on the price of the Caillaux loan in the remaining of our period. On July 16, 1935, the fiscal status of the Caillaux *rente* was changed, since it was decided that it could only have nominative status. The purpose of this modification was to impede people from pretending they owned this kind of *rente* when the tax administration asked them why they did not declare any security income at the IGR (response that could not be verified if the *rente* had the bearer form). The effect was to submit the *rente* to the inheritance tax that it escaped mostly before, like most bearer securities. Since the marginal rate of that tax for direct heirs was about 25%, it accounts easily for the sharp decrease of the relative price of the Caillaux *rente* vis-à-vis other public bonds. While the price of the 3% *rente* remained flat from April to September 1935, the price of the Caillaux loan dropped from 96 francs on the first of July to 84 on the 16th of September. After September 1935 we have corrected the price of the Caillaux *rente* by a factor 1.15 in order to account for this regulatory change. We have not found quotation of the Caillaux *rente* before January 1926, when it was worth 90. We have fixed the price to par (100) in the issuance period (from July to October, 1925).

VII.2 A measure of the influence of expected exchange rate movement on market interest rate

The market price of the 4% *rente* with exchange rate guarantee can be used to assess the

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[25] Remember that in the computations of the net implied market rates of the *rente* 3%, we suppose a tax rate of 15%.

[26] See "Tableau indiquant le taux net du revenu de quelques valeurs mobilières étrangères (...)" (SAEF B 33.042): the calculations made on the basis of quotations on July 9, taking into account a future rise in the income tax on foreign securities from 18 to 25%, gave 3.25% as net yield on the British consols, 3.53% on Swiss rentes, 3.55% on Swedish, 3.75% on Norwegian and 4.3% for Argentina. France could not pay more!

importance of the expected loss in value of the French currency on French interest rate. The coupons of these *rentes* were indexed on the pound/franc exchange rate, and the *rentes* could be redeemed at a value in francs equal to 50 times the last half-yearly coupon. This means that they could be redeemed and that the capital itself was indexed on the exchange rate. We will assume that the redemption was expected in 10 years, and we will compute an internal rate of return on the next five years, the price and the coupon being expressed in pounds and expected pounds. This rate of return is solution of the equation from the Appendix V, and is plotted as RERA_375 and RERA_325 in Figures 4 and 5. The expected exchange rate (ERA), plotted in Figure 9 along with the actual exchange rate, is computed according to the uncovered interest rate parity formula on the next five years (since interest rates are five year interest rates) using the rates of return on the 3% *rente* and the exchange rate guaranteed 4% *rente*:

$ERA = \left(\frac{1 + RA3\_35/100}{1 + RERA\_35/100} \right)^5 ER$ for the years before 1933 and

$ERA = \left(\frac{1 + RA3\_3/100}{1 + RERA\_3/100} \right)^5 ER$ for the years 1934 to 1937 (for the change of expected long term interest rate from 3.75 to 3.25% after 1933, see section III above)

Using the issuing price of the Caillaux loan to compute the expected exchange rate, leads to a very low expected exchange rate (160 francs per pound, see Figure 9). This signals one was willing to subscribe to the Caillaux loan only when expecting a large depreciation of the franc. The first quoted price we found, for January 1926, did lead to a much higher expected exchange rate of about 130, very close to the spot rate at the same time. We may conclude that the failure of the Caillaux loan resulted from an implied exchange rate below the one expected by most market participants.

The rate of return in constant francs (RERA_375) is very high in early 1926, which means that there was expectation of appreciation while the current value of the franc was extremely low. The expected exchange rate derived from the price of the Caillaux *rente* never reached 150 francs per pound, so we can consider that the sharp depreciation of the franc (fluctuating between 150 and 200 francs per pound) in the first half of 1926 did not reflect the medium term anticipations of the market and can be considered as a speculative bubble.

From 1928 to 1931 the rate of return in constant francs was between the rate of return in francs and the rate of return in pounds of the British consol. A main part of the very low level of the rate of return in francs relatively to the French internal rate of return in pounds was explained by an expectation of appreciation of the franc. In the two years following September 1929, the difference between the British and French rates was on average 5.3 points, while the difference between the constant franc rate and the nominal franc rate (RERA_375 - RA3_375) was 3.1%. Expected appreciation of the franc explains about 3/5th of the gap between French and British rates.

Symmetrically, after 1931, expectation of depreciation accounts for the rise in French interest rates, while constant francs and British rates are getting lower. In 1934, the gap between the nominal

franc rate and the constant franc rate has been larger than the gap between the French and the British rates (Fig. 5). Expected depreciation explained therefore more than the observed gap between French and British rates.

The rise of the budget deficit after 1932 did not have any impact, independently of depreciation expectation, until 1936, since the constant francs rate went down until mid-1935, and the subsequent rise could be, at the beginning, explained by the 10% Laval cut which was supported by the Caillaux loan. After the September 1936 devaluation (which had been correctly expected for a while[27]), expectations of further depreciation appeared almost immediately in late 1936.

In general, there was a difference between the rate of return in constant francs in Paris and the rate of return in pounds in London. This difference cannot be simply explained by the existence of capital controls since the prices of the British consol in London and in Paris (where it was also quoted on the stock exchange) were quite close when converted with the pound/franc exchange rate (Fig. 10). Some other explanation has to be found. Taxation cannot be such an explanation since our implied market interest rates have been computed net of taxes.

VIII. Conclusion

The main result of this paper is that a better methodology than usually used allows a better understanding of many features of French interest rates during the interwar period. First, the interest rates during the *Cartel* period were quite high (about 16%), but very far from what one would believe while on the edge of hyperinflation. Moreover, the increase in the rate after 1924 (when the market implied rate was 13%) could be explained by the threat of a capital levy. The apex of the exchange rate crisis from May to July 1926 (the rate going from 140 to 200 francs per pound) appears as a speculative bubble, since exchange rate expectations were already declining and were quite below the actual rate. Second, the low interest rates in France during the 1928-1931 period reflected expectations of appreciation of the franc *vis-à-vis* the pound. Symmetrically, after 1931, expectations of depreciation of the franc account for the high level of interest rates in France.

The interpretation that results from these findings is the following: the politically motivated struggle about the capital levy increased the interest rates in 1925 but disappeared early enough for the stabilization to be still possible and expected even before Poincaré took over, so that his supposed victory on inflation was a Pyrrhic one: no hyperinflation had been beginning and the return to normal had already begun. This episode had two important consequences: first it contributed to an excessively low stabilization level for the franc, which was reflected in expectations of reevaluation lasting up to the devaluation of the pound. Second, the myth of the franc Poincaré saving France

[27] One should have taken into account the Laval 10% cut, estimated above at 2 percentage points, in the computation of net of tax French interest rates RA3_325 and RERA_325; but this omission on both rates cancels out in the expectations of the exchange rate.

from a sharp political struggle and from the edge of hyperinflation explains partly the reluctance of all political parties to any devaluation in the 1930s. However, given the strong opposition to capital flow restrictions and the contradiction between a monetary financing of the budget deficit and explicit deflationary measures, expectations of a devaluation rapidly appeared. They explain the rise of interest rates in France during the depression.

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Appendix

I. Long term expected interest rates (in the United States).

Knowing medium (5years) and long (15 years) market interest rates i_M and i_L, one can compute the long term expected rate (expected to prevail for ten years after 5 years from now), which is the forward rate *f*, by using i_M and *f* as discount rates to compute the present value of a bond with coupon i_L. By definition of i_L the price of this bond is 1. Therefore:

$$1 = \sum_{j=1}^{M} \frac{i_L}{(1+i_M)^j} + \sum_{j=1}^{L-M} \frac{i_L}{(1+i_M)^M (1+f)^i} + \frac{1}{(1+i_M)^M (1+f)^{L-M}}$$

and $$1 = \frac{i_L}{i_M}\left(1 - \frac{1}{(1+i_M)^M}\right) + \frac{i_L}{f(1+i_M)^M}\left(1 - \frac{1}{(1+f)^{L-M}}\right) + \frac{1}{(1+i_M)^M (1+f)^{L-M}}$$

hence f

i_M and i_L are taken in Baum and Thies (1992) and Cecchetti (1988, pp. 1131 sq.).

II. Probability of conversion

In the law which permitted issuance of new public debt the condition of redemption of the *rentes* were given. Both the rente 5% issued in 1915 and the rente 6% issued in 1920 could be redeemed after January 1931. We have computed the implied probability of reimbursement by considering that the price of one of this rente was equal to the discounted flow of coupons up to 1931, plus a repayment in 1931 of 100 with probability *q* or a value of capital in 1931 equal to the nominal coupon divided by the long term interest rate with probability 1-*q*. Before computing the implied probability, one needs a discount rate up to 1931, this rate is computed with the price of the 3% *rente*.

Denoting n_t the length between current year and 1931, $P3_t$ the price of the 3% *rente* which pays a coupon (net of income tax) of $cp3$ francs, $j3$ the capital tax to be paid each year until 1931, and r_L the expected long term rate for the future after 1931 (net of income tax), the internal rate $r3_t$ of return on the 3% *rente* for the n_t following years, is defined by:

$$P3_t = \sum_{i=1}^{n_t} \frac{cp3 - j3}{(1+r3_t)^i} + \frac{cp3/r_L}{(1+r3_t)^{n_t}} = \frac{cp3 - j3}{r3_t}\left(1 - \frac{1}{(1+r3_t)^{n_t}}\right) + \frac{cp3/r_L}{(1+r3_t)^{n_t}}$$

The implied probability q_t of redemption on a rente which is priced P_t and which pays a coupon *cp* is defined by:

$P_t = \sum_{i=1}^{n_t} \frac{cp - j}{(1+r3_t)^i} + q_t \frac{100}{(1+r3_t)^{n_t}} + (1-q_t)\frac{cp/r_L}{(1+r3_t)^{n_t}}$, and therefore

$$q_t(100 - cp/r_L) = (1+r3_t)^{n_t}\left(P_t - \frac{cp-j}{r3_t}\left(1 - \frac{1}{(1+r3_t)^{n_t}}\right)\right) - cp/r_L$$

III. Implied middle term market rate

The rate of return on perpetual government bond (*rentes perpétuelles*) is usually computed as the ratio of the coupon to the the price. This rate is a very long rate. It is possible to compute a medium term interest rate r_t by assuming that we know the expected price of the rente, or the infinite interest rate which will prevail in some years. Denoting r_L this rate (net of tax), P_t the price of the bond, and *cp* the coupon received (net of income tax), the medium term interest rate r_t (net of tax) for the following five years is such that:

$$P_t = \sum_{i=1}^{5} \frac{cp}{(1+r_t)^i} + \sum_{i=1}^{\infty} \frac{cp}{(1+r_t)^5(1+r_L)^i} = \frac{cp}{r_t}\left(1 - \frac{1}{(1+r_t)^5}\right) + \frac{cp/r_L}{(1+r_t)^5}.$$

If a rente holder has to pay a tax of φ francs per *rente* (because of a capital levy) in the following five years, the equation between price and internal rate of return will be:

$P_t = \frac{cp-j}{r_t}\left(1 - \frac{1}{(1+r_t)^5}\right) + \frac{cp/r_L}{(1+r_t)^5}$. Observing P_t, and making an hypothesis on r_L, one can compute r_t.

IV. Rate of return on private bonds:

The issue of private bonds was designed to induce a constant total charge of the debt, interest paid and reimbursement. So, with *cp* as the nominal (coupon) interest rate, the amortization of the capital each period should follow: $Am_j + cp\left(K - \sum_{i=1}^{j-1} Am_i\right) = Am_{j-1} + cp\left(K - \sum_{i=1}^{j-2} Am_i\right)$. And therefore, $Am_j = (1+cp)Am_{j-1}$.

If the capital *K* is to be paid back in *N* periods, $K = \sum_{i=1}^{N} Am_i = Am_1\left(\frac{(1+cp)^N - 1}{r}\right)$, and

$Am_j = \frac{(1+cp)^{j-1}}{(1+cp)^N - 1} cpK$, for *j* from 1 to *N*.

If a bond is going to be paid back with constant charge from T_1 to T_2, which means it has been issued at $T_1 - 1$, and $N = T_2 - T_1 + 1$ with a nominal interest rate of *cp*, the share of the borrowed capital to be reimbursed at *t* (between T_1 and T_2), is: $k_t = \frac{(1+cp)^{t-T_1}}{(1+cp)^N - 1} cp$. Between *t* (excluded) and T_2 the share of capital that will be paid back is:

$$k_t^{T_2} = \sum_{i=1}^{T_2-t} k_{t+i} = \sum_{i=1}^{T_2-t} \frac{(1+cp)^{t+i-T_1}}{(1+cp)^N - 1} cp = (1+cp)^{t-T_1+1} \frac{(1+cp)^{T_2-t} - 1}{(1+cp)^N - 1}.$$

In the *Annuaires des valeurs*, the numbers of bonds which had already been reimbursed is reported. We have checked for each of the bonds that the share of reimbursed bonds is close to $1 - k_t^{T_2}$ for *t*=1926.

Suppose that a bond had been issued with different series to be reimbursed by random drawing in order for the issuer to have a constant charge to be paid each year, the probability for a holder in *t*, of a bond (which has not yet been reimbursed) to see the capital paid back at *t*+*i* is $\frac{k_{t+i}}{k_t^{T_2}} = \frac{(1+cp)^{i-1}}{(1+cp)^{T_2-t} - 1} cp$. If the price of this bond is P_t, the internal rate of return between *t* and *t*+5 denoted *r*, assuming that the rate of return after *t*+5 will be r_L, is such that,

$P_t = \sum_{i=1}^{5} \frac{(1-t)cp - dtrans + k_{t+i} / k_t^{T_2}}{(1+r)^i} + \sum_{i=6}^{T_2-t} \frac{(1-t)cp - dtrans + k_{t+i} / k_t^{T_2}}{(1+r)^5 (1+r_L)^{i-5}}$, where τ is the tax rate on received interest, and *dtrans* is the transmission duty proportionnal to the previous year price.

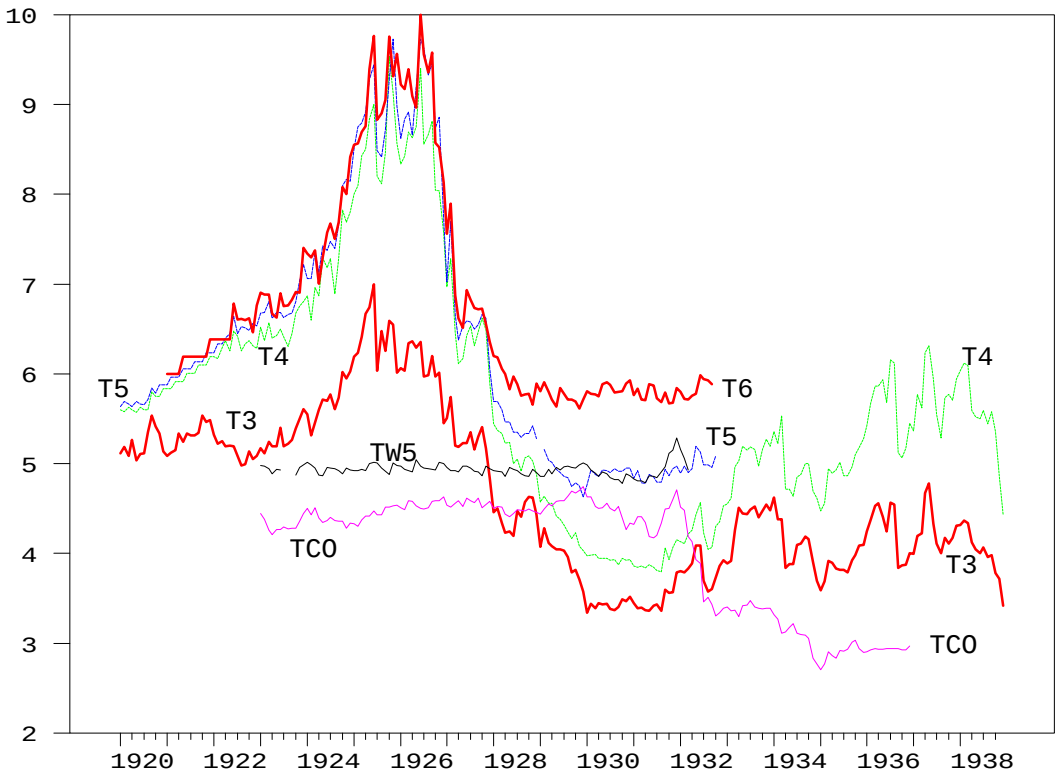
V. Rate of return on the Caillaux bonds

For the internal rate of return on the *rente* Caillaux 4% with exchange rate guarantee, we assume that there was always expectation that the capital would be eventually paid back. We furthermore assume that this reimbursement would occur in 10 years from the current period. We have computed the internal rate of return with a price and a coupon defined in constant francs (the quoted price of this *rente* has been multiplied by 1.15 after July 1935 to correct for the drop in the quoted price of this rente after the repeal of its tax exemption.)

$$\frac{P_t}{e_t / 95} = \sum_{i=1}^{5} \frac{4}{(1+r_t)^i} + \sum_{i=1}^{5} \frac{4}{(1+r_t)^5 (1+r_L)^i} + \frac{100}{(1+r_t)^5 (1+r_L)^5} \text{ or,}$$

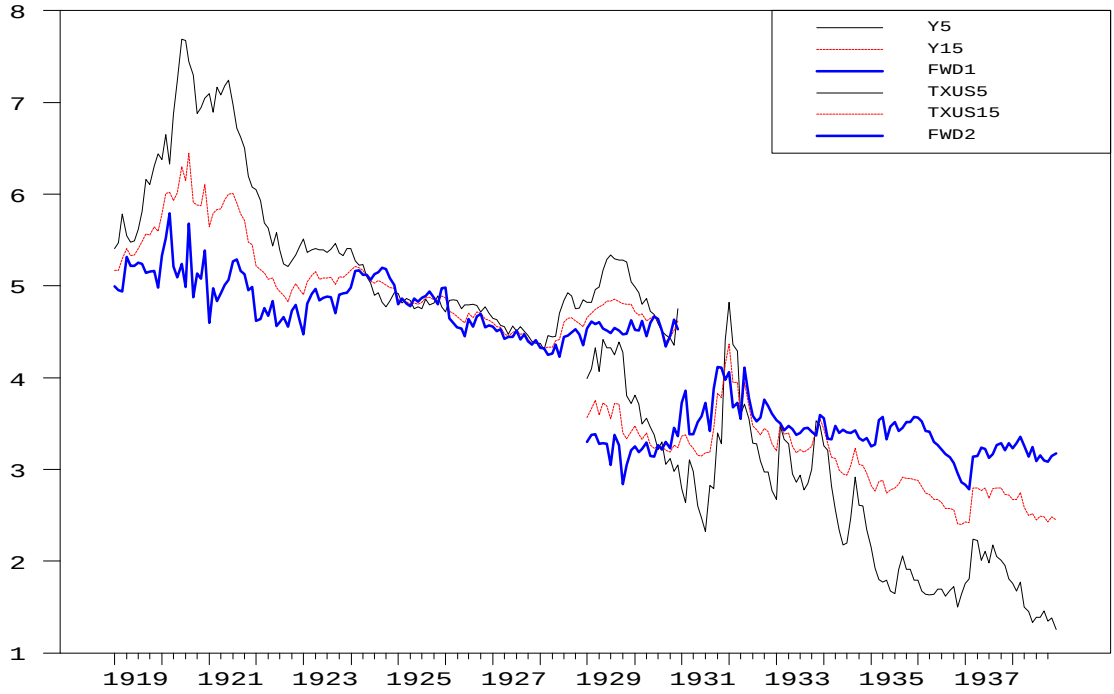
$$\frac{P_t}{e_t / 95} = \frac{4}{r_t} \left(1 - \frac{1}{(1+r_t)^5} \right) + \frac{4}{r_L (1+r_t)^5} \left(1 - \frac{1}{(1+r_L)^5} \right) + \frac{100}{(1+r_t)^5 (1+r_L)^5}$$

Figure 1: Coupon/price ratios for various government bonds



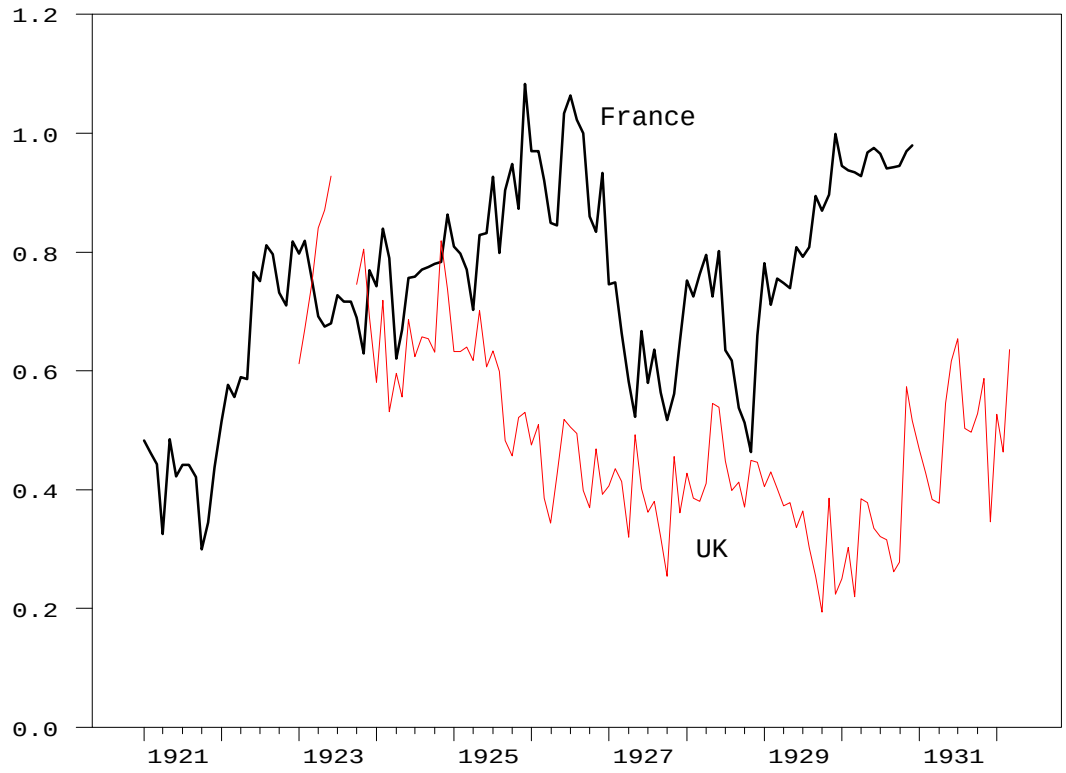
Note: T3, T4, T5 and T6, are the coupon/price ratios of the French 3%, 4%, 5 and 6% *rentes*. TCO and TW5 are the coupon/price ratios of the 2.5% British consol and the 5% war loan converted in September 1932.

Figure 2: US Rates



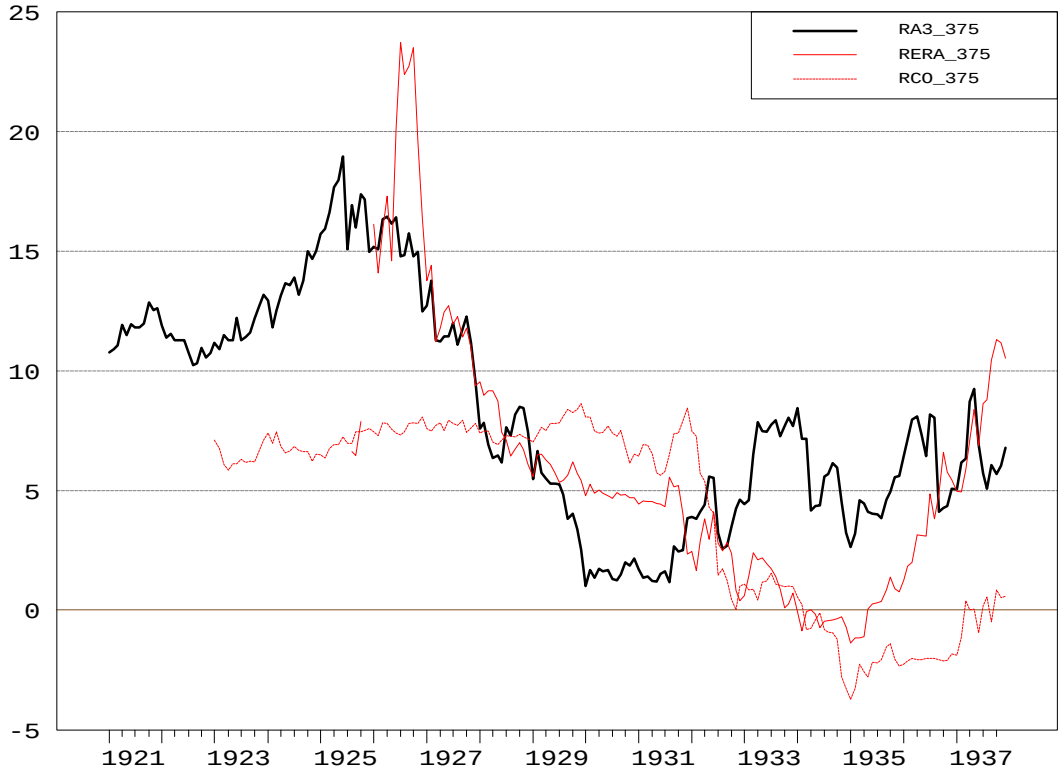
Note: Y5 and Y15 are 5 and 15 years railroad Aaa bond from Baum and Thies (1992). TXUS5 and TXUS15 are 5 and 15 years zero coupon rates derived from US government bond from Cecchetti (1988). FWD1 and FWD2 are the long term expected rates respectively computed from Baum and Thies' and Cechetti's rates. These are the forward rates in 5 years for 10 years (see Appendix I).

Figure 3: Implied conversion probabilities



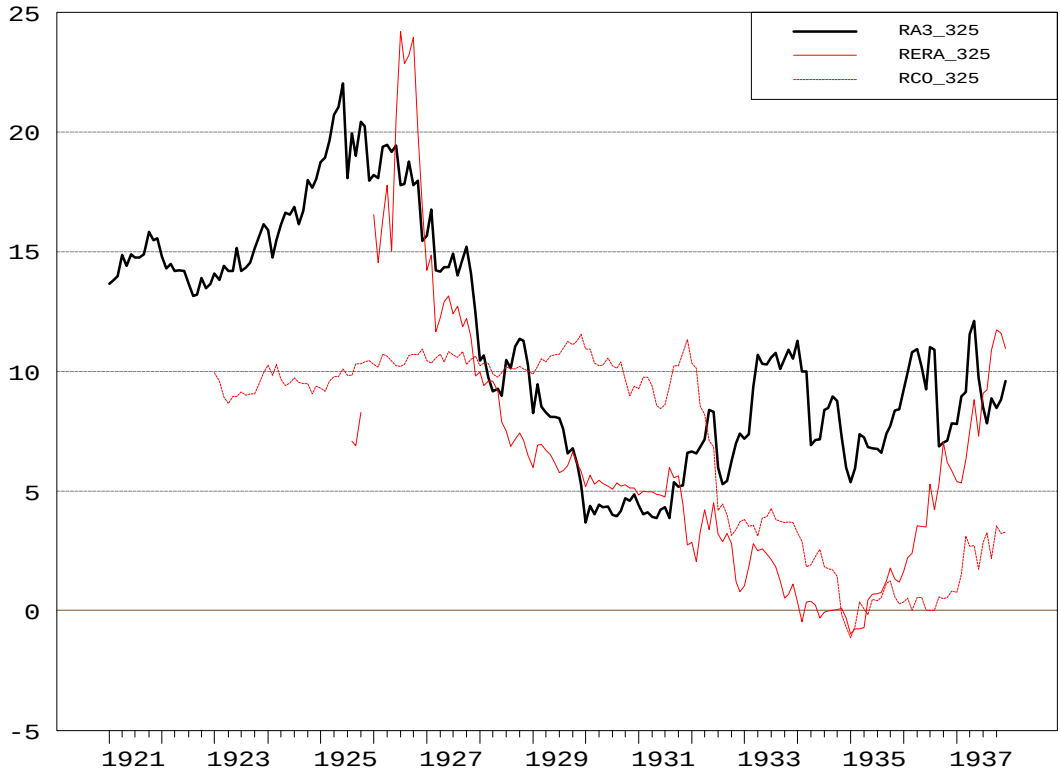
Note: Conversion probabilities (see Appendix II) of the 6% French rente and of the British 5% War loan, with an expected gross long term rate of 3.75%.

Figure 4: Implied net market rates with 3.75% as gross long term rate



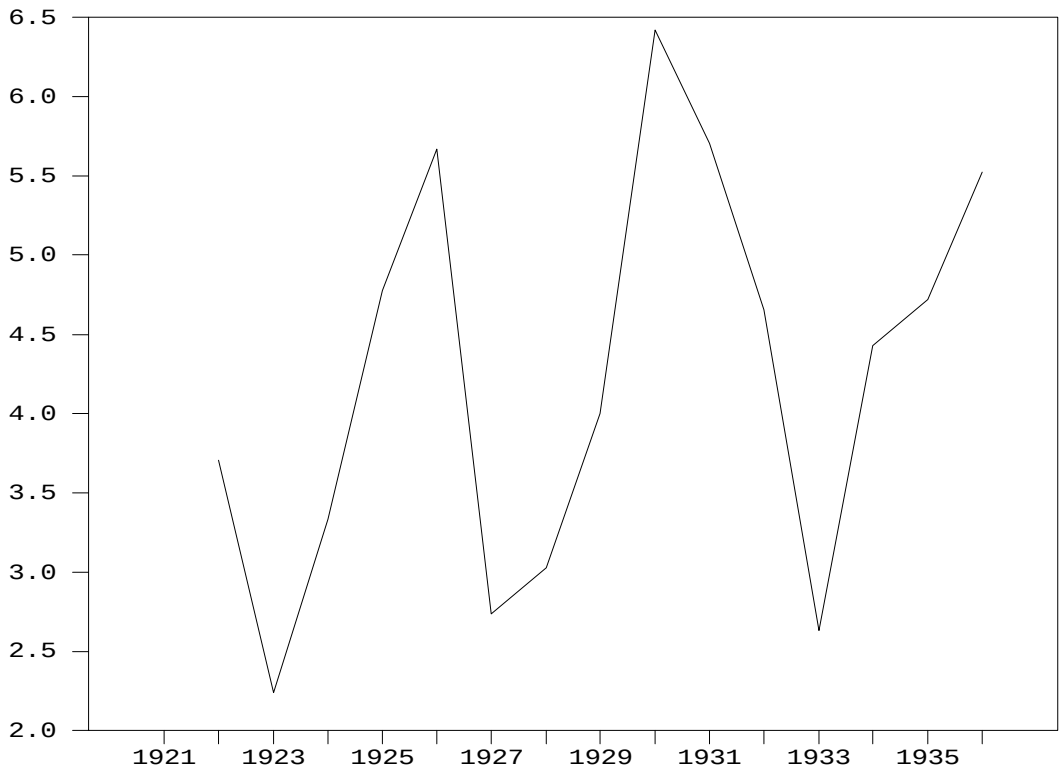
Note: RA_, RERA_, and RCO_ are the implied net market rates derived from the prices of the French 3% rentes, the Caillaux loan, and the British 2.5% consol.

Figure 5: Implied net market rates with 3.25% as gross long term rate



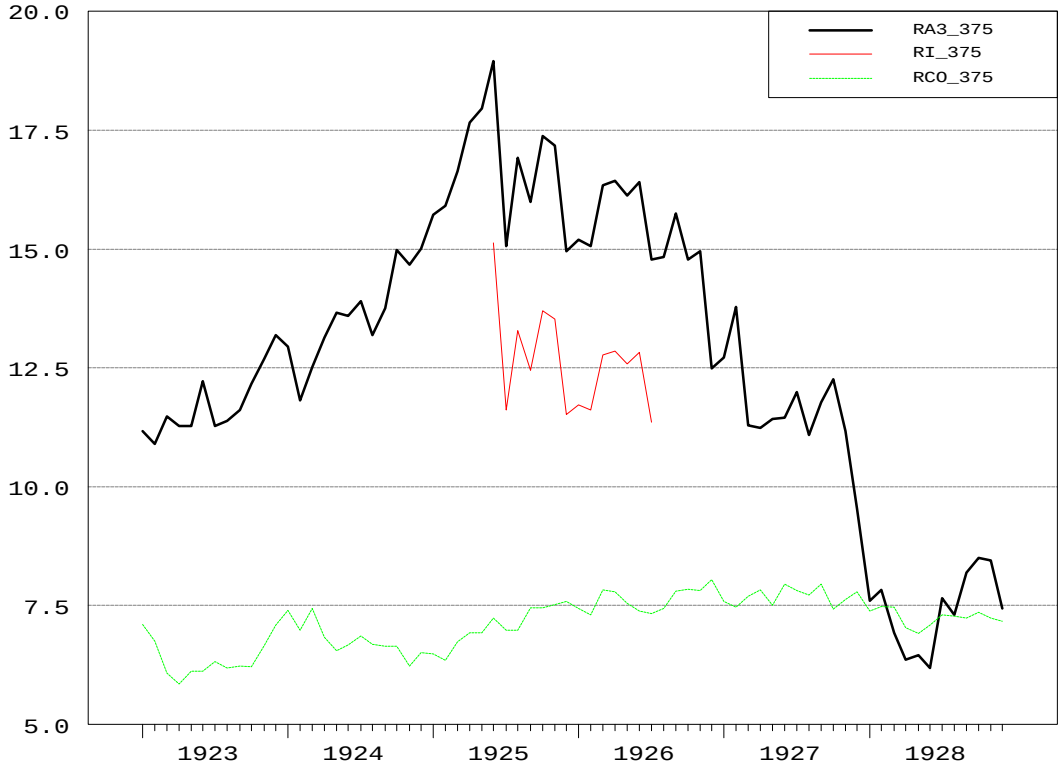
Note: RA_, RERA_, and RCO_ are the implied net market rates derived from the prices of the French 3% rentes, the Caillaux loan, and the British 2.5% consol.

Figure 6: Implied Premium for Utility Bonds



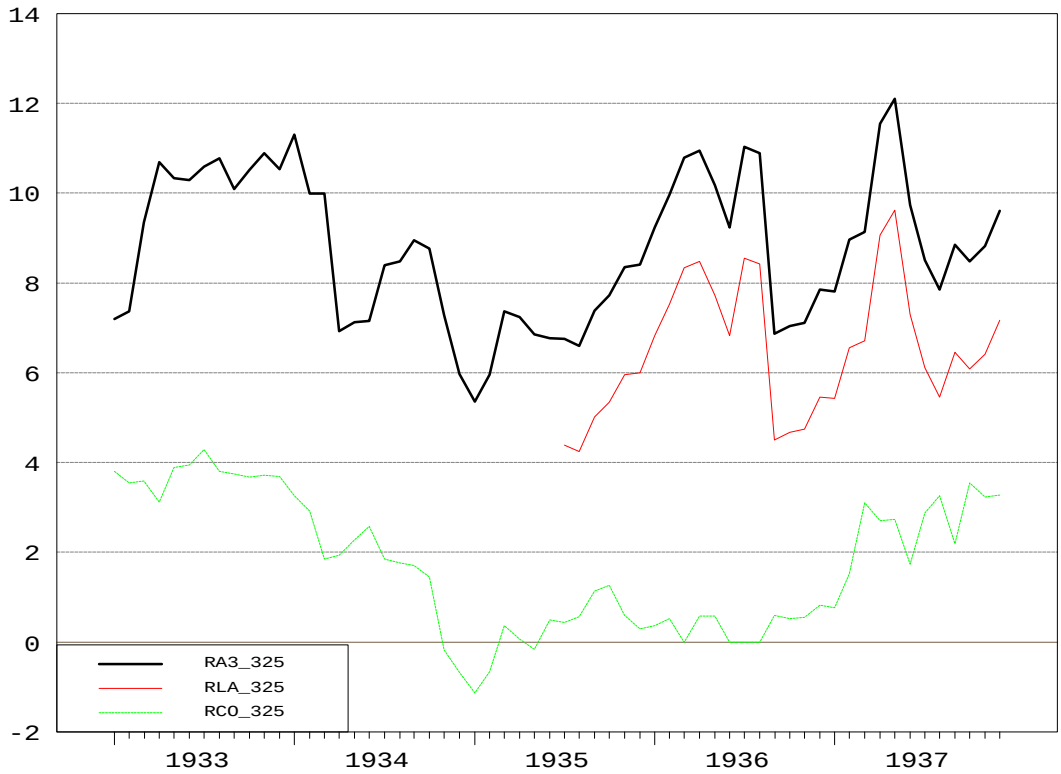
Note: This premium is the difference between the average of the implied 5 years internal rates of return for 14 utility bonds (see Appendix IV) and the 5 year internal rate of return computed for the 3% rentes (RA3_35). Both rates are net of income tax.

Figure 7: Expectation of capital levy effects (gross long rate 3.75%)



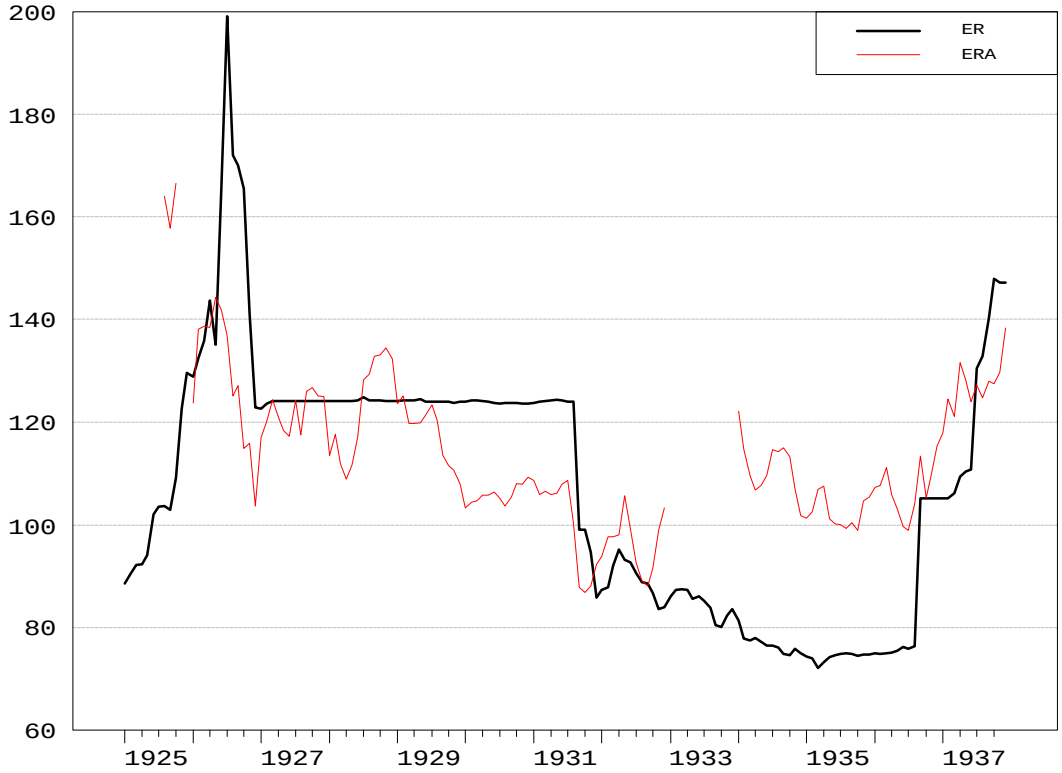
Note: RA3_375 and RCO_375 are the implied net market rates derived from the prices of the French 3% rentes and the British 2.5% consol. RI_375 is the implied rate net of a 20% capital levy staggered on 5 years (see Text).

Figure 8: impact of 10% Laval with (3.25% as gross long term rates)



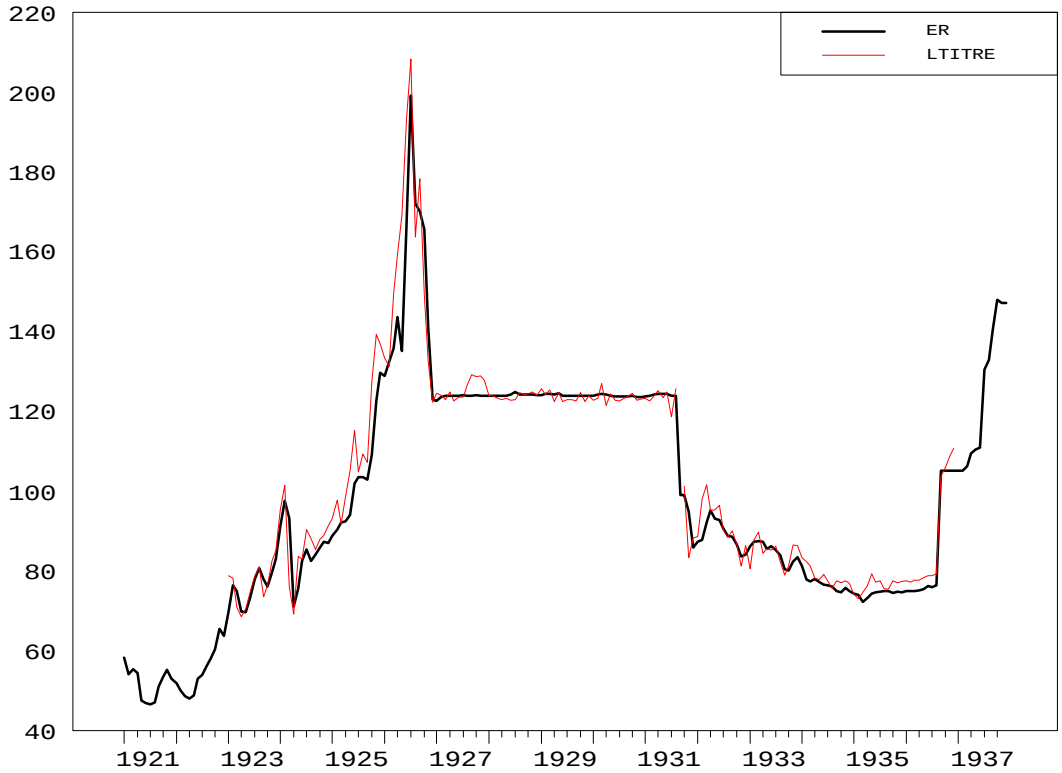
Note: RA3_325 and RCO_325 are the implied net market rates derived from the prices of the French 3% rentes and the British 2.5% consol. RLA_375 is the implied rate net of the 10% cut on coupon imposed by Laval.

Figure 9: Actual and Expected exchange rates



Note: ER is the observed franc/pound exchange rate. ERA is the 5 years expected exchange rate (see Text).

Figure 10: Exchange rate and Price of the consol in Paris / Price of the consol in London



Note: ER is the observed franc/pound exchange rate. LTITRE equals the prix in franc in Paris of the British 2.5% consol divided by the price in pounds in London of the same consol.

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