

French index linked bonds for U.S. investors?*

For the U.S. investor, the French bond market has provided positive real returns, while their stock market has not.

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The scarcity in the United States of "real" securities, with explicit contractual claims tied to commodity prices, has long been a cause of amazement.¹ Since hedging against inflation would seem to be a widely shared investment motive, it is indeed hard to explain the absence of U.S. bonds tied to a general or to any price index.

The absence of indexed assets is not characteristic of every country. At various times, Argentina, Austria, Brazil, Finland, France, Israel, Sweden, and the United Kingdom, among others, have issued index linked bonds tied to the price of a bundle of commodities. The purpose of this paper is to summarize some results from a larger study² of the French case. In doing so, we report the risk and return of investing in French indexbonds, both in absolute terms and in comparison with more familiar assets such as common stocks, ordinary nominal bonds, and short-term money market instruments. Also, we report how indexbonds have performed as hedges against general inflation.

THE SAMPLE AND THE ISSUERS

About sixty index linked bonds were issued in France during the 1952-1960 period.³ They represented a large part of the new issues of fixed income securities during that period. In 1961, the French government forbade issuance of new indexbonds, contending that their prohibition would enhance price stabilization and reduce inflationary expectations.

* This research was sponsored by a grant from CORDES and the Commissariat General du Plan.

1. Footnotes appear at the end of the article.

Two notable exceptions were made later to enable the French government itself to issue gold linked bonds in 1973 and 1977. As of 1977, 28 of these issues were still in existence, thus providing a long historical record of prices. They constitute a large proportion of French bonds of all types. During the last three years, for example, indexbonds have represented more than 50% of the total transactions volume on the Paris Bourse. Our sample includes all such bonds that were actively traded for at least five years.

Excepting the gold indexbonds issued by the Treasury, French index linked bonds have been issued by corporations or derivations thereof. In our sample, eight bonds were issued by public sector corporations and 26 by private firms. Within this last category, fifteen were issued by individual companies and eleven by syndicates of companies belonging to the same industry. Table H lists the 35 index linked bonds in our sample along with their most important characteristics.

CHARACTERISTICS OF THE INDEXATION

Several types of indexation have been used. Eight bonds are linked to a single commodity's price, one to gold and seven to another commodity. The non-gold commodities are products manufactured or serviced by the issuer. For example, in the case of Electricité de France (EDF), the French state monopoly for producing and distributing electricity, the index is the price per kilowatt hour. A second category of indexation involves sales volume in monetary units. Sixteen bonds belong to this category. In the case of bonds issued by a syndicate of companies belonging to the same industry, the sales volume of the entire in-

dustry is employed as an index. In a third category, the index is related to financial performance of the issuing company — either dividends (nine issues) or earnings (three issues). These should probably be termed "participating" bonds rather than "indexed" bonds since their performance might be more akin to a U.S. convertible bond.

Clearly, bonds indexed to earnings or to dividends have less than perfect linkage to the purchasing power of currency. This is also true of bonds linked to single prices, or to sales volume. In all instances, relative price changes could conceivably affect substan-

tially the bond's value as an inflation hedge. On the other hand, a portfolio of such bonds, each member being linked to a different price, sales volume, or financial result, might confer a reasonable degree of protection against general inflation. Furthermore, the existence of different linkage covenants implies that individual investors can tailor a portfolio that matches their own consumption bundle, at least approximately.

A peculiarity of French linked securities is that coupons and principal reimbursement are often linked differently, usually to the same index but with differ-

TABLE A
Summary Measures of Returns on French Stocks, Ordinary Bonds,
Indexbonds, and Short-term Loans, 1960-1975.

Series	Average Annual Return	Standard Deviation of Returns	Number of Years with Returns		Annual Rate of Return (and year)	
			Positive	Negative	Highest	Lowest
<u>Nominal Returns (in \$)</u>						
1. Common Stock	2.968	13.193	8	8	22.43 (1968)	-15.99 (1963)
2. Ordinary Bonds	7.865	6.209	15	1	21.03 (1973)	-7.52 (1968)
3. Indexbonds	9.989	6.96	15	1	21.44 (1973)	-6.08 (1969)
4. Gold Bond ⁶	11.25	18.62	12	4	65.93 (1975)	-5.86 (1967)
5. Short-Term Interbank Loan Rate	6.066	2.652	16	0	10.90 (1974)	3.52 (1962)
6. U.S. Consumer Price Index	3.976	3.00	16	0	11.49 (1974)	.65 (1961)
<u>Excess Returns (in \$)</u>						
Stock less Short-Term Interest	-3.10	13.44	7	9	17.15 (1972)	-30.92 (1974)
Ordinary Bonds less Short-Term Interest	1.80	7.058	10	6	13.97 (1973)	-15.42 (1969)
Ordinary Bonds less Common Stock	4.91	15.31	11	5	28.86 (1974)	-29.95 (1969)
Indexbonds less Short-Term Interest	3.92	7.155	12	4	15.75 (1960)	-13.98 (1969)
Indexbonds less Ordinary Bonds	2.12	3.07	12	4	8.89 (1975)	-1.35 (1971)
Indexbonds less Common Stock	7.022	15.553	11	5	37.39 (1974)	-28.51 (1969)
<u>Real Returns</u>						
Common Stock less U.S. Consumer Price Index	-1.01	13.81	6	10	20.11 (1961)	-31.51 (1974)
Ordinary Bonds less U.S. Consumer Price Index	3.92	7.155	12	4	14.35 (1960)	-13.46 (1969)
Indexbonds less U.S. Consumer Price Index	6.01	6.864	15	1	18.30 (1960)	-12.02 (1969)
Gold Bonds less U.S. Consumer Price Index	7.27	16.78	11	5	58.84 (1975)	-8.88 (1967)
Short-Term Interest less U.S. Consumer Price Index	2.09	1.672	14	2	4.56 (1970)	-1.35 (1973)

ent weights. All but one (EDF 1959) have some linkage of both coupon and reimbursement.

INDEXING & TECHNIQUES

For most of the bonds, the formulae of indexation are linear piecewise, i.e.,

$$C_t = a_0 + a_1 P_{xt}$$

$$V_t = b_0 + b_1 P_{xt}$$

when $P_{xt} > 0$; otherwise $C_t = a_0$ and $V_t = b_0$; where C_t and V_t represent the monetary value of coupon and repayments of principal in year t ; a_0 and b_0 are the base coupon and principal payments that are also the minimum payments; P_{xt} is the percentage increase in the index; and a_1 and b_1 are coefficients of proportionality in reaction to an increase in the index. For example, the indexbond GIS 1955 has the following indexation formula:

$$C_t = 5.50 + .60 \frac{S_t - S_{1954}}{S_{1954}}$$

$$V_t = 100 + 12 \frac{S_t - S_{1954}}{S_{1954}}$$

where S_t is sales volume of GIS⁴ in year t . The minimum coupon and reimbursement of principal are 5.55^{FF} and 100^{FF}, respectively. When there is a 10% increase in sales volume vis-à-vis the reference year 1954 (which was just before original issue), the coupon is increased to 5.56^{FF}, a rise of 1.1%; the principal payment rises by 1.2% to 101.2^{FF}. Full indexation of 1 to 1 between the increase in the value of the index and the value of payments is rare. The span of indexation varies between 1 to 1 and 1 to 1/30, depending on the issue. The system just described is the most frequent, although some of the more widely traded bonds have a different scheme.

One of the most widely held bonds — Caisse Nationale de l'Énergie 3%, 1952 — will provide a detailed example of an indexation system. This "bond" is actually an annuity designed to indemnify former shareholders of nationalized electricity producing and distributing companies. The constant annual base payment, 4.08% of the original indemnisation value, represents both interest and principal reimbursement. (There is no final large principal balloon payment as with ordinary U.S. bonds.) The payments began in 1952 and will continue through 1966. The aggregate premium for indexation is 1% of the combined sales of Electricité de France (EDF) and Gaz de France (GDF).

The proportion of base interest each year is determined by standard annuity tables (each outstanding bond receives a nominal coupon of 3%), while principal repayment is made to bond holders drawn at random. On June 1, 1974, for example, the base in-

terest payment was 1.95% and the base principal repaid was 2.13% of the original total value of the security (963,960,104.98^{FF}). Holders of non-retired bonds in 1974 received $1.95/4.08 = 47.8\%$ of the total payment. Bondholders drawn for reimbursement received the complementary portion as their premium. Thus, in 1974, they received 2.13% of the original total issue value plus 52.2% of 1% of the aggregate sales of EDF and GDF. Since the number of outstanding bonds decreases over time and since the sales of EDF and GDF seem to be growing geometrically, a bondholder benefits greatly when he is lucky enough not to have his bonds drawn for reimbursement in the lottery.

The premium is now much larger than the nominal coupon or nominal principal repayment. In 1974, for example, after the 12% withholding tax on the nominal coupon, each non-reimbursed holder of a 100^{FF} nominal value bond received 16.9^{FF} in interest. Each holder of a bond drawn for reimbursement (of 100 nominal value) received 565.62^{FF}. During the last ten years of the issue's life (in the 1990s), the bonds that remain outstanding will receive extremely large payments because the 1% premium will be divided among a much smaller number of bonds and will very likely be multiplied by a much larger base.

The index is published officially only once a year, but monthly estimates are available from EDF and GDF with about a two-month lag.

The essential characteristics of the two gold linked bonds are also worth mentioning. The better known is the 3.50% of 1973, which resulted from the consolidation of two bonds previously issued in 1952 and 1958; it is called the PINAY-GISCARD bond after the two Secretaries of the Treasury at the times of issue of the original bonds. It is indexed to the arithmetic average of the prices of the 20^{FF} Napoleon coin for the last 300 trading days. The other bond, the 7% of 1973, is linked to the European Unit of Account (EUA), which in turn is linked to gold.

RESULTS

This section presents performance results for French index linked bonds in absolute terms and relative to common stocks, ordinary bonds, and short-term assets. The CAC (Compagnie des Agents de change) index was used to measure common stock returns. The CAC index is a value weighted index of 430 French stocks representing over 90% of the total French market capitalization. To measure the returns on ordinary bonds, we constructed an equally weighted index of ordinary bonds matching the indexbonds in every characteristic. Short-term interbank loan rates collected in *IMF Statistics* [1960-77] were used as a proxy measure of short-term risk-free

rates in France. The period covered is 1960-1975 inclusive.

The point of view is that of a U.S. investor who has committed some of his funds to the French financial market. Franc-denominated nominal returns on each type of asset (stocks, bonds, and short-term interbank loans) were translated into nominal dollar returns by the spot exchange rate prevailing at the end of each period. Real returns were computed by deducting rates of change in the U.S. consumer price index.

The results are given in a set of self-explanatory tables. Table A presents summary statistics: the mean annual returns, standard deviations of returns, numbers of positive and negative annual returns, and largest and smallest annual returns. Table B through F (no Table E) present dollar-denominated holding period returns for all available combinations of holding periods from 1960-1975.³ Table G gives correlation coefficients among the holding period returns on different types of assets (tables showing holding period

TABLE B1

Common Stocks

Annual Dollar-Denominated Holding-Period Returns

To the End of	From the End of															
	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
1960	4.21															
1961	12.48	20.76														
1962	8.05	9.97	-0.81													
1963	2.04	1.32	-8.40	-15.99												
1964	1.13	0.36	-6.43	-9.25	-2.50											
1965	-0.07	-0.93	-6.35	-8.20	-4.30	-6.11										
1966	-1.57	-2.53	-7.18	-8.78	-6.37	-8.31	-10.52									
1967	-1.01	-1.76	-5.51	-6.45	-4.06	-4.59	-3.82	2.87								
1968	0.44	-0.03	-3.00	-3.36	-0.84	-0.42	1.47	7.46	12.06							
1969	2.64	2.47	0.18	0.32	3.04	4.15	6.71	12.45	17.25	22.43						
1970	2.15	1.95	-0.14	-0.06	2.22	3.01	4.83	8.67	10.60	9.87	-2.70					
1971	1.87	1.66	-0.25	-0.19	1.78	2.39	3.81	6.68	7.63	6.15	-1.99	-1.28				
1972	3.44	3.38	1.80	2.06	4.06	4.88	6.45	9.28	10.56	10.19	6.10	10.50	22.28			
1973	3.58	3.53	2.10	2.36	4.19	4.94	6.32	8.72	9.70	9.23	5.93	8.80	13.84	5.40		
1974	2.01	1.85	0.39	0.49	1.99	2.44	3.39	5.13	5.45	4.35	0.74	1.60	2.55	-7.31	-20.02	
1975	2.96	2.88	1.60	1.79	3.27	3.79	4.78	6.48	6.94	6.20	3.50	4.74	6.24	0.90	-1.36	17.31

TABLE C1

Ordinary Bonds

Annual Dollar-Denominated Holding-Period Returns

To the End of	From the End of															
	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
1960	15.79															
1961	12.01	8.24														
1962	10.31	7.57	6.90													
1963	9.60	7.53	7.18	7.46												
1964	8.97	7.26	6.93	6.95	6.44											
1965	8.52	7.19	6.92	6.93	6.67	6.89										
1966	8.00	6.71	6.40	6.28	5.88	5.60	4.31									
1967	7.59	6.42	6.11	5.96	5.58	5.29	4.49	4.68								
1968	7.56	6.53	6.29	6.18	5.93	5.80	5.43	6.00	7.31							
1969	6.05	4.97	4.56	4.23	3.69	3.14	2.20	1.49	-0.10	-7.52						
1970	5.81	4.81	4.43	4.13	3.65	3.18	2.44	1.97	1.07	-2.05	3.42					
1971	6.55	5.71	5.45	5.29	5.02	4.82	4.47	4.51	4.46	3.52	9.03	14.64				
1972	6.90	6.16	5.97	5.98	5.70	5.61	5.42	5.61	5.80	5.42	9.73	12.88	11.13			
1973	7.91	7.30	7.22	7.25	7.23	7.32	7.37	7.81	8.34	8.54	12.55	15.60	16.08	21.03		
1974	7.97	7.41	7.35	7.39	7.38	7.47	7.54	7.94	8.41	8.59	11.81	13.91	13.66	14.93	8.84	
1975	7.87	7.34	7.28	7.31	7.30	7.37	7.42	7.77	8.15	8.27	10.90	12.40	11.84	12.08	7.60	6.37

TABLE D1

Index Bonds

Annual Dollar-Denominated Holding-Period Returns

To the End of	From the End of															
	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
1960	19.74															
1961	15.90	12.07														
1962	13.31	10.09	8.11													
1963	12.76	10.44	9.62	11.14												
1964	11.36	9.26	8.32	8.43	5.72											
1965	10.65	8.83	8.02	8.00	6.43	7.13										
1966	9.68	8.00	7.19	6.96	5.57	5.49	3.86									
1967	8.91	7.36	6.57	6.27	5.05	4.82	3.67	3.49								
1968	8.90	7.55	6.90	6.70	5.81	5.84	5.41	6.18	8.88							
1969	7.40	6.03	5.28	4.88	3.83	3.45	2.53	2.09	1.40	-6.08						
1970	7.21	5.95	5.27	4.92	4.03	3.75	3.07	2.88	2.67	-0.43	5.22					
1971	7.71	6.62	6.08	5.85	5.19	5.11	4.78	4.96	5.33	4.14	9.26	13.29				
1972	8.13	7.17	6.72	6.58	6.08	6.12	5.98	6.33	6.90	6.40	10.57	13.24	13.19			
1973	9.08	8.26	7.95	7.93	7.61	7.82	7.91	8.49	9.32	9.41	13.28	15.97	17.31	21.44		
1974	9.64	8.92	8.67	8.72	8.50	8.78	8.96	9.60	10.47	10.74	14.10	16.32	17.33	19.41	17.37	
1975	9.99	9.34	9.14	9.22	9.06	9.37	9.59	10.23	11.07	11.38	14.29	16.11	16.81	18.02	16.31	15.25

TABLE F1

Short-Term Interbank Loans

Annual Dollar-Denominated Holding-Period Returns

To the End of	From the End of															
	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
1960	3.99															
1961	3.87	3.63														
1962	3.77	3.61	3.52													
1963	3.71	3.58	3.52	3.53												
1964	3.86	3.80	3.83	3.99	4.50											
1965	3.90	3.86	3.90	4.03	4.31	4.38										
1966	3.97	3.94	3.99	4.11	4.32	4.21	4.35									
1967	4.03	4.02	4.08	4.19	4.37	4.31	4.45	5.52								
1968	4.20	4.21	4.29	4.41	4.60	4.62	4.81	5.53	4.64							
1969	4.49	4.53	4.64	4.80	5.01	5.11	5.38	6.05	5.86	7.90						
1970	3.92	3.90	3.93	3.98	4.05	3.97	3.95	4.10	3.33	3.07	9.88					
1971	4.25	4.26	4.32	4.41	4.53	4.53	4.61	4.86	4.46	4.68	8.88	7.19				
1972	4.74	4.80	4.90	5.04	5.21	5.29	5.47	5.82	5.70	6.17	9.47	8.92	5.14			
1973	5.05	5.12	5.24	5.39	5.58	5.70	5.91	6.27	6.25	6.73	9.34	8.94	7.05	7.06		
1974	6.00	6.14	6.33	6.56	6.84	7.07	7.41	7.91	8.12	8.84	11.35	11.55	11.16	13.22	10.90	
1975	5.67	5.90	7.02	7.36	7.68	7.97	8.36	8.92	9.23	10.00	12.29	12.64	12.62	14.47	13.94	11.22

TABLE G

Correlation Coefficients for Dollar-Denominated Annual Returns on Various French Assets

	Arithmetic Mean Annual Return	Correlation Coefficients or Standard Deviations (on diagonal)					
		Common Stocks	Nominal Bonds	Index Bonds*	Gold Bond	Interbank Loans	CPI (U.S.)
Common Stocks	2.968%	13.193%					
Nominal Bonds	7.865%	-.1335	6.209%				
Indexbonds*	9.989%	-.1056	.8974	6.96%			
Gold Bond	11.25%	.0862	.0882	.456	18.62%		
Interbank Loans	6.066%	.0083	-.1284	.1156	.7113	2.652%	
CPI (U.S.)	3.976%	-.0976	.042	.247	.6632	.832	3.00%

* Not including the gold linked bond

returns on a year-by-year basis relative to short-term interest rates and U.S. inflation rates are available from the authors on request).

The tables show that both indexed and ordinary French bonds earned positive real returns, translated into dollars, during the 1960-1975 period. Although the average real returns were higher on indexed than on ordinary bonds, an analysis-of-variance of yearly returns failed to detect a statistically significant difference. The estimated probability was 39% that the difference could have occurred by chance.

Compared to short-term French money market instruments, however, indexed bonds had significantly higher returns. The estimated probability was only 3.4% that the average difference in returns could have occurred by chance.

Indexed bonds also performed better than French common stocks. Again on a dollar-denominated basis, the difference in real returns between indexed bonds and stocks could have arisen by chance with only a 7.8% probability, although the dominance of French *ordinary* bonds over short-term loans and over stocks had a lower level of significance. The estimated probabilities that the differences in mean returns could have occurred by chance were 31% for short-term loans and 21% for common stocks.

As with most statistical analyses, these estimated probabilities presume a random sample period. Thus, if the 1960-1975 period was atypical for any reason, the probabilities will not portray the likelihood of the same events in the future. Many analysts will find it difficult to accept the proposition that a period is

truly representative when it has displayed a greatly superior average return for bonds relative to stocks. Viewed ex post, the 1960-1975 period in France may have been atypical in the poor performance of equities. It was, perhaps, also atypical in the extent of commodity price appreciation both in France and in the U.S.; this would have resulted in atypical superior performance for index linked securities.

The correlation coefficients among dollar-denominated returns on various French assets (Table G) reveal that common stocks were negatively related to both kinds of bonds and also to the U.S. inflation rates. Ordinary and indexbond returns were very closely correlated. The best hedges against variation in inflation rates seem to have been the gold bond and short-term loans. This latter result is consistent with a more detailed study of asset hedges against inflation in the U.S. (See Fama and Schwert [1977]). French

indexbond returns, though positively correlated with the U.S. inflation rate, were much less correlated than returns from French short-term loans. Thus, although U.S. investors would have received a higher *average* real return on French indexbonds than on other French assets, they would have enjoyed less protection against variations in the U.S. inflation rate. This might have been a result of the typical contractual features of French index securities: they are not usually linked one-for-one, and thus they appreciate only fractionally with the index.

¹ Numerous economists have advocated on several grounds the use of indexation in financial contracts, Fisher and Keynes among others and more recently M. Friedman (1974) and Stanley Fischer (1975).

² See Jacquillat and Roll (1977), a methodological companion

TABLE H
The Sample of Indexbonds with Their Index Characteristics

TYPE	OF		INDEXATION	
	SALES VOLUME	COMMODITY PRICE		DIVIDENDS
		BOND	ISSUE	
COMPAGNIE NATIONALE DU RHONE 6%, 1957	a/ GOLD		CITROEN 6%, 1954	ROCHETTE CENPA 6%, 1957
METALLURGIQUE DE NORMANDIE 5.75%, 1953	Emprunt d'Etat 3.5%, 1973 (linked to Gold)		CITROEN 5.5%, 1955	PRISUNIC 5.75%, 1956
GROUPEMENT INDUSTRIEL DE LA CONSTRUCTION ELECTRIQUE (GICEL), 6%, 1957	GAZ DE FRANCE 5.18%, 1957		CITROEN 5.5%, 1956	SIMCA 5.5%, 1959
GICEL 6%, 1957	CFCAL 6%, 1958		SAINT GOBAIN PONT A MOUSSON 6%, 1958	
GICEL 6%, 1958	ELECTRICITE DE FRANCE (EDF) 5%, 1958		FRANCE DUNKERQUE 5.51, 1955	
GROUPEMENT DE L'INDUSTRIE SIDERURGIQUE (GIS) 6%, 1953	EDF 5%, 1959		FRANCE DUNKERQUE 5.5%, 1956	
GIS 6%, 1954	SOCIETE NATIONALE DES CHEMINS DE FER FRANCAIS (SNCF) 5.5%, 1956		SACILOR 5.5%, 1959	
GIS 5.5%, 1955	SNCF 5.5%, 1957		FORGES DE STRASBOURG 5.75%, 1954	
GIS 5.75%, 1957	SNCF 6-6.5%, 1958			
GIS 6%, 1958				
CAISSE NATIONALE DE L'ENERGIE 3%, 1952.				
SOCIETE CHIMIQUE DE GERLAND 5%, 1956				
SOCIETE NATIONALE DES PETROLES D'AQUITAINE 6.65%, 1958				
PETROFIGAZ 6%, 1958				
MICHELIN 5.5%, 1955				
VALLOUREC 6%, 1958				

paper to Ibbotson and Sinquefield (1976), applied to French data.

- ³ For a detailed presentation of the French experience with indexed bonds, see Rosental (1969). For the other countries see OCDE (1974).
- ⁴ GIS is an acronym for "Groupement de l'Industrie Sidérurgique," a consortium of companies in the iron and steel industry.
- ⁵ Although the empirical results go as far as 1975 only, the inclusion of years 1976 to 1978 would not have affected seriously the average results. At the end of 1978, the CAC index was at its 1975 level after two "bad" years, 1976-1977, and a strong upturn in 1978 following the March elections. The inflation rate stayed in the vicinity of 10%.

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