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A challenge to triumphant optimists?

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Abstract

Most empirical knowledge on the long term performance of financial investments is derived from the behaviour of the most successful markets. Recent research has tried to broaden the sample of markets studied towards European ones, many of which were among the worlds' most developed up to World War One and again weight substantially in today's global portfolio. The synthesis by Dimson, Marsh and Staunton (2001) proposes data on the 20th century for 16 countries, and ends up with an optimistic tone, although a less enthusiastic one than most of the American literature. They argue that even in the worst case – Belgium – the stock market long term performance remained positive (2.5% yearly real return on the 20th century), and superior to that of other investments. The results of this paper suggest that most of the continental European results may be wrong, since they may significantly overestimate the performance of investments in stocks during the 20th century. We concentrate on the French case, but we argue that similar calculations on other European countries may well give similar results.

This paper describes and analyzes a new homogeneous stock index for the French stock market from 1854 to 1998, and compares it to those of some other countries. The paper first describes the index's methodology (a weighted, yearly adjusted index comparable to Euronext's CAC40). It then provides some major results. First, investment in French stocks provided a positive real return during the 19th century, but a negative one – because of inflation – in the 20th. After 1914, hoarding gold or investing in real estate provided better returns than stocks. The equity premium was low and consistent with standard models of risk aversion. These results contrast no only with those observed on the US market, but also with older studies of the French market, which were based on un-weighted large indices suffering survivor bias. They are more consistent with the history of the French financial markets and economic policy regimes in the 19th and 20th centuries.

Keywords : Paris Stock exchange, stock index, survivor bias, sample bias, weighting problems, stock return, long term performances, equity premium, gold, 19th century, 20th century.

JEL classification : G1, G12, N23, N24.

A Challenge to Triumphant Optimists?

A New Index for the Paris Stock-Exchange (1854-2007)

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Most empirical knowledge on the long term performance of financial investments is derived from the behaviour of the most successful markets. Those of the United States – and more broadly Anglo-Saxon countries – could be termed survivor markets. They benefited from being established in countries which suffered no war on their national territories, limited inflation and no true socialism. Because their markets survived even the Great depression, these countries developed modern financial theory and empirical studies earlier, so that their performance influences heavily what we think today about financial markets. Alas, much of the rest of the world was not so fortunate. The Russian stock-exchanges and securities, which were thriving before World War One[1], disappeared for 70 years. Clearly, the fate of Russian investors from 1917 to 1992 can be understood without portfolio indices, and they frequently lost not only their financial wealth. But Russian stocks and bonds were part of many foreign portfolios (not least French ones) up to the Revolution, so that global performance must take them into account for a global measure. The same is true for other markets such as those of Austria-Hungary or even China. In between happy Americans and poor Russians, most of continental Europe's stock exchanges suffered a chaotic 20th century, but without complete disruption (Germany being the limit because of the 1923 hyperinflation and the post-1945 dismantlement). Recent research has tried to broaden the sample of markets studied towards them, with much reason since many of them were among the worlds' most developed up to World War One or even during the interwar period (Brussels, Amsterdam, Paris, Berlin, Milano, etc), and they again weight substantially in today's global portfolio. The synthesis by Dimson, Marsh and Staunton (2001) proposes data on the

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[1] On Russia, see Lizunov (2002), Borodkin & Konovalova (2003).

20th century for 16 countries, and ends up with an optimistic tone, although a less enthusiastic one than most of the American literature. They show that continental European countries perform worse on average than overseas Anglo-Saxon countries (Canada, the U.S., Australia and South-Africa) and the U.K., with the exception of Sweden[2]. They attribute the poorer Italian, French, German or Belgian performances to the wars, inflation and nationalizations. But their data suggests that even in the worst case – Belgium – the stock market long term performance remains positive (2.5% yearly real return on the 20th century), and superior to that of other investments. The results of this paper suggest that most of the continental European results may be wrong, since they may significantly overestimate the performance of investments in stocks during the 20th century. We concentrate on the French case, but we consider that there are good reasons for similar calculations on other European countries to give similar results.

The paper describes and analyzes a new homogeneous stock index for the French stock market from 1854 to 1998. This index is not the first stock index for France, but we argue that it is the first one that measures French stock prices' variations from the point of view of the investor for such a long period. The paper first describes the index's methodology, which is based on Euronext's CAC-40, adapting it slightly to take into account some constraints from historical research. Basically, the index is a monthly index of the 40 most prominent shares among French firms, ranked by market capitalization, thus avoiding survivor's bias. The index is weighted by these capitalizations and its composition and weights are adjusted yearly. These characteristics, which are standard for today's indices, were frequently not present in older indices, which may explain a significant bias in their results.

The first major result of this article is to provide new estimates of the long term returns that holders of such a diversified portfolio of French stocks obtained. We show that the pure portfolio index (without dividends) didn't protect its owners against inflation. Its real performance was positive up to 1914 (in a period of stable prices) but it was substantially negative for the 20th century; the last two decades (1983-2000) of rapid growth in stock prices were not enough to compensate the impacts of both World Wars and the 1970s inflation.

When one turns to total return (including the dividend yield, supposedly tax-exempted), the performance is substantial during the 1854-1914 period (more than 5% yearly total return net of inflation), but below zero for the period between 1914 and 1983. During the 20th century, gold ends up as a better investment than stocks, a result that would be much strengthened if one would take taxes into account.

These results contrast strongly with those of Arbulu (1998) and Gallais-Hamonno & Arbulu (1995), who linked the 20th century official indices to similarly constructed new indices for the 19th century, and have been used as the basis for French investment performance in Dimson & alii (2001). We show that the reason for the divergence rests on Arbulu's and official indices' methodology, which suffers

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[2] Dimson & alii (2001), p. 50. On Sweden, Frennberg & Hansson (1992).

both survivor bias and weighting problems. In particular, they don't weight the stocks by capitalization and then gives much higher implicit weights to small caps, leading to a seriously overvalued index in the long run.

The poor performance of the CAC-40 does not result from a badly functioning French stock market. To the contrary, we suggest the market was as efficient as others; returns follow standard properties, such as a quasi-normal distribution with large tails in most periods, and the absence of autocorrelation among monthly returns. Comparing this "historical CAC 40" with US indices (the S & P, the Cowle's series and those by Goetzmann & al., 2000), we show that low French long term returns compared to the US ones partly reflect lower French risks. This was true as early as the 19th century. This suggests that France was not an outlier in terms of risk/return combination, and provided a less risky stock market, consistent with the view of the US as an emerging market, at least in the 19th century.

Contrasting with the well-known results for the US (e.g. Siegel 1994), the low equity premium that we observe in France is in line with most models of risk aversion. This suggests (as some previous studies already argued) that the US equity premium is driven by special characteristics of the US economy, and then that the equity premium puzzle is not a universal phenomenon[3]. Finally, we argue that the evolution of the CAC-40 can only be understood as the result of changes in macroeconomic policy regimes, with the resulting effects on financial markets' role, taxation and, mostly, on inflation.

Section I presents in details the methodology of our index. Section II presents the main results. Section III discusses the market efficiency and the main changes in policy regimes that may explain the index performance in the long run.

I. Methodology: a weighted blue chip index in the CAC-40 spirit.

The aim of this section is to detail the methodology which we used in order to build the new index. On the very long run, even details matter, since any error is magnified by the virtue or compounded interest. The index concentrates on French stocks; not because French investors held only French stocks (they actually held much foreign ones, especially up to 1914), but because focusing on national securities is the first step generally used before considering the effects of international diversification, which could be measured using various foreign indices.

We chose to build a blue chip index, considering such an index best proxies the behaviour of actual investors. The index is weighted by the stock market capitalizations of the stocks included, in order to make it reflect the actual market (except for new issues, the increase in the market value of the firms included reflects that of the index). Diversification is usually considered as sufficient to eliminate specific risk when the number of stocks in a portfolio reaches 25. For an index weighted by stock market capitalizations, a something higher number is better. We chose 40 stocks in order to facilitate

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[3] Another explanation could be that US indices are large ones, including many stocks for which liquidity was low, especially before the 1970s, so that very high US returns could result mostly from a liquidity premium.

the linkage with today's CAC 40, the major Euronext-Paris index and to satisfy these requirements. These forty biggest firms represent 77 % of the total market capitalization in 2004 and 87 % in 1854.

The list of stocks included is fixed following a stable, simple and transparent formula in order to avoid ex-post insight. This imposes to avoid today's practice of choosing the stocks composing the CAC-40 among the 100 bigger capitalizations listed in Euronext-Paris, with the help of a scientific committee that we cannot reinvent for previous periods. We then include more simply the 40 stocks with the biggest capitalizations, and we rebalance the portfolio each year at the beginning of the year.

This methodology allows us to eliminate the survivors' bias that affects many retrospective studies of stock prices. This is the more important since a number of major firms failed during the period under study, and should not be avoided.[4]

We added two minor criteria to the capitalization for the selection of stocks included in the index. The first one is a liquidity criteria; its use results from the functioning of the 19th Paris Bourse, which sometimes listed stocks without wondering about the potential for an active market[5]. This was the case for some firms with a very small number of shares, especially insurance companies which frequently even required the agreement of the Board for any stock transaction to be valid. We considered that only firms with at least 10,000 shares could actually be included in the portfolio of an outside investor, and then in our index. This number corresponds to one fourth of the average number of shares of all the firms listed on the market in 1853, the last year for which the number of firms satisfying the requirements for inclusion in the index is below 40, so that the index starts in 1854. In any case, the liquidity constraint excludes only a small number of firms and only during a short period, so that it cannot affect significantly the long term performance of the index[6].

The last criteria is the limitation to one category of stock per firm for inclusion in the index. When a firm has various categories of shares (something rather frequent in the 19th century), we measure the capitalization of each category and include only the one with the highest capitalization (almost always the ordinary shares). Another solution would have been to add-up the various categories into a single one or to include all categories satisfying the previous criteria. We decided for our rule for two reasons: first, it is used today by Euronext for the calculation of the CAC-40[7]. Second, the addition of all categories in a single capitalization would create biases, since the rights on the profits and the risks

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[4] Early cases are Crédit mobilier (1867), Union Générale (1882), Comptoir d'escompte de Paris and Société industrielle des métaux and the Panama canal (1889), or more recently Eurotunnel, Eurodisneyland, or Crédit foncier de France. Just before the 1882 krach, Union générale was the 6th capitalization of the Paris Bourse.

[5] Hautcoeur (2007). See Courtois (1857) for information on listed firms.

[6] The only well-known firm that is excluded during a period because of that requirement is Saint Gobain, which is number 34 by capitalization in 1858 (a rank that increases later) but with only 4364 shares (each priced at 33,000 francs, or some 100,000 euros in today's money). One excluded insurance company is Assurances nationales incendie up to the 1860s (only 2,000 shares, but 26th capitalization).

[7] The very existence of this rule probably modifies today firms' behaviours, and makes them eliminate special shares in order to improve the likelihood to access the CAC-40 and the visibility it gives them. This was not the case in the past, but we found still better to maintain that rule for continuity.

of the various shares were usually different, making their prices vary differently[8]. This rule mostly affects a few railroads' "actions de jouissance" in the 19th century, and the Suez Canal in the interwar period. The most affected year is 1936, in which the activity and share price of the Canal are recovering when the French market suffers overall decline. During that year, not only are the ordinary shares of the Canal the first (by far) capitalization of the Paris Bourse, but its other shares, put together, represent more than the second and the third capitalizations put together (table 1).

Share names	Capitalizations
Canal maritime de Suez, ordinary shares	8 024 456 160
Crédit Foncier de France	2 291 250 000
Banque de France	1 697 250 000
Canal maritime de Suez, Société civile[9]	1 652 111 850
Canal maritime de Suez, parts de fondateurs	1 634 000 000
Canal maritime de Suez, Actions de jouissance	1 394 668 800
Crédit Lyonnais	1 329 600 000

Table 1. First seven capitalizations on the Paris Bourse, January 1936.

Nevertheless, giving the Suez canal a weight in the index similar to that of all its shares in the capitalization would probably make the index too much dependent on a single firm (at the peak, its ordinary shares represented 22.93% of the CAC, and the total of its shares as much as 32.02%).

The index was calculated using various periodicals which provide the last price quoted and the last dividend paid[10]. The data they use comes from the official list price of the Paris Bourse, the *Cote Officielle*, and from the *Cote des valeurs en banque* in the few cases where shares were not traded on the official market but instead on the *Coulisse*[11]. The first step was to collect for the first Friday of every January the name, last price, nominal value, paid value, last dividends for every listed share (a number which varied from 100 to more than 600 during our period). When a stock was not listed during the day, the previous price was used instead. When various prices were available, the last price of the day was chosen. This first collection allowed us to calculate the capitalization of all important

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[8] For example, "actions de jouissance" were shares which nominal value had been reimbursed (something frequent in the period, and even statutory in many firms which activity depended on terminable concessions from the government, typically in railroads, electricity distribution and other utilities); this gave them no right to the "interest" part of the dividend of ordinary shares (usually 5% of the nominal value), but a right to the "superdividend" above that "interest"; "parts de fondateurs" were special shares, which were usually given to the firms' founders and gave them a right to a fixed portion of the total payments of "superdividend" to all other shareholders; on the other hand, priority shares were much less frequent than in the U.S. for example. See Hautcoeur (1999) for more details.

[9] The Société civile du canal de Suez owns the 15% of profits that were reserved to the Egyptian government, and which were sold and listed through Crédit foncier in 1880.

[10] Periodicals used include *Journal des chemins de fer* (for 1842-1940), *Journal des actionnaires* (for 1852-1930), *Journal du credit public* (1855-1934), *Journal des finances* (1869-today), *Cote Desfossés* (1895-today), *AGEFI* (1911-today) and *La vie française* (1945-today). All are conserved at Bibliothèque nationale in Paris.

[11] The *Coulisse*, or "marché en banque" was an unofficial exchange that developed outside the regulated *Bourse* during the 19th century. It was partly legalized from 1893 on. See Hautcoeur (2007) and Pollin (2007).

listed shares, and then to select the 40 most important ones[12]. The second step consisted in collecting monthly prices for these 40 stocks. They are collected for the first Friday of each month[13].

Some technical choices had to be made, which from our point of view have no lasting impact on the level of the index. First, when prices are missing, the previous listed price is used. No adjustment was made for capital changes (except for stock splits, for which prices were adjusted) or firms appearing or disappearing during the year (IPOs, mergers, nationalisations, bankruptcies). All these assumptions artificially decrease the within year volatility, but don't affect year to year changes in the index. Furthermore, these choices affect a limited number of prices, making it unlikely that the index is significantly modified.

Within each year, our index is calculated using individual stock prices weighted by their capitalization, from January to January of next year. Weights are modified every January, using the new capitalization data and each year's index is chained to the next one using January value as a basis. This index is based on the value of the official CAC-40 index when it was created on January 31st, 1987, which was taken as 1000.

II. Results

<u>Nominal performance</u>

Figure 1 compares our index to the only other existing index that covers the whole period[14], that of Arbulu-SGF-INSEE, with a common basis in 1854=108. The discrepancies are obviously enormous, but also surprisingly easy to explain.

The Arbulu-SGF-INSEE index links an index built by Arbulu [1998] for the 1802-1913 period to those built at the time by Statistique générale de la France (SGF), the official statistical office, and later by its successor INSEE. It has been used – or part of it – by all recent studies on the long run performance of the Paris stock exchange, mostly by lack of competitors (Gallais-Hamonno & Arbulu [1995]; Jorion & Goetzmann [1999]; Dimson & alii [2002]) and because of its inclusion in official publications (for example Société des nations [1939]).

Hautcoeur [2006] shows that the index built by SGF in the interwar period – as well as those of many other statistical institutions at the time – did not aim at measuring the performance of a portfolio of stocks but rather at observing or anticipating fluctuations in macroeconomic activity. For that reason, it did not focus on long term level change, and did not worry about incorporating a substantial upward

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[12] Some other shares could be listed for brief periods, especially on the *Coulisse* in the 19th century, but they were marginal and could not modify our results, in particular the list of 40 major stocks.

[13] Friday was chosen because it does not correspond to settlement periods (forward operations were settled every 15 days or every month depending on the moment during our period), and because weekly periodicals, usually published on Saturday, gave Friday prices.

[14] Hautcoeur & Petit (2004) provide an original index for the interwar period, with a methodology similar to ours. It includes 30 blue chips, with a slightly more conservative selection procedure since shares are chosen only if they remain at least 4 years among the biggest capitalizations of the Bourse. This may explain why it features somewhat more fluctuations.

bias. In order not to miss any impending crisis or recovery, it was calculated for every industry, and aimed at including as many firms as possible; it also included them all on an equal basis, since they all could equally signal down or up-turns. Then, the index was an average of industry indices, which themselves included on an equal basis all firms in the industry. Even if the aggregate index was weighted by industry capitalization (probably in order to measure nation-wide fluctuations without giving the same weight to all industries), it was based on un-weighted industry indices. This method was maintained with little change by INSEE after 1945 (INSEE [1963]). It was also mostly the method used retrospectively by Arbulu [1998].
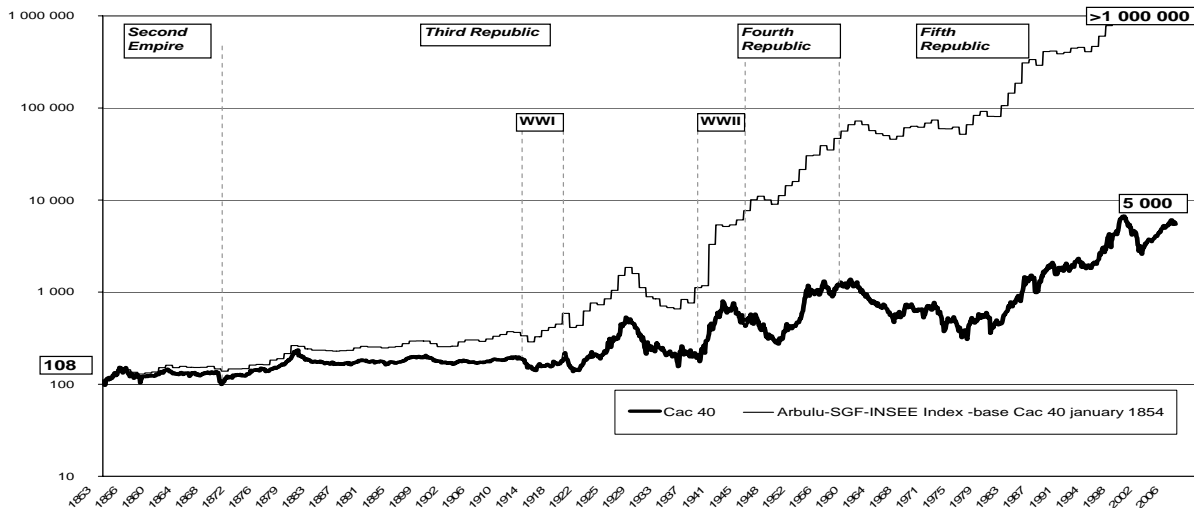
Figure 1. Our CAC-40 index, Arbulu-SGF-INSEE index. 1854=108 basis (allows to join the official CAC-40 at 1000 in 1988).

The upward bias coming from constructing un-weighted broad indices is enormous, as one example will show. In 1963, Rhône-Poulenc was the most important French firm, with a market capitalization of 5.21 billions francs, or 4.6% of a total market capitalization of 112 billions (INSEE [1963]). Within our CAC-40 index, Rhône-Poulenc weight is 10.35% since the total capitalization of the 40 first shares is 50 billions. In the SGF-INSEE methodology, Rhône-Poulenc is one among 22 firms in the "produits chimiques, electro-métallurgie et verreries" group (mostly chemicals), which weight is 15.6% in the official index. The impact of Rhône-Poulenc shares is then 15.6/22 or 0.71%, compared to its 10.35% in our index. At the other end of the spectrum, Cotelle et Foucher – Javel La Croix, a chemicals firm capitalizing a 74 millions francs value (or 0.066% of the market, 60 times less than Rhône-Poulenc) also weighted 0.71% in the index. Table 2 provides a measure for the chemicals industry in 1963 of the discrepancies between the weights in the index and those in the capitalization, showing that the overrepresentation of small firms was a general phenomenon, and one that could affect enormously the index. If, as we now know (Fama and French [1992], Hamon & Jacquillat [1999] for the French market after 1968), the performance of smaller firms is on average superior to that of bigger ones, this overrepresentation of small firms creates an upward bias in the index. For example, if the average difference in performance between firms included in our CAC-40 and the others is 1% a year, and the

CAC-40 includes only a tenth of the firms included in the SGF-INSEE index, that index should outperform the CAC-40 by almost 1% a year even if the capitalization of CAC-40 firms represents a huge proportion of the total market capitalization.

| | Market Capitalization | | Weight in | (weight in INSEE index) / | |
| | in francs | % of total Capitalisation | General Index INSEE | (% of the total market capitalization) | |
		I	II	II/I	II/I
Produits Chimiques d'Auby	103 962 700	0,09%	0,71%	771%	
Bordealise de Produits Chimiques			0,71%		
Glaces de Boussois	558 000 000	0,49%	0,71%	144%	
Le Carbonne-Lorraine	103 082 000	0,09%	0,71%	777%	
Clin-Byla	158 800 000	0,14%	0,71%	504%	
Cotelle et Foucher	**74 513 000**	**0,07%**	**0,71%**	**1075%**	
Jean Lefèbvre	146 640 000	0,13%	0,71%	546%	
Française des Glycérines	87 552 000	0,08%	0,71%	915%	
Huiles, Goudrons et Dérivés	122 949 000	0,11%	0,71%	652%	
Kuhlmann	841 522 000	0,74%	0,71%		95%
Roger Bellon	95 200 000	0,08%	0,71%	841%	
Laboratoire Toraude	83 700 000	0,07%	0,71%	957%	
Nobel-Bozel	214 405 000	0,19%	0,71%	374%	
Péchiney	1 815 460 000	1,61%	0,71%		44%
Gle d'Engrais Pierrefitte	145 935 000	0,13%	0,71%	549%	
Produits Azotés	170 550 000	0,15%	0,71%	470%	
Progil	493 050 000	0,44%	0,71%	162%	
Rhône-Poulenc	**5 213 000 000**	**4,61%**	**0,71%**		**15%**
Roussel-Uclaf	778 000 000	0,69%	0,71%	103%	
Saint-Gobain	2 613 863 000	2,31%	0,71%		31%
SIFA	207 060 000	0,18%	0,71%	387%	
Ugine	1 575 280 000	1,39%	0,71%		51%

Market capitalization (INSEE)   112 974 027 000

Table 2. Actual share in total capitalization, weight in the INSEE index of stocks included in the « chemicals » industry index, and their ratio. All for 1963. Shares over-represented in the INSEE index (II/I >100%) are in column 4 which gives the degree of over-representation. The same for under-representation in column 5.

Other choices also bring substantial biases in the existing index. Arbulu's calculations suffer substantial survivor bias, since he chooses the shares included partly on the basis of their stability (Arbulu [1998], p. 424), more precisely he eliminates all shares which don't remain listed at least five years, which makes him "forget" the Union générale (6th capitalization by size in 1881, 5.51% of our CAC-40, failed in 1882) or the Panama canal (9th capitalization in 1884, also soon failed), and the substantial downward impact of their failure on contemporaries portfolios (and attitude towards stock investment, see Zola [1891]).

A major flaw of the official indices built by INSEE after SGF is their treatment of nationalizations. Nationalized firms represented an enormous proportion of listed firms and even more of our CAC-40, since they included all the railroads in 1937, and all the electricity, gas, coal, bank and insurance industries in 1945. We could not find details on how the SGF calculated the impact of 1936-37

nationalizations. Concerning the 1944-45 nationalizations, which represented more than 30% of early 1939 CAC-40 capitalization, Laforest and Sallee [1969] provide us with the following indices including and excluding nationalized firms for 1939 to 1945 (table 3).

Unsurprisingly, that period is the one with most divergences between our CAC-40 and the official index, even if our method probably underestimates the negative impact of nationalizations on the portfolios of their shareholders[15].

We conclude that many flaws add up in the existing Arbulu-SGF-INSEE index in order to make it overestimate greatly the actual performance that could be obtained by investors[16].

INSEE Indices	Nationalized firms	
	included	*Excluded*
December, 1st 1939	131	147
December, 1st 1941	380	432
December, 1st 1942	590	705
December, 1st 1943	529	676
December, 1st 1944	489	705
December, 1st 1945	450	798

Table 3. INSEE indices including or excluding 1944 nationalized firms.
Source : Laforest & Sallee [1969]

Robustness checks

Given the enormous difference between the traditional index and ours, one may ask for more robustness checks than just identifying the biases in the traditional index. A direct way to validate our own methodology is to compare it to the true CAC-40. We did so for the first decade of its existence (1987-1997). Both indices are heavily correlated. Nevertheless, our own index performs something worse than Euronext's one (7.5 points of growth below in 10 years, compared to a global rise of 185%, or a 4% difference). This difference is probably not significant: Fisher, Student or Chi-2 tests actually do not reject the hypothesis of identical means, variances, skewness, kurtosis or distribution. If it were, it would likely result from the choices in Euronext's selection method, that allow smaller or more dynamic firms to be included, compared to our automatic selection method. In any case, that divergence is small, if significant, compared to the one we observed between the Arbulu-SGF-INSEE index and ours.

We also use this period in order to distinguish which consequences have on the one hand our selection method (strictly 40 first capitalizations), and on the other hand our simplifying assumptions (rebalancing of the selection only once a year, no treatment within the year of mergers, nationalization or failure, little correction for some capital modifications). For that purpose, we calculate another

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[15] We just use the last price quoted for our index. But actually, some nationalizations blocked the shareholders investments during a long (highly inflationary) period before they obtained a compensation that could be sold and reinvested in other shares (as we suppose was done at the end of the year when the last price was quoted). It may be worth investigating the special case of electricity and gas firms (900 firms, one millions shareholders at the time) where shares were converted in bonds indexed on the sales of Electricité de France that may have been a better investment than reflected by the last share prices.

[16] A comparison of the performances of our CAC-40 and the SGF-INSEE-Arbulu index shows the latter overperforms significantly the former in all decades but one since 1854.

index, CAC3, which is composed as the authentic one at the start of each year, but not recomposed during the year, and which suffers our simplifying assumptions. Table 4 shows that – contrary to our index – this index performs <u>better</u> than the authentic CAC-40, suggesting the sample selection is the major cause of the negative difference between our index and the official one, and that our simplifying technical assumptions per se would more probably bias the index upward – if there is a bias. This would then mostly reinforce our conclusions.

Annualised monthly price variations (1988-1997)			
	Euronext Cac 40	**Approximate Cac 40**	
		40 first capitalizations	*same components*
	Cac1	**Cac2**	**Cac3**
Mean	12,32%	11,69%	12,90%
Standard-deviation	18,74%	17,80%	18,17%
Kurtosis	3,16	2,99	2,89
Skewness	-0,01	0,06	0,09
T-test*		93,85%	94%
F-test*		57,88%	74%
Correlation coefficient*		0,993	0,989

* compared with Euronext Cac 40

Table 4. Comparison of Euronext's CAC-40 (Cac1), our index (Cac2) and an index using the official CAC composition in each January but without the within-year adjustments (Cac3).

The official CAC-40 also presents an assumption that we did not apply to our historical reconstruction: it puts a 15% maximum to the weight of any stock. Our historical data (Figure 2) show that the share of the biggest firm (even when restricted to its most important share, as described above) varies heavily, and that this 15% ceiling was bypassed in 21 years of our sample. But recalculating our index with a similar assumption showed no significant impact. Since such an assumption has little theoretical support, we preferred to keep with our un-limited index.
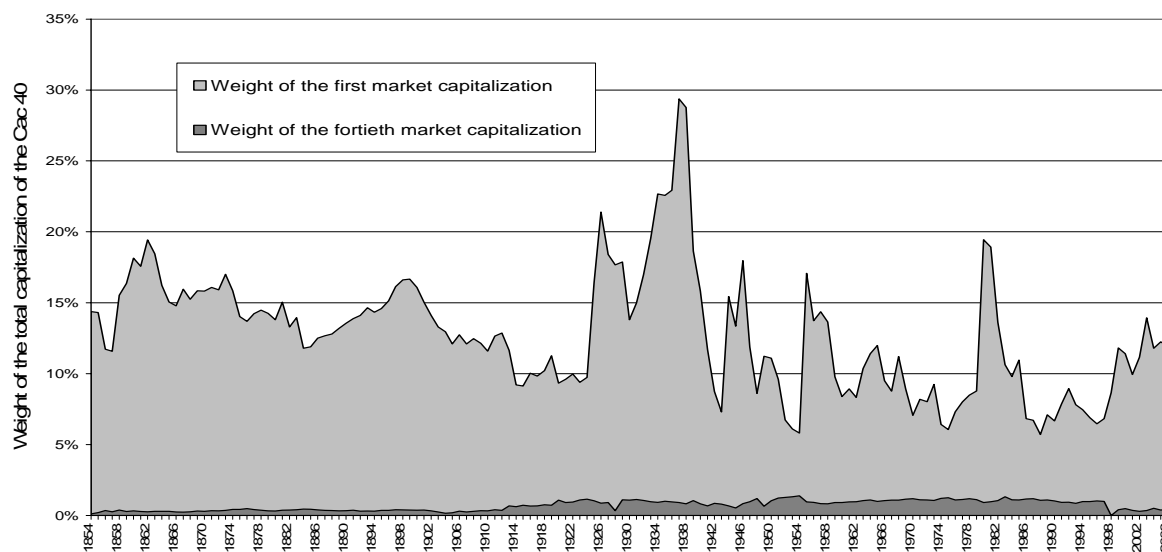
Figure 2. Shares of the biggest capitalization in our CAC-40 and of the smallest one, every year.

A last robustness check is provided by the calculation of an equally-weighted index based on the same sample as ours. Unsurprisingly, the performance of the equally-weighted index, that over-weights the (relatively) small firms in the index, is better than that of our capitalization-weighted index. This confirms the importance of a strict selection method and of the frequent adjustments in sample and weights.

Real performance: regime changes ?

Contrary to what appeared in previous studies, the real long term performance of the CAC-40 index (without dividends) was significantly <u>negative</u> for the complete 1854-2007 period: with on average a 4.28% increase, the CAC-40 was far from the average inflation of 5.66% (see table 5). Nevertheless, this performance was not constant over time. A clear regime change appears during World War One, when the price level for the first time rises permanently above its 19th century level. Up to 1914, the CAC-40 is always above the price level, providing a positive return to investors. Afterwards, prices bypass it before the end of World War One, and it never catches up, the return becoming negative for the rest of the century, even on the basis of someone having invested in 1854.

The 1914 change is clearly consistent with historical evidence, since the two wars' inflation clearly represented a radical and definitive move from 19th century metallic standards. One may wonder when the inflationary regime that started in 1914 ended. From French political history, two dates stand off as worth investigating. The first one is 1958, when France moved first to a new Republic and second to a convertible currency under the Bretton-Woods system, and adopted the stabilization policy that was considered necessary in order to do it (the Pinay-Rueff plan). The second possible regime change is the "tournant de la rigueur" under François Mitterrand, when Keynesian macroeconomic policies were abandoned and monetary stabilization made a priority (a move dated either from the second devaluation of June 1982 or, more frequently, from March 1983). From 1983 on, the inflation rate remained below 10% by year.

A simple look at figure 1 suggests no complex calculations are necessary to discriminate between the two dates. The 1958 stabilization actually does not correspond to any marked change in the CAC-40, which was increasing up to 1955 and started decreasing from 1962 until it reached three minimum values in August 1967 (468 points), February 1978 (307 points) and July 1981 (370 points). A clear switch to a period of sharply rising stock prices can be observed in 1983. We then give in table 5 the values for long term performances for the 1914-1982 period considered as a single one, and for 1854-1913 and 1983-2006 for comparison. The real performance of the pure-prices CAC-40 go from approximately 1% per year before 1914 to a negative – 7.8% from 1914 to 1982, and to a positive 10.5% from 1983 to 2006. But that glorious final period is not enough to compensate for the previous very long inflationary period, so that a *rentier* living on the income of a CAC-40 invested portfolio would have lost on average 1.5% of his capital since 1854.

Dividends

One may nevertheless wonder whether the pure-prices CAC-40 index may bias our understanding of the impact of that change on investment performance. A rise in dividend payments could have compensated the decline in real capital gains that our index measures. More generally, one may argue that what one must measure that a correct measure must include the reinvestment of dividends.

Actually, table 5 suggests that dividends did not compensate for the decrease in real stock prices after 1914, since dividend to price ratios on average <u>decreased</u> in the 20th century. This evolution is actually consistent with the change of dividend behaviour that has been documented in various countries around the First World War, and which may have resulted in particular from tax optimization choices and maybe also from changes in firm's governance and investment strategies[17]. In France as elsewhere, capital gains substituted for dividends in investors' income, probably in response to rapidly rising income taxes on dividend; but in France capital gains were mostly illusory because of prices increasing still more rapidly. Nevertheless, as Figure 3 illustrates, most of the changes in dividend yield can be accounted by variations in stock prices rather than by autonomous changes in dividends.
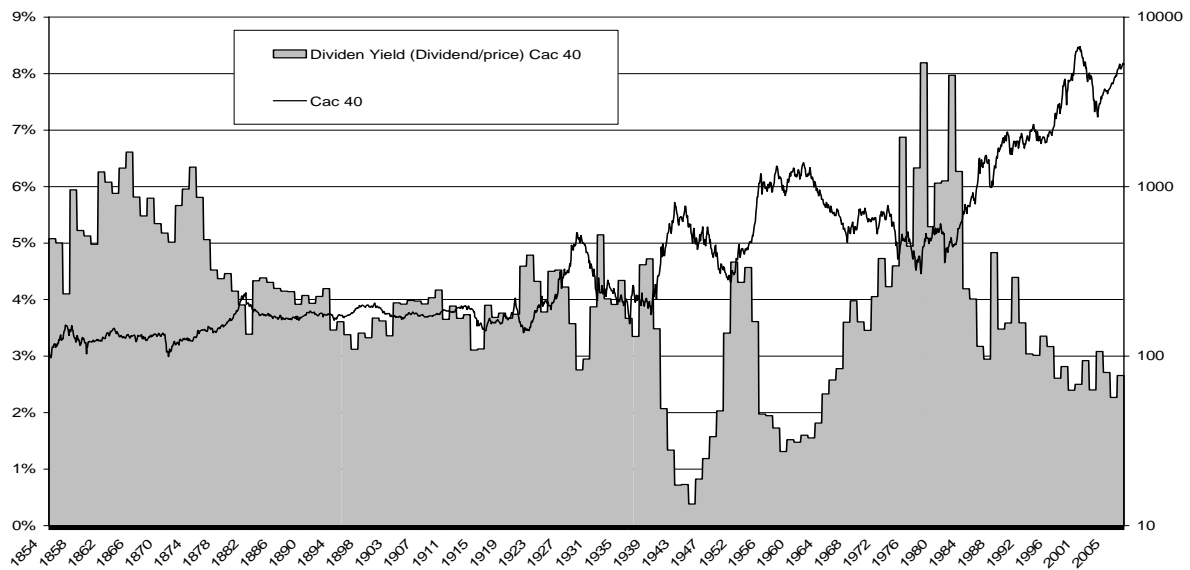

Figure 3 Dividend yield for CAC-40 firms.

Then 1914 is even more a regime change in terms of total returns of stock investment (including the reinvestment of dividends) than in terms of pure capital gains. From 1854 to 1914, the CAC-40 holder who reinvested all her dividends earned a 5.76% yearly real total return, slightly below the 5.7% nominal one (including 1.24% of capital gain and 4.52% in dividend payments), when from 1914 to 1982, the nominal total return increased to 7% in spite of a decrease of dividend yields to 3.34%, but real total return decreased to a negative -2.82%[18]. Investment in French equities did not protect against

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[17] Rutterford (2004) suggests the dividend was long the major information on stock value, hence high dividend yields as a proportion of total returns. Goetzmann (1993) observes the same pattern on various markets.
[18] All these changes are statistically significant.

inflation during that period, even when reinvesting all dividends, something which has been observed in other countries, but never for such a long period[19]. For the complete 1854-2006 period, investment in stocks protected against inflation, but provided a limited 3% return, two periods of high real return compensating the long period of negative return.
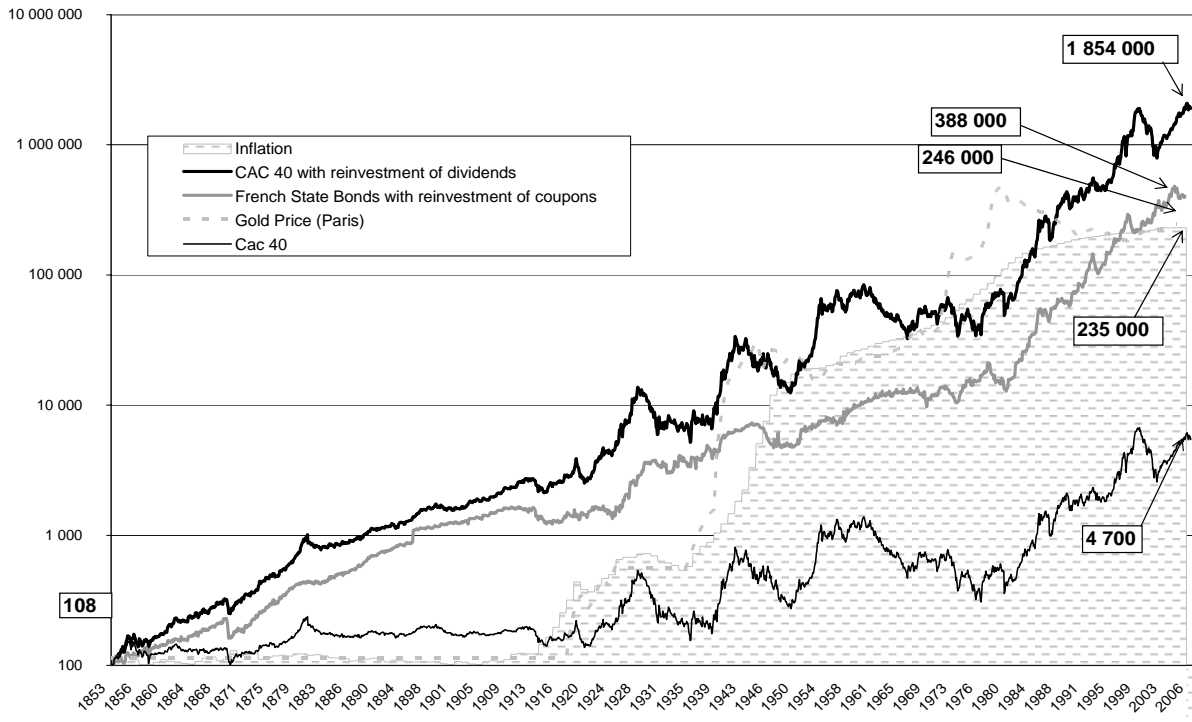

Figure 4 Long term performance of investment strategies in various French assets (see table 5 for details on the sources).

The 1914 regime change also appears in volatility series (figure 5). After a long period of decreasing volatility from 1854 to 1914, it increased sharply and remained high throughout the 20th century (with 1983 being no regime change concerning that indicator). On average, standard deviation almost tripled from the 19th century to the 20th. A khi-2 test comparing the distribution of monthly variations for 1854-1913 and the same number of months after 1914 clearly rejects the hypothesis of identical distributions[20]. This much higher volatility may be understood as the sign of a high inflation risk, although its persistence after 1983 suggests another explanation may be necessary.

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[19] The literature on the relationships between stock returns and inflation is huge. It frequently finds some negative correlation for the short run, but not in the long run. See Boudoukh & Richardson (1993), Geske & Roll (1983), Fama (1981), David & Robinson (1989), Siegel (1994, p. 158), Sharp & Bailey (1999, p. 137), Ibbotson & associates (1997).

[20] This test does not suppose a Gaussian distribution (see below): we distribute the variations in classes by quarter of standard deviation, which allows comparing directly the distributions.
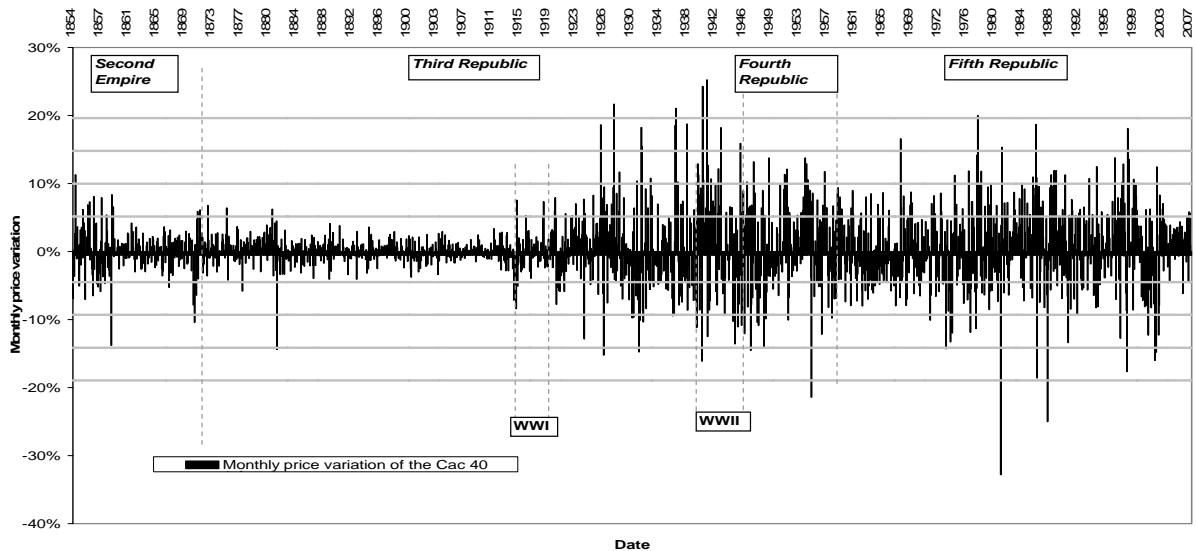
**Figure 5. Monthly price variation of the CAC-40 index, 1854-2006**

The "short 20th century" (1914-1982) was then exceptional in the low return on stocks. Contrary to standard views, this underperformance was not limited to the two war or post-war periods, but was maintained during a substantial period of economic prosperity after the reconstruction. Furthermore, the recent period (since 1983) does not appear as a return to the 19th century: not only is overall real return higher (which may result mostly from a shorter period, which incorporates little bear market yet), but volatility remains very high (actually slightly higher than in the "20th century") and dividends remain low.

Comparison with other investments and optimal portfolio

A well-known result of US long term investment is the equity premium puzzle: in the long run, equities perform not only better than other investments, but the return they provide is higher than what their higher volatility requires as a compensation for risk. Although no explanation for this fact is generally accepted, it has provoked much discussion; its validity outside the U.S. still requires detailed scrutiny. In the French case, an equity premium also exists for all of our period, but it remains low compared to either government bonds or bills (less than one percentage point for geometric means), in spite of an increase in the relative risk of equities, especially during the 1914-1982 period. Figure 6 draws a risk line for the French financial market from 1914 to 1982 and table 5 gives detailed data for all periods. Figure 6 suggests that returns were to some extent related to risks, with no excessive risk premium for equities. The most striking point is the high risk and high return for investments in gold. In a period of unstable monetary regime, during which France was on the verge of hyperinflation at least once (at the end of World War Two), gold became a "valeur refuge" that was highly priced by French investors. This was not an absurd behaviour, as has frequently been argued, since gold obtained the highest average return on that period in spite of paying no income. From the position of gold on the risk line, we can argue that an optimal portfolio in the Markovitz definition should have

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included a significant proportion of gold from 1914 to 1982. This suggests French investors were rational in investing so much in gold, even if it may have been costly in terms of lost economic growth. It was also very risky, since during the two stable-prices periods (before 1914 and since 1983) gold gave the lowest return of all investments.
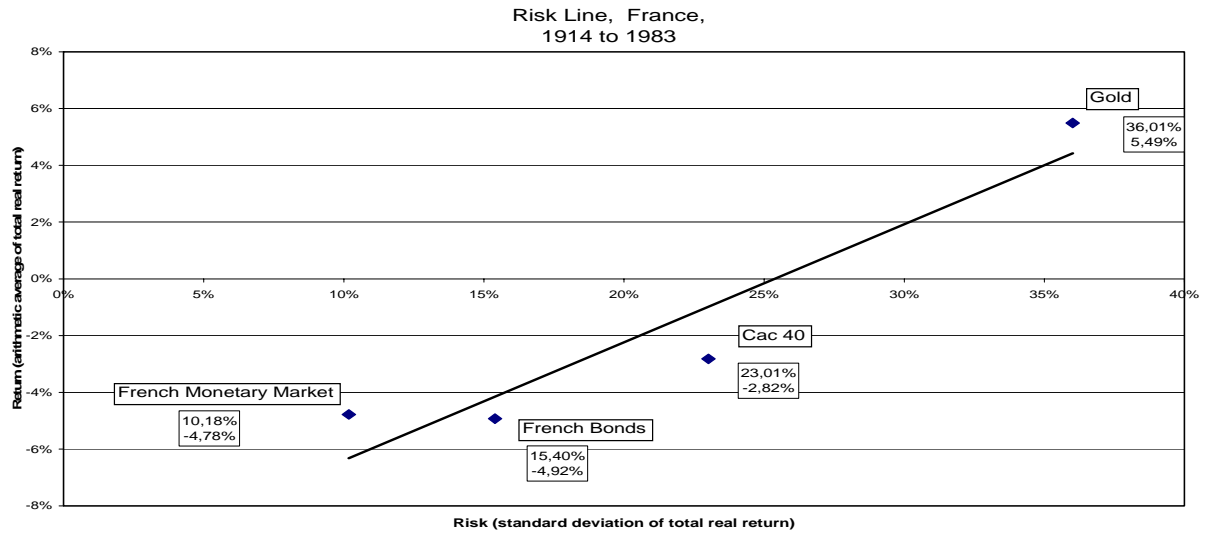
Figure 6. Risk-return line for the French financial market, 1914 to 1982

Nevertheless, if one would include investments in real estate, that result may need some qualification. The data by J. Friggit (see Friggit, 2007) suggest that not only was the return on an apartment bought and rent in Paris approximately as high as the one on gold, but also that risk was much lower. This may explain why real estate investment was so much favoured by the French as a protection against inflation. Nevertheless, it may also result from a survivor bias, since the success of Paris as a major international city cannot be compared to that of many other French towns, not to speak about rural areas which population dropped during the period. It may well be that although the owners of Parisian apartments did well by renting and reselling them (with a negative period of rent constraint mostly limited to the 1914-1950 period), the result cannot be extended to other real-estate investment.

Comparison with the U.S.

Jorion and Goetzmann (1999) suggested that the equity premium in the U.S. may be the result of a survivor bias at the level of the American market as a whole compared to the global stock market. The U.S. actually diverged from most European countries after 1914 since they were much less affected by the two world wars. Our data suggests that before 1914, the U.S. market performance was already very high, but also very risky compared to the French market, making it consistent with an optimal international allocation of portfolios. The risk line for 1872-1914 drawn on figure 7 should be augmented with other data but looks reassuring[21].

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[21] We prefer to stay with the standard Cowles – Standard & Poor's index. The recent Goetzmann & al. (2000) index is not weighted by capitalization. Siegel's (1992, 1994) data from 1802 lack a good measure of dividends.

From january 1854 to december 2006

	Cac 40						French State Bonds (1)				Gold (2)		Bills(3)		Prices
	Dividend Yield	Annual Price Variation	Total Nominal Return	**Total Real Return**	p-value*		Coupon Yield	Annual Price Variation	Total Nominal Return	**Total Real Return**	Annual Price Variation	**Total Real Return**	Interest Yield	**Total Real Return**	**INSEE**
Arithmetic mean	3,84%	4,18%	8,02%	3,06%	*t-test*	*F-test*	5,22%	0,94%	6,16%	1,49%	7,47%	1,83%	4,53%	-0,25%	**5,66%**
Geometric mean		**2,56%**	**6,42%**	**1,18%**	*0,04%*	*0,00%*		**0,37%**	**5,57%**	**0,37%**	**5,18%**	**0,00%**	**4,48%**	**-0,65%**	
Standard deviation	1,57%	19,12%	19,31%	19,74%			2,49%	10,70%	11,34%	14,55%	30,29%	24,77%	2,74%	8,48%	10,43%

from january 1854 to december 1913

	Dividend Yield	Annual Price Variation	Total Nominal Return	Total Real Return	p-value*		Coupon Yield	Annual Price Variation	Total Nominal Return	Total Real Return	Annual Price Variation	Total Real Return	Interest Yield	Total Real Return	INSEE
Arithmetic mean	4,52%	1,24%	5,76%	5,70%	*t-test*	*F-test*	3,78%	0,97%	4,75%	4,72%	0,00%	-0,08%	3,43%	3,35%	**0,22%**
Geometric mean		**0,98%**	**5,51%**	**5,35%**	*0,84%*	*0,00%*		**0,77%**	**4,56%**	**4,40%**	**0,00%**	**-0,15%**		**3,27%**	
Standard deviation	0,95%	7,27%	7,38%	8,56%			0,72%	6,14%	6,25%	7,95%	0,00%	3,72%	0,96%	4,19%	3,78%

from january 1914 to december 1982

	Dividend Yield	Annual Price Variation	Total Nominal Return	Total Real Return	p-value*		Coupon Yield	Annual Price Variation	Total Nominal Return	Total Real Return	Annual Price Variation	Total Real Return	Interest Yield	Total Real Return	INSEE
Arithmetic mean	3,44%	3,56%	7,00%	-2,82%	*t-test*	*F-test*	5,57%	-1,25%	4,31%	-4,92%	17,00%	5,49%	4,71%	-4,78%	**11,31%**
Geometric mean		**1,26%**	**4,70%**	**-5,35%**	*0,28%*	*0,00%*		**-1,86%**	**3,73%**	**-6,23%**	**12,45%**	**1,66%**	**4,67%**	**-5,38%**	
Standard deviation	1,54%	22,95%	23,30%	23,01%			2,36%	10,96%	11,14%	15,40%	42,92%	36,01%	2,94%	10,18%	12,95%

from january 1983 to december 2006

	Dividend Yield	Annual Price Variation	Total Nominal Return	Total Real Return	p-value*		Coupon Yield	Annual Price Variation	Total Nominal Return	Total Real Return	Annual Price Variation	Total Real Return	Interest Yield	Total Real Return	INSEE
Arithmetic mean	3,34%	13,18%	16,52%	13,50%	*t-test*	*F-test*	7,77%	7,17%	14,95%	11,97%	-1,56%	-4,03%	6,20%	3,94%	**2,63%**
Geometric mean		**10,53%**	**13,90%**	**10,99%**	*36,04%*	*0,00%*		**6,03%**	**13,71%**	**10,81%**	**-1,76%**	**-4,26%**	**6,15%**	**3,91%**	
Standard deviation	1,18%	23,89%	24,14%	23,30%			3,16%	15,34%	16,47%	15,82%	6,22%	6,70%	3,32%	2,44%	1,77%

* compared with French State Bonds (totale nominal return)

(1) Rente 3 % and after 1970, taux obligations Etat à long terme (source Banque de France),

(2) Gold Price in Paris, Banque de France and INSEE (interpolate)

(3) Taux de l'escompte de la Banque de France, and taux interbancaire au jour le jour after 1928 and TMM (CDC-IXIS) since 1998

Table 5 Returns for various investments in French assets for 1854 to 2006 and three sub-periods.
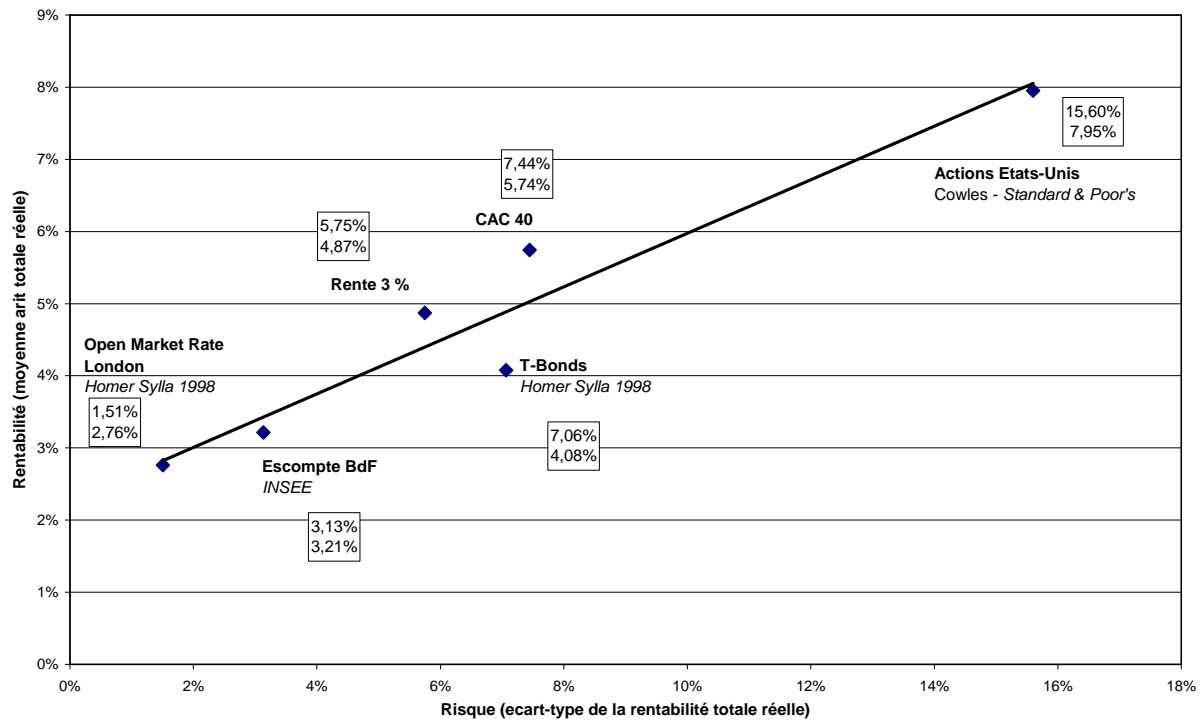
Figure 7 International risk-return line, 1872-1914.

III. A market efficient but marginalized for a long period

The poor performance of the French stock index for the "short 20th century" might result from inefficient pricing or from exogenous shocks on the French economy. We will argue here that the functioning of the French market was not qualitatively different from that of other market, but that the poor performance of the CAC-40 was very much related to the drop in financial markets development in France, itself a by-product of its economic history.

Efficiency

Many definitions and tests of financial markets efficiency have been proposed. We will here focus on just a few descriptive statistics. A simple test of efficiency can be applied to our index: the calculation of autocorrelation between pairs of successive (or more distant) monthly or yearly performances[22] shows that it was very low (either before or after 1914), a result consistent with an efficient market.

The distribution of returns for the CAC-40 is not well represented by a Laplace-Gauss law, because of the presence of fat tails (table 6); this is a standard result in the literature, which does not make the French market special (see e.g. Longin, 1996). The probability of a normal distribution is negligible as well for the all period or for either the 19th or 20th centuries. Nevertheless, if one divides our period in

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[22] In the vein of Fama (1965), Solnik (1973) or Lo & Mackinley (1988).

homogeneous periods of 30 years' duration, two of them differ: 1883 to 1913 and 1944 to 1973. During both of them, skewness and kurtosis don't differ significantly from their values for a normal distribution. This is particularly funny for the second period, since the post-World War Two period is precisely the one when financial repression is supposed to reach its maximum, suggesting it may have limited the occurrence of extreme variations on the Paris stock exchange.

	1854-2007	1854-1913	1914-2007
Mean	**4,02%**	**1,23%**	**5,81%**
Standard Deviation	**16,70%**	**7,63%**	**20,49%**
Kurtosis	**7,13**	**10,26**	**5,03**
p-value kurt=3	*0,0008*	*0,0006*	*0,0051*
Skewness	**0,07**	**-0,58**	**0,02**
p-value skewness=0	*0,3221*	*0,0241*	*0,8085*
Range	58,03%	25,69%	58,03%
Minimum	-32,79%	-14,40%	-32,79%
Maximum	25,24%	11,30%	25,24%
Count	1842	719	1123
Confidence Level(95,0%)	0,0022	0,0016	0,0035
Jarque-Berra	1308	1619	194

Table 6 Major characteristics of the distribution of CAC-40 variations for 1854-2007 and two sub-periods.

The examination of these distributions also shows a deep change in the origins of extreme variations in the French stock market. If one measures these cases as those above four standard deviations from the mean, we find 4 cases before 1913 and four from 1914 to 2006 (in the first case, this is slightly more than the 3 cases predicted by a normal distribution; in the second one it is the exact number). During the 19th century period, one such extreme variation is a rise, that occurred in May, 1854, and the three others are drops, which occur in April, 1859, in September 1870 and in January 1882 (the so-called Union Générale crash). In the 20th century, two cases of extreme rise are June 1940 and January 1941, and two drops occur in May 1981 and October 1987. It is noticeable that only one extreme variation is from political origin in the 19th century (the 1870 one) when only one is clearly from economic origin (and from international origin actually) in the 20th century (the 1987 crash). A more detailed examination shows that political decisions are central to many of the extreme variations in the 20th century: the next major variations include May 1981 (presidential election), April 1928 (franc legal stabilization), October 1936 (franc devaluation), March 1978 (parliamentary elections), etc. It looks that during the 20th century the most important events to look at and interpret for French financiers were political ones, at least up to the 1983 economic policy regime change.

Economic policy regime changes

We consider that the peculiar trajectory of the CAC-40 must be related to the structural changes of the French financial market during the 20th century. The first one is the impact of the wars. It is visible in

the evolution of dividend payments, which drop after the First and even more after the Second World War (Figure 8). It results partly from the negative impact of the wars on profits, and partly from inflation, which makes profits and dividends appear higher than their true level, and exposes them to high taxes. In the case of public utilities subject to government price regulation, inflation frequently leads to price caps and to a reduction in profits. As we already mentioned, the decrease in dividend yields may result from an adaptation of firms to the rise in corporate and personal income taxes, a rise which is very sharp during and after World War One and will be followed by a gradual decrease mostly from the 1960s only[23]. It remains that the 1914 level of overall dividend payments by the CAC-40 firms was not surpassed until 1968.

The main explanation for this is not an overall stagnation of the economy or even of profits. It is the government involvement in many firms, and especially the nationalization of many of the biggest firms. The firms involved were certainly not always as profitable as they had been, as in the case of the railways which profits had stagnated during years because of regulation when they were finally nationalized. Nevertheless, the nationalization of the railways, the Banque de France, and after World War Two that of the electricity, coal, gas, banking and insurance industries, deprived the stock markets from many of their biggest listed securities. The last (short-lived) case was the 1982 nationalization of the major industrial firms (Thomson, Saint-Gobain, Rhône-Poulenc, Pechiney-Ugine-Kuhlman, Usinor) and the remaining big banks (Indosuez, Paribas, CIC, Crédit du Nord, CCF, Rothschild). This explains the evolution of the ratio of CAC-40 firms (and of total capitalization) to GDP (Figure 9).
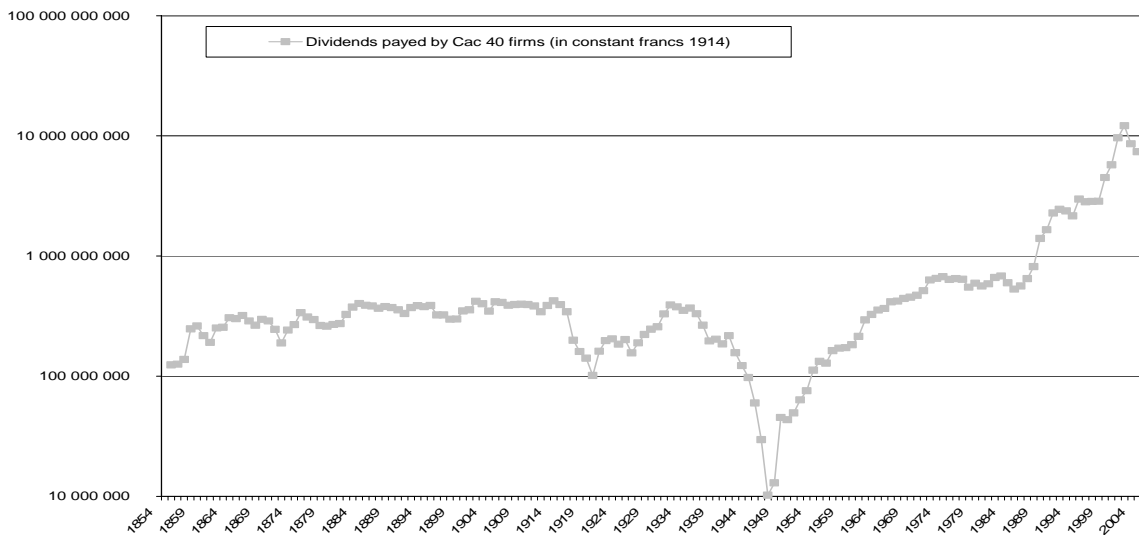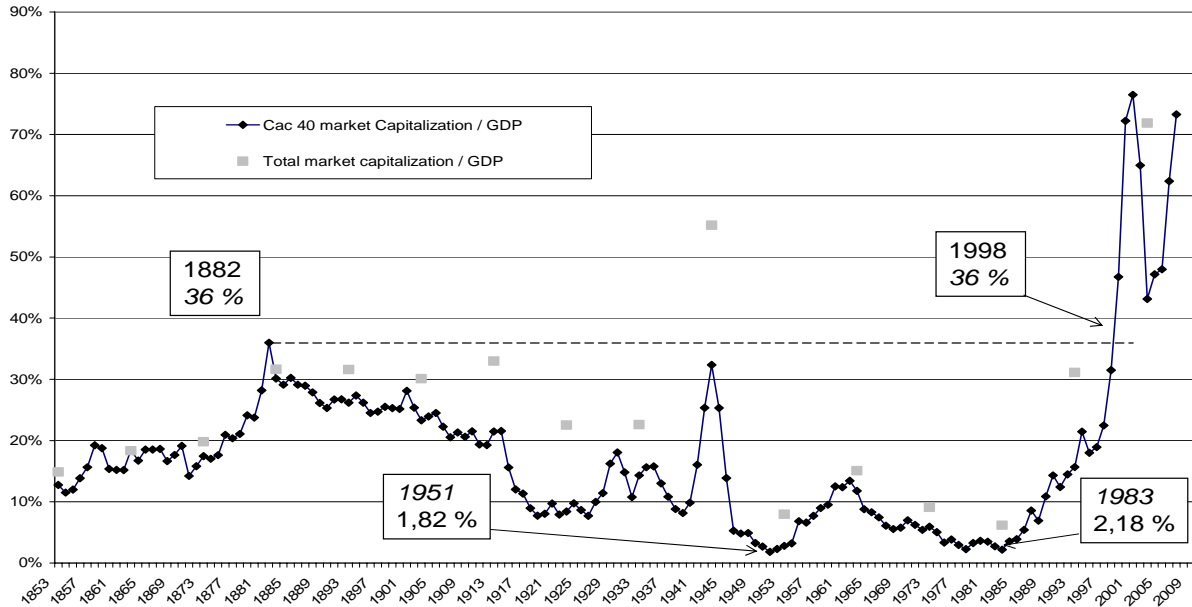

Figure 8. Dividends paid by CAC-40 firms, constant 1914 francs

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[23] On the creation of profit taxation in France and the problems in measuring its impact in an inflationary period, see Hautcoeur & Grotard (1995); on the taxation level in France in the 20th century, see Piketty (2001).

Figure 9. Ratio of the capitalization of CAC-40 firms and the total capitalization of French listed firms to GDP. Minima are reached in 1951 (1.82%) and 1983 (2.18%). The 1882 maximum of 36% for the CAC-40 is reached again in 1998.

In 1983, the ratio of CAC-40 capitalization to GDP was minimal. It rose sharply in the next two decades thanks to two radical moves: the privatization of almost all the manufacturing, financial and utilities firms that were government-owned, and the rise in the stock index. This rise also resulted to a large extent from the regime change of 1983, by which the French governments chose to let the financial market play again a major role in the economy. A substantial rise in profits, that was a condition for French firms to become attractive for investors, succeeded, and French stock prices became well integrated with international markets. From 1983, then, the stock index again provides a measure that is relevant for the study of the French economy.

Conclusion

We proposed a new index of the French stock prices, much more consistent than previous ones first with modern stock index methodologies, second with the history of the French capital market in the 20th century.

Previous indices presented, we argued, serious methodological flaws, that made them dramatically overestimate the variations of stock prices. Reasonably well measured stock prices, as in our CAC-40, present a radical regime change from 1914: because of war inflation, but also of the rise of taxation (which impact was multiplied by inflation since it applied on nominal incomes), stock prices decreased in real terms. Soon, nationalization affected a large proportion of listed firms, so that the size of the stock market decreased sharply. Up to the next regime change, the stock index performed badly and suffered large fluctuations. At the same time, by and large, the economic function of the stock exchange almost disappeared. This was reversed in the 1980s, which explains both the rise in the stock index and of the size of the stock market.

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We consider this story more consistent than the one which made stock prices rise in France almost as if no significant event had affected the country in the 20th century. More importantly, we wonder whether the same story – or a variation on it – may apply to many other European countries. The same methodological flaws may very well affect other European indices. As Hautcoeur [2006] shows, the US Cowles commission was a pioneer in using indices in order to measure seriously stock market performance from the point of view of an investor. Some European newspapers, such as AGEFI in France, did the same, but with much less success, and their indices didn't survive long enough. But in most countries outside the U.S., the indices built by statistical administrations in the interwar or early post-1945 periods may well be based on the principles as the SGF and INSEE indices. The same destructive wars led to similar experiences of financial repression, taxation and inflation – with significant variations among countries – all over Europe.

More broadly, optimistic assessments of the long term performances of stock investment must be tempered : when some extrapolated from Siegel's results on the U.S. market the existence of a « Siegel's constant » of 6 to 7% yearly real total return for such investments (Smither & Wright, 2000), we find that CAC-40 total return varied from –5% to 11% depending on the period, with an average of only 1.18% for whole period. The only standard result that is not affected in the French case is the existence of a risk premium of equities compared to other financial investments. Contrary to many comments, equities didn't protect against inflation, and less against political risks; this was true not only in the short but in the long term. If the 1914 to 1982 period was a parenthesis, it was a long one, and then one which provides us with non-negligible experience; an experience which may also explain common elements in the attitude towards financial markets among the European countries that lived it.

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