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Portfolio advice before modern portfolio theory: The Belle Epoque of French analyst Alfred Neymarck

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ABSTRACT

In this article, we propose an original analysis of advice given by financial analysts prior to WW1. Our article focuses on the writings of A. Neymarck, one of the most popular French analysts in the early 20th Century. The creation of portfolios from a new database composed of the monthly returns of all the security types listed on the official Paris Stock Exchange from 1903 to 1912 has provided results demonstrating that Neymarck correctly identified the risk in a number of sectors. The performances of these portfolios, which were built according to Neymarck's guidelines, confirm Neymarck's ranking in terms of both risk and return: the richer the investor, the riskier and the more profitable his portfolio was seen to be. Finally, the Modern Portfolio Theory enables us to pinpoint the few imperfections in Neymarck's advice, which globally appears to be driven by reliable financial analysis.

KEYWORDS

Portfolio advice; diversification before WW1; financial markets prior to WW1

JEL CLASSIFICATIONS

G11; N23; N83

1. Introduction

During the decades preceding the First World War, Great Britain and France were at the forefront of huge international capital flows (Woodruff, 1966; Fishlow, 1985; Goetzmann & Ukhov, 2006; Edlinger, Merli, & Parent, 2013). There were almost as many foreign issues as domestic issues on the Parisian market between 1900 and 1914 and on the eve of the First World War, the Paris Stock Exchange had fully developed, giving French investors wide access to many different securities issued by public or private issuers from not only European countries but also more distant nations.

The French financial press also grew strongly from the beginning of the 19th century to 1914, with a rapidly increasing number of financial journals following the growth of the Paris Stock Exchange. In 1908, there were approximately 331 newspapers and journals dealing with economics and/or finance (*L'Annuaire de la Presse Française et Étrangère*, Paul Bluysen, 1908). The majority of these publications published information about security prices and revenues, and advised their investors about which securities they should sell or buy at any given time. In this context, the *Annuaire de la Presse Française et Étrangère* (1908 and former editions) provides information about the quality of the publications and

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their ownership. Among the financial journals whose quality was not questioned were *L'Economiste Français* and *Le Rentier*. The latter was directed by Alfred Neymarck, one of the leading French financial analysts before WW1.[1] Alfred Neymarck (1848-1924) was a member of several scientific societies and committees, including the *Société Statistique de Paris*, the *Société d'Économie Politique*, the *Comité des Travaux Historiques et Scientifiques* and the *Conseil Supérieur de Statistique*. He launched a journal in 1869 that focused on finance and business reports, but also reported the discussions of various scientific societies. In addition to his books and reports discussing economics, public finances and securities, Neymarck's journal led to the publishing of his successful handbook *Que doit-on faire de son argent?* (1913), in which he 'gathered in specific chapters several studies that have been regularly published in [his] journal *Le Rentier* under various headings for many years' (Neymarck, 1913, p. 5).

In their analysis of a series of financial advice documents from the 1870 s to the beginning of the twentieth century, Rutterford and Sotiropoulos (2016) documented that despite some differences between the UK and France, the main concepts of Modern Portfolio Theory (Markowitz, 1952, 1959) were discussed in both countries before WW1.[2] 'The core principles of Modern Portfolio Theory, namely, the risk-averse investor, the distinction between specific and systematic risk, the concept of correlation and the strategy of international diversification (on the basis that markets are segmented), appeared and were discussed both among UK and French financial experts, reviews, newspapers, books and pamphlets' (Rutterford & Sotiropoulos, 2016, p. 940). Sotiropoulos and Rutterford (2018) used naïve diversification as a benchmark to show that before WW1, global naïve diversification, then called *geographical distribution of risk* and recommended by analysts in UK before WW1, was in fact a sophisticated strategy and was not sub-optimal compared to Markowitz optimization.

Our article goes beyond Rutterford and Sotiropoulos' findings and uses Modern Portfolio Theory (hereafter referred to as MPT) to test the accuracy of financial advice in France during the pre-WW1 period, and specifically to assess the relevance of Neymarck's financial advice at this time. This is achieved by the creation of a new database composed of the monthly returns of all regularly quoted securities on the Paris Stock Exchange from 1903 to 1912 and published in *L'Économiste Français*. We provide evidence that Neymarck correctly identified risk in a number of sectors. Our findings also confirm that his advice regarding investors' wealth categories results in a clear hierarchy of risk-return trade-off. The construction of optimal portfolios according to Modern Portfolio Theory revealed few imperfections in Neymarck's advice, which appears to be driven by the economic rationality and financial background of his time. The results highlight Neymarck's ability to implement portfolio selection methodology 40 years before Markowitz's famous works on diversification and portfolio selection.

Edlinger and Parent (2014) showed that Neymarck's writings were more than mere guidelines for security investments. They are part of what Preda (2006, p. 150) defines as a proto-science: a 'heterogeneous set of practices, know-how techniques and rationalization procedures with the help of which social actors make sense of their economic environment and the economic consequences of their own actions…'. Edlinger and Parent (2014) provide evidence that Neymarck, and consequently the French investors who followed his advice, recognized the benefits of diversification before the First World War. Neymarck even campaigned for an international portfolio diversification, referred to as the 'division of capital

and risk',[3] which was designed to minimize the dispersion of returns. Neymarck (1913) distinguishes four categories of investors according to their wealth, and consequently according to the risk they can bear. These categories are 'small rentiers, small capitalists', 'middle-class investors', 'well-off investors'; and 'investors with large fortunes'. Neymarck classifies securities within three categories according to their risk level: sound investments, stock providing additional income, and speculative stock.[4] He also suggests a very detailed portfolio composition for each type of investor. Whilst the portfolios of small investors should only be composed of the safest securities, richer investors are encouraged to invest a higher proportion of their wealth in securities 'for additional income' and even in 'speculative' stocks for the richest of them. Neymarck suggests four portfolios, selecting up to 25 categories of securities for each category of investors, and specifies the weight that should be devoted to each category of assets.[5]

The portfolios suggested by Neymarck cover all the types of securities listed on the Paris Stock Exchange (PSE). Our analysis is based on the 10 years preceding the publication of Neymarck's handbook in 1913, *Que doit-on faire de son argent?* A successful evaluation of Neymarck's advice required a database that covered all the types of securities listed on the PSE during this period, but existing databases were not suitable for this purpose since they focus solely on specific types of securities at different frequencies and periods, and were built using different methodologies.[6] Even if we had combined these databases, data for some types of securities (such as foreign and colonial shares and bonds) would still be missing. We therefore built an exhaustive database covering the range of securities recommended by Neymarck from January 1903 to December 1912. This new database contains the monthly quotations for all the types of securities listed on the Paris Stock Exchange that were regularly quoted in the leading financial journal *L'Économiste Français*. This is one of the major contributions of this study.

Our methodology consists of stepping into the shoes of a typical French investor operating on the Parisian market from 1903 to 1914. We assume that investors select one source of information for prices and revenues. *L'Economiste Français* is an obvious choice, both for the excellent reputation of the journal and the recognized expertise of its director Paul Leroy-Beaulieu.[7] Mermet (1882, p. 105) highlights how serious and popular the journal is: '*L'Économiste Français* is amongst the most appreciated and respected journals. It is divided into three parts dedicated to political economy, business and finance, respectively. Every week, it features outstanding articles by Paul Leroy-Beaulieu, A. de Foville, A. de Feretperduis, Arthur Mangin, etc'. This journal has the additional interest of having been published every Saturday from 1873 to 1936, and reporting the last share price of the week, as quoted by the *Cours Authentique*.[8] *L'Economiste Français* sorts securities according to their type (bonds, shares, government loans) and the industrial sectors to which they belong. Accordingly, our database includes all available security categories: French rentes, foreign government loans, public or local bonds, and private shares and bonds. It also takes into consideration the range of French industrial sectors, including the ever-present railway sector, mines, banks, metallurgy companies, maritime and land transport companies, gas, electricity and water.

The main body of our article is structured as follows: Sections 2 and 3 provide the detailed structure of the portfolios suggested by Alfred Neymarck (1913) and set out the different steps of the database construction, and Part 4 presents the methodology and results. We conclude our findings in the final section.

2. *L'Economiste Français* and the writings of the French financial analyst Alfred Neymarck

2.1. L'Economiste Français: a reliable source of information

The literature pinpoints two main features when considering the development of the French financial press over the 19th century until WW1. First, there is a dramatic increase in the number of financial publications following the development of the Paris Stock Exchange. Second, an increasingly negative view develops of the relationships between these publications and the business and financial world. The commonly accepted opinion qualifies these relationships as 'dangerous and scandalous collaborations' over the 19th century (Beltran & Griset, 1994), suggesting an underlying and systematic suspicion of corruption.

With the rise of capitalism in France in the middle of the 19th century, a profusion of financial newspapers sought to follow and encourage investments. These included the *Bulletin Financier, Le Capitaliste, Le Journal des Rentiers, Le Conseiller – Gazette des Chemins de Fer, Le Conseiller de l'Epargne, Cote de la Bourse et de la Banque, Le Crédit, Le Crédit national, Le Crédit Public, L'Echo Agricole, L'Echo du Commerce, L'Économiste Français, L'Epargne Française, Le Fermier, La Finance Nouvelle, Les Fonds Publics, L'Impartial Financier, L'Industrie, Le Journal des Actionnaires, Le Journal d'Agriculture et de Commerce, Le Journal d'Agriculture Pratique, le Journal des Chemins de Fer, Le Journal des Économistes, Le Journal de la Bourse, Le Messager de Paris, le Moniteur de la Bourse et de la Banque, Le Moniteur Financier, Le Moniteur des Tirages Financiers, Le Moniteur des Valeurs à Lot, Le Mouvement Financier, Le Portefeuille, Paris-Bourse, La Réforme Économique, La Semaine Financière and Le Tirage Financier*.

The general suspicion around the French press was due to a specific process called '*affermage*'. This involved newspapers leasing out their financial columns to financial institutions or banks, thus losing their journalistic independence in the eyes of the public. Beltran and Griset (1994) paraphrased Choderlos de Laclos to qualify the relationships between the French press and Paris Stock Exchange as '*liaisons dangereuses*'. Indeed, this view was dominant among historians, writers such as Zola, and left-wing contemporary politicians. Jean Jaurès blamed the 'trust' of financial newspapers: 'There is a trust of financial journals: it is a unique and centralized organization that delivers exactly the same report at the same time for any event; you can imagine the formidable influence that such a press necessarily exerts on public opinion by discrediting or firing at the same firms at the same time. This pushes opinion like a herd along the same path' (Jean Jaurès, discours à la chambre, 6th April 1911).

This globally delivers a gloomy picture of the French press and explains the suspicion that economists showed towards it. Kindleberger (1989) described it as 'venal journalism' (p. 119) and 'financial perfidy' (p. 121). Lévy-Leboyer (1977) adopted a similarly extreme point of view regarding the reliability of French financial data: he systematically criticized the data provided by financial analysts and newspapers, all described as not only biased but also guilty of artificially boosting figures in order to retain the confidence of subscribers.

The *Annuaire de la Presse Française et Étrangère* (1908 and former editions) provides some details about the quality of the publications and their ownership: For instance, investors were aware that the *Journal des Intérêts Financiers* was owned by the *Crédit Mobilier Français* bank, and that it was likely to promote the financial products sold by this financial institution. Although this kind of information might not be available for every journal, there is no doubt

that it could be found in former editions of the *Annuaire de la Presse Française et Étrangère* or was frequently discussed in Parisian social circles.

It has to be noted that *L'Économiste Français* is never mentioned in cases about the venality of the press. On the contrary, it appears to be the most serious of the financial newspapers. We selected this journal for its regular quotations and reliable information. By selecting assets that were continuously quoted over a long period of time, we were *a priori* certain to have assets for which regular information was available to the public. Our working hypothesis (is that *L'Économiste Français* was probably the best financial journal in terms of public information. As recalled by Parent and Rault (2004, p. 328–329): 'Maurice Levy-Leboyer asserted that the financial information available to investors regarding foreign assets was routinely compromised by the informal and ongoing contact between the financial community in Paris and the French Foreign Office or the French government. It is difficult to ascertain, however, whether these contacts led to a systematic bias in the dissemination of inaccurate information because part of the risk and uncertainty associated with some foreign investments would have been deliberately hidden. However, one could also consider these papers as one of the rare sources of information that attempted to rationalize the decision making of investors by taking into account all the available information concerning a particular foreign investment'.

2.2. The writings of Alfred Neymarck

In the introduction, we reiterate that Neymarck's activity in *Le Rentier* led him to publish his successful handbook *Que doit-on faire de son argent?* in 1913. In this publication, he strongly advocates the geographical distribution of capital. Indeed, Neymarck (1913, p. 348) states that 'for risk division to be effective, there must be several placements of different types: national or local government loans, railway stock, various industrial companies and so on… But this is not enough… the diversification and decrease of risk should be carried out by distributing investments across stock from various countries'. Edlinger and Parent (2014) show that Neymarck (1913) recognizes risk-averse investors and advised them on the best composition of their portfolio. In particular, he distinguishes four categories of investors according to their wealth, and assumes that small investors cannot bear as much risk as richer investors. Neymarck (1913) follows the DARA principle, which states that risk aversion decreases as investor wealth increases. Consequently, the portfolio suggested to small investors is limited to the safest securities listed on the Paris Stock Exchange:

> Small investors and small capitalists should only put their money into investments that may be called totally secure; we mean the government bonds, local or French colony loans, the *Crédit Foncier* or French railway bonds (Neymarck, 1913, pp. 365–366). This 'safe' base makes up the entire portfolio that is suggested to small investors (Table 1).

Neymarck (1913, pp. 365–366) does however specify that 'This scale is only information, considering that this investor may change the suggested distribution according to their family circumstances, age, etc'. The 'middle-class' investor category is advised to diversify their portfolio with a wider range of securities that Neymarck considers to be riskier. He suggests that these investors should restrict the 'safe' base to 70% of their holdings and add some French corporate bonds, some shares in the main French railway companies (whose

dividends are guaranteed by the French government) and some securities in the most reliable foreign governments (Table 2).

The portfolio share devoted to the 'safe base' is then reduced to 55% for the 'well-off investors'. In addition to the investment categories advised for 'middle-class investors', these investors are also encouraged to complete their portfolio with more than 10% of shares in French industrial companies, credit and insurance companies, and French or foreign corporate bonds and shares (Table 3).

Neymarck considers that the wealthier investors can better accept potential capital losses. They can therefore include a greater proportion of riskier and potentially more profitable securities. As a result, the 'safe' base proportion is reduced to 35% in the portfolio suggestions for the richest investors. The range of investments advised for these 'investors with large fortunes' covers almost all the securities listed on the Paris Stock Exchange prior to the First World War (Table 4).

Table 1. Portfolio suggested for 'small investors'.

30%	French rentes, colonial debts guaranteed by the French government
20%	Railway bonds guaranteed by the French government
10%	Unguaranteed colonial debts
20%	Paris City bonds
20%	Bonds issued by the Crédit Foncier
100%	

Source: Neymarck, 1913, p. 365, reproduced by Edlinger & Parent, 2014, p. 38.

Table 2. Portfolio suggested for 'middle-class investors'.

25%	French rentes, colonial debts guaranteed by the French government
15%	Bonds in the main French railway companies
10%	Unguaranteed colonial debts
10%	Paris City bonds
10%	Bonds issued by the Crédit Foncier
10%	Industrial and miscellaneous French bonds
10%	Shares in the main French railway companies
10%	Debts of foreign countries
100%	

Source: Neymarck, 1913, p .372, reproduced by Edlinger & Parent, 2014, p. 38.

Table 3. Portfolio suggested for 'well-off investors'.

20%	French rentes, colonial debts guaranteed by the French government
10%	Bonds in the main French railway companies
5%	Unguaranteed colonial debts
10%	Paris City bonds
10%	Bonds issued by the Crédit Foncier
10%	Industrial and miscellaneous French bonds
15%	Shares in the main French railway companies
5%	Shares in credit and insurance companies
10%	Debts of foreign countries
5%	Shares in French and foreign industrial companies
100%	

Source: Neymarck, 1913, p. 377, reproduced by Edlinger & Parent, 2014, p. 39[9].

Table 4. Portfolio suggested for 'rich investors'.

French rentes		
	3% perpetual French rentes	5%
	3% redeemable French rentes	10%
	Colonial Debts	5%
Bonds in main railways companies		
	2,5% Bonds	5%
	3% Bonds	5%
Paris City and Credit Foncier Bonds		
	Paris City bonds	2.50%
	Bonds Issued by the Crédit Foncier	2.50%
	3% and 4% Industrial Bonds	10%
Shares		
	Shares in a 6 main railways companies	6%
	Shares in Algerian railways companies	3%
	Shares in secondary railway network companies	2%
	Shares in French banks	5%
	Share in life insurance companies	3%
	Share in fire insurance companies	2%
	Shares in colliery companies	3%
	Shares in metalworking, steelworks and building companies	3%
	Shares in transportations, tramways and electricity companies	3%
Total domestic securities		**75%**
Governement loans and foreign securities		
	Debts of low-risk countries	5%
	Debts of moderate-risk countries	3%
	Debts of high-risk countries	2%
	3% and 4% Industrial Bonds	5%
	Shares in foreign railways companies	3%
	Shares in foreign banks	5%
	Shares in various foreign industrial companies	2%
Total		**100%**

Source: Neymarck, 1913, p. 377, reproduced by Edlinger & Parent, 2014, p. 40.

Neymarck admitted that the restricted portfolio and limited financial means of 'small investors' meant that they could not obtain the same returns as the richest investors:

> The small rentiers, whose means are weak, who often just have what is required to survive, are the ones who have to be content with tiny incomes, investments under 3%, investments at 2.5% or 2%, or at 'almost nothing percent', as the scoffers would say; whilst the big stock holders can afford investments yielding 4.5% or 6%! (Neymarck, 1913, pp. 284–285; Edlinger & Parent, 2014, p. 37, footnote 34.)

At a general point of view, Neymarck (1913) invites the reader to a form of 'Discourse of the method'. This method consists of a classification method that is initially based on the type of investor, then on a proportion of types of assets to be respected within the portfolio of each category of investor. Neymarck's classification method is therefore to favor asset classes (by identifying types of investors) rather than promoting particular assets rather than others.[10]

Neymarck (1913) only clearly names three assets, which are all included in the portfolio of 'small investors'. Two of them correspond to an investment category. These three assets are:

- The 3% French rente: this makes up part of the 30% of the portfolio dedicated to 'French rentes and other colonial loans guaranteed by the State'. Neymarck considers this 3% French rente to be one of a number of perpetual funds that are 'an absolute security' (page 366).
- City of Paris Bonds and Crédit Foncier Bonds, each accounting for 20% of the total portfolio of 'small capitalists and rentiers'.

On p. 372, Neymarck's (1913) recommendations to the 'middle class' highlight new categories of securities: French industrial bonds, shares in the French railways and foreign Government funds. Neymarck justifies this selection by the economic argument of the liquidity of the market to which they are backed. Shares in French railways (the only variable-income assets included in this asset class) are described as follows by the author: 'These are the only variable-income securities that we have indicated to middle-class security-holders; they are, moreover, variable-income securities of a very special nature, given that the State, under the terms of the 1883 agreement, guarantees them a minimum dividend. This minimum income is 38 francs for the East, 88 francs for Lyon, 80 francs for the South, 56 francs for Orleans, 84 francs for the North' (p. 374). The investor is therefore free to select these securities as he wishes. Finally, for the category of 'capitalists and rentiers', no advice is given for the choice of securities to be included in the portfolio:

> It is, of course, impossible to highlight categories among all these assets of such diverse origins and importance, it is *a priori* appropriate to put this one in the portfolio or to discard that one; we must limit ourselves to general observations on this point (p. 380).

This study seeks to reconstruct the portfolio advice provided by Neymarck and measure its efficiency (in line with the Modern Portfolio Theory) under several assumptions based on the actual returns of the securities listed on *L'Economiste Francais* from 1903 to 1912.

3. Creation of a new database using the financial information published in *L'Économiste Français*

As explained in the introduction, no existing database was adequate for the reconstruction of these portfolios; even if we had combined them all, some types of securities would still have been missing. Our new database is entirely composed of the information provided by *L'Economiste Français,* the most popular journal at that time, known for its reliability. For this reason, this database can be considered as an indicator of available public information. We first photographed the financial part of the 520 editions published between December 1902 and December 1912. The documents were provided by the library of the Faculty of Law, Economics and Management in Nancy. Eight well-differentiated categories of securities were identified, namely French and Colonial Debts, Other French Public and Municipal Debts, Corporate Bonds, Main Foreign Government Debts, Shares in Railways in France and Abroad, Bank Shares, Insurance Shares and Shares issued by 'Various Companies'.

We collected the most recently published price at the end of the current month. When the security considered had not been quoted during the last week of the month, we took the price of the previous week into consideration (this concerns less than 0.1% of the prices of the final database). We then calculated the monthly returns for every security according to the following formula:

$$R_{i,t} = \frac{P_{i,t} + D_{i,t} - P_{i,t-1}}{P_{i,t-1}}$$

Where

$R_{i,t}$ refers to the return of security i for the month t;

$P_{i,t}$ refers to the price of security i for the month t;

$D_{i,t}$ refers to the dividend or coupon of security i received during the month t;

These are nominal returns. As our aim is to replicate available information, we do not correct the returns with a price index, built post-date. Moreover, Bouvier (1979, p. 42) notes that prior to 1914 'the word "inflation" is only defined in dictionaries as "pathological swelling", because it does not exist in economics. Prices are directed by gold standard constraints, the slow growth of consumption, the compression of domestic demand, and the success of production and productivity. The inflationist era begins beyond this point'. Asselain (1984) has a similar opinion, claiming that the rise in prices is not anticipated because it isn't a 'perennial reality'.

We excluded 23 securities because of their specificities: premium bonds, 'jouissance' shares and founders' shares. Leroy-Beaulieu (1906) and Neymarck (1913) give precise definitions of the various type of categories listed on the Paris Stock Exchange. Premium bonds are debt securities which offer an additional income when reimbursed as a result of a lottery, in addition to the coupons. 'Bons' are equivalent to zero-coupon bonds, since there is no coupon during their lifetime. As we do not have any precise information regarding these additional incomes (amount, quantity, due date), they have been removed from our database. 'Jouissance' shares are usually issued by companies with public concessions when the ordinary shares are reimbursed during the company's lifetime. They give neither voting rights nor dividends, but their owners can obtain a share of any additional profit or remaining asset on the dissolution of the company. Founders' shares are very similar except that they are granted to company's founders without any financial counterpart. Due to their particular and marginal status in comparison with other types of security, we have decided to exclude them from this study.

As a result, our database is exclusively composed of rentes, ordinary shares and bonds. We therefore only retain the securities traded every month. Between January 1903 and December 1912, 139 securities matched this constraint. Unfortunately, no single share in insurance was traded without interruption throughout the period in question. In order to continue using these two sectors (share of life insurance companies, share of fire insurance companies) quoted by Neymarck, we built two indices by calculating their monthly returns as the average of the monthly returns of the securities composing them (15 stocks for the share of life companies and 17 stocks for share of fire insurance companies, see Table 5). The resulting database consists of 139 individual securities (from 23 different sectors) and 2 insurance indices (for life insurance and fire insurance).[11]

We corrected the prices and the corresponding returns according to the various events that could affect the prices of securities, such as the assimilation of securities, mergers or nominal value division. These are detected by observing the average returns and the maximum and minimum returns of each security: extreme values are often an indicator of this type of event. Substantial research is needed to identify the reasons behind these extreme price variations; although most of the information is available in the journal, it does not necessarily accompany the price movements. Sometimes these anomalous values simply

Table 5. Description of the 25 indices.

Number	Index name	Number of securities	Monthly average returns	Standad deviation
1	3% perpetual French rentes	1	0.1708	0.7128
2	3% redeemable French rentes	1	0.2065	0.7235
3	Colonial loans guaranted by French government	3	0.1683	0.9370
4	Unguaranted Colonial debts	3	0.2024	0.8870
5	Paris City bonds	8	0.1551	0.6618
6	Bonds Issued by the Crédit Foncier	8	0.1649	0.6417
7	2,5% Bonds in main railways companies	2	0.1451	0.7777
8	3% Bonds in main railways companies	10	0.1859	0.7473
9	Bonds issued by foreign railways companies	16	0.3030	1.3030
10	Bonds in Industrial and miscellaneaous French companies	3	0.4117	1.2252
11	Shares in a 6 main railways companies	6	0.2800	1.3720
12	Shares in Algerian railways companies	3	0.2994	1.1558
13	Shares in secondary railway network companies	1	−0.0194	5.7552
14	Shares in foreign railways companies	7	0.6160	2.9937
15	Shares in French banks	11	0.6651	1.3793
16	Shares in life insurance companies	1(15)	1.0724	2.3507
17	Shares in fire insurance companies	1(17)	0.4972	1.8229
18	Shares in foreign banks	3	0.4482	1.5791
19	Shares in collery companies	12	0.9005	2.1234
20	Shares in metalworking, steelworks and building companies	7	0.8494	2.4054
21	Shares in transportations, tramways and electricity companies	5	0.4597	3.5470
22	Shares in various indutrial companies	8	0.7341	2.7383
23	Debts of low-risk countries	8	0.2256	0.7823
24	Debts of moderate-risk countries	12	0.4261	1.3126
25	Debts of high-risk countries	3	0.5119	2.1621

reflect the bankruptcy of some companies. These extreme values can also be the signal of a nominal division of a security or a signal of a merger. For instance, this is the case of the share prices of the life insurance Companies Générale, Nationale and Phénix which were divided by five in May 1908 after a nominal division.

The monthly return of each index is calculated as the arithmetic average of the monthly returns of the securities making up this index. To avoid anachronism, we do not use security capitalization or outstanding debt value. Indeed, the complex calculations and data collection required by this process make this an unlikely preoccupation for a French investor prior to 1914, and Neymarck never mentions these criteria. In addition, neither *L'Economiste Français* nor the *Cours Authentique* report capitalizations or outstanding bond loan amounts. We can therefore presume that this information was not included in the portfolio decision process of French investors prior to 1914.

Ultimately, our database includes all available assets' categories: French rentes, French public or local bonds, foreign government debts, French and foreign private shares and bonds. It is initially organized in eight main categories, similar to those of *L'Economiste Français*. We reorganized them into 25 categories corresponding to the most detailed categories described by Neymarck (1913).[12] Table 5 describes these indices (wording and number) and gives the number of securities within each of them (first and second column). The third column gives the value of the monthly arithmetic average return, and the last column gives the monthly standard deviation.[13]

Over the period from 1903 to 1912, shares represent a higher overall risk than bonds. Only foreign railway bonds and French industrial bonds are as risky as some share indices.

The same applies for returns: with the exception of foreign railway and French industrial bonds, all the other fixed income indices are less profitable than share indices.

Share indices are the best performing indices in terms of average monthly returns, and this is particularly true of shares in French life insurance companies (index 16) and French and foreign industrial companies (indices 19, 20), followed by shares in French banks (index 15), which have the additional advantage of being less risky than the preceding categories, and foreign railway companies (index 14). Share indices are also the most volatile indices. The worst performing index – in terms of return and volatility – is also a share index, namely shares in secondary French railway companies (index 13).

The 'main French railway companies' (indices 7, 8 and 11) are the six companies for which the French State guarantees a minimum dividend: these are the Compagnie du Nord, de l'Est, du Midi, de l'Ouest, de Lyon and d'Orléans. The Algerian railway companies whose shares make up index 15 are the companies of Bône-Guelma, Est-Algérien and Ouest-Algérien. They also benefit from a guarantee from the French government. Foreign railway bonds and shares come solely from southern Europe and Austria. There are three securities in the industrial bond index, issued by the Compagnie Transatlantique (Maritime transportation), Fives-Lille (Metalworking) and the Compagnie Générale des Eaux (Water). The industrial shares indices (19, 20, 21 and 22) are composed of 32 securities: the colliery shares index (index 19) contains 12 stocks of French colliery companies, and the metalworking, steelworks and building shares index (index 20) is composed of 7 stocks. Index 24 is mainly composed of shares in transportation companies. Both maritime and land transportation encountered great difficulties prior to the First World War, which explains why this index performs weakly in comparison to the other French industry indices. From the end of the nineteenth century onwards, many attempts were made to modernize land transportation and to move from horse-drawn transport to steam machines then to electricity. This rendered omnibus and some tramway lines obsolete, requiring huge investments. René Girault (1979, pp. 203–206) explains the difficulties of French maritime transportation over the same period: between 1897 and 1913, the French navy slipped from the second to the sixth world place in terms of shipped volume, far behind Great Britain and Germany.

The share index in various foreign industrial companies (index 22) is composed of 8 stocks from various industrial sectors: two are issued by the Suez company, three by mining companies whose exploitation sites are located in the South of Europe and one, for an oil rig in Russia, issued by the company Naphte de Bakou. There is also one water company and one Spanish gas company.

The French banks index (index 15) is made up of shares in major banks, many of which still exist today: the Banque de France, the Banque de Paris et des Pays-Bas, the Comptoir National d'Escompte de Paris, the Crédit Industriel et Commercial, the Société Générale pour le développement du commerce et de l'industrie, the Crédit Lyonnais, etc. There are three foreign bank shares (index 18) issued by Austria, Egypt and the Ottoman Empire.

The debts of low-risk countries are composed of British consols and bonds issued by Scandinavian countries (Finland, Norway and Sweden), Switzerland, and the Netherlands. The debts of moderate-risk countries are composed of bonds issued by European countries, namely Austria, Hungary, Greece, Spain and Italy. This category also includes securities issued by the governments of Argentina, Brazil and Russia. Finally, there are three bonds issued by less secure countries, i.e. Bulgaria, Serbia and the Ottoman Empire.

4. Methodology and empirical results

4.1. Risk perception of each category of assets by Neymarck

Before carrying out a detailed analysis of the portfolios proposed by Neymarck, we compared the investment universes he suggests for each type of investor. He builds them by progressively adding riskier types of securities to the 'safe' base. This analysis is based on Table 5 (Section 3).

The first eight indices are the indices composing the 'safe' base: the two French rentes (indices 1 and 2), colonial debts (guaranteed or not; indices 3 and 4), Paris city bonds (index 5), the bonds issued by the *Crédit Foncier* (index 6) and the bonds in the main railway companies (indices 7 and 8). Neymarck considers these to be the safest categories for investment (1913, page 373). Table 5 shows that they are, indeed, the least volatile indices. The debts of low-risk countries (index 23) also show similar properties. Figure 1 shows the indices according to their average return and their risk measured by the standard deviation: These eight first indices are remarkably close to each other. Additionally, with the exception of the 3% redeemable French rente and the 2.5% railway bonds, these indices are highly correlated, with correlation coefficients ranging from 0.45 to 0.85 (see Supplementary material, Appendix 1). This outcome suggests that Neymarck has correctly identified the safe base, i.e. the most secured securities. It is worth noting that the debts of low-risk countries could have been added to this group of indices. Neymarck added this category as early as the second portfolio (Table 2). This could indicate that he was aware of its low volatility. He writes (page 375) that these indices offer 'a slightly higher income than the French rentes with excellent safety guarantees'.

For middle-class investors, Neymarck suggests building a portfolio that is mainly concentrated on the safe base (representing 70% of the portfolio). He adds three of the least volatile categories: the debts of low-risk countries (index 23, included in the first group highlighted in Figure 1), shares in the main French railway companies (index 11, included in the second group in Figure 1) and bonds in industrial companies (index 10, included in the second group

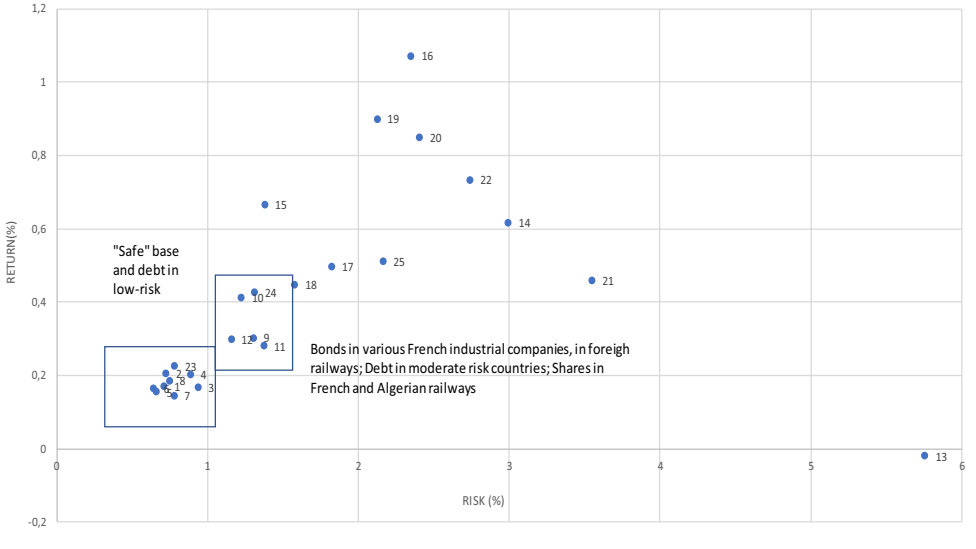

Figure 1. Position of the 25 indices in a risk/return framework.

in Figure 1). These indices actually add slightly more return and volatility to the portfolio. The safe base only represents 55% of the advised portfolio for well-off investors, and the three additional categories mentioned for the middle-class investors now make up 35% of the portfolio (i.e. 5% more than for the middle-class investors). In addition, Neymarck suggests adding much riskier indices with average returns that are between 3 and 6 times higher than those of the safe base indices. These indices are the bank and insurance share indices[14] (indices 15, 16, 17) and the industrial share indices (indices 19, 20, 21 and 22). Note that these very high returns are not observed for shares in transportation, tramways and electricity, which are very risky for an average return that is only twice as high as those of safe-base indices). The portfolio suggested to the richest investors (investors with large fortunes) includes all possible categories

Finally, Neymarck (1913) established the classification between the three categories of foreign government debts. It is interesting to note how this author identified foreign debts according to their risk and return levels (see Table 5 and Figure 1): the foreign government debts of low-risk countries are indeed the least risky but also the least profitable, whilst the debts of high-risk countries (third class foreign debts) are both the riskiest and the most profitable of all foreign government debt categories. This fits the link made by Neymarck (1913) between risk and return.

This first result demonstrates that Neymarck correctly identified the least risky categories of assets, namely the safe base, and successfully evaluates the overall risk of each sector.

4.2. Advised versus optimal portfolios

Taking our analysis one step further, we considered a risk-averse investor who follows the Modern Portfolio Theory principles, and specifically applies the Capital Asset Pricing Model (Sharpe, 1963; Lintner, 1965; Mossin, 1966). A classical methodology is implemented to test the rationality of investments, as used by Goetzmann and Ukhov (2006) or Edlinger, Merli, and Parent (2013). The idea is that if investors used monthly returns from January 1903 to December 1912 to form their risk/return expectations for January 1913, the mean variance solution would maximize their utility and would be superior ex post to any other advised recommendation.[15] By using Markowitz mean variance optimization as an efficiency benchmark, we can compare the portfolios that we expect rational investors to have held on the eve of the First World War with those suggested by Neymarck (1913).

The diversification principle postulates that when building a portfolio with imperfectly correlated stocks, an investor can reduce the overall variance of his portfolio, thereby reducing its risk. This investor should select an efficient portfolio, i.e. a portfolio providing minimum variance for a given expected return (or providing maximum expected return for a given variance). The set of efficient portfolios is called the *efficient frontier of risky assets* or the *mean variance frontier*. When a risk-free asset is available on the financial market, the efficient portfolio with the highest Sharpe ratio is the optimal one. The Sharpe ratio measures the excess of return compared to the risk-free rate by risk unit and is defined as:

$$SR[\tilde{r}_x] = \frac{E[\tilde{r}_x] - r_f}{\sigma[\tilde{r}_x]}$$

where $E[\tilde{r}_x]$ is the expected return of the portfolio, $\sigma[\tilde{r}_x]$ is the volatility of the portfolio and r_f is the risk-free rate.

These investors allocate their wealth according to the previous monthly returns of assets As Neymarck had keenly observed economic life since the beginning of the century, we based our analysis on a long period from 1903 to 1912. The probability distribution of stock returns was used to construct the efficient frontier and find the optimal portfolio for each type of investor. For this study, the investment universes of each type of investor are considered to correspond to those suggested by Neymarck. For instance, the universe of small investors is composed of French rentes, colonial debts guaranteed by the French government, railway bonds guaranteed by the French government, un-guaranteed colonial debts, Paris city bonds, and bonds issued by the *Crédit Foncier* (see Table 1). Similarly, the investment universe of investors with large fortunes covers all the stocks listed on our database (see Table 4). As a consequence, we constructed four mean variance frontiers and four optimal portfolios.

Statistical analysis revealed that no asset was risk-free: the standard deviation of every security of our database is above 0.5% and below 11.4% (or annual standard deviations of around 1.7% and 39.5%, respectively). Neymarck (1913, p. 364) expresses the view that no security, even the 'safest', is risk-free: 'All the securities, without exception, have some risks; the expression *tranquil security, safe security* is only an expression; in fact, securities, like real estate investments, can be hazardous'.[16] He nevertheless considers the 3% French rente to be the safest security[17]:

> We consider the 3% French [perpetual] rente, our great national fund, to be absolutely safe because it has a signature that will never be refused: that of France. Nevertheless, like every security, it is subject to varying fluctuation: one must, indeed, bear in mind that in addition to the intrinsic value of this security and the soundness of its guarantees, there is another component that influences the determination of its price: the cost of money, which is very variable and depends on the monetary, economic and financial situation of the country. (Neymarck, 1913, p. 365–366)

According to Neymarck, any investment in the 3% French rente should be made on the long-term because the investor can be sure of the regular payment of coupons (Neymarck, 1913, p. 367). In addition, like the other securities of the safe base, the French rente is accepted by the Banque de France as a guarantee for short-term loans. This means that investors who needed money could keep their securities and obtain a short-term loan from this financial institution. For Neymarck (1913, p. 373), this option was particularly interesting for the investor at times when selling securities would lead to capital losses: 'It is interesting to hold in one's portfolio a certain number of securities against which the Banque de France agrees to accord a loan, thus making it possible, at a given time and for a short period, to easily obtain funds without selling the securities at the wrong time and running the risk of having to buy them back at a higher price later, once the squall has passed'.

Finally, this study does not consider short sales – our intention is to scrupulously replicate Neymarck's portfolios, and no such strategy is described in his portfolio advice. Similarly, Hayaux Du Tilly (1901) argues that short sales are practiced on a small scale and only by professionals. Neymarck's advice is clearly not intended for professionals: 'This book is not intended for the professionals of the Stock Exchange' (Neymarck, 1913, p. V).[18]

Our optimal portfolios and the efficient frontiers of risky assets were built under two main assumptions, namely A1: There is no risk-free asset; A2: The 3% perpetual French rente is considered as the risk-free French asset. The risk-free rate is thus equal to the average monthly

return of this asset from 1903 to 1912, namely 0.171%, and the optimal portfolio is the portfolio which maximizes the Sharpe ratio. Under assumption A1, we compare the portfolio advised by Neymarck with the efficient portfolios that have the same risk. Under a third assumption (A3), the 3% perpetual French rente is considered as a benchmark for risk-free investment by French investors. We therefore consider it as the new numeraire. The prices of all assets are expressed in rente units, i.e. investors assess security performances through the prism of the performance of the 3% perpetual French rente.[19]

For each assumption described above (A1, A2 and A3), we constructed optimal portfolios for each type of investor according to their investment universe. For each type of investor, the investment universe is limited to the categories suggested by Neymarck (see Tables 1–4).

As a main test, we determined the optimal portfolios when the investment universe is composed of indices (called *Optimal Portfolio Indices*). This portfolio is then compared to Neymarck's advised portfolio (called *Advised Portfolio Indices*).

We also carry out two robustness tests. First, we determined the optimal portfolios for each type of investor, presuming that the investment universe is composed of stocks. We built the advised portfolios based on the assumption that investors are free to select one security or more from the categories suggested by Neymarck. The proportions invested in this portfolio must respect the proportions advised by Neymarck (this portfolio is called *Advised Portfolio Stocks*). The *Advised Portfolio Stocks* could be viewed as the best combination of securities while respecting the proportions suggested by this analyst. This portfolio is then compared to the optimal portfolio obtained from the stock universe (called *Optimal Portfolio Stocks*). A second robustness test determined the optimal portfolios for each type of investor, based on the assumption that the investment universe is composed of the best stock of each category.

The small investor's investment universe is limited to the eight first categories shown in Table 5, namely the two 3% French rentes, the two colonial debts indices, the Paris city bonds index, the bonds issued by the *Crédit Foncier* and the 2.5% and 3% bonds in main French railway companies. When the 3% perpetual French rente is considered as the risk-free French asset, the small investor's *Optimal Portfolio Indices* is the combination of these eight indices, which maximizes the Sharpe ratio. The *Advised Portfolio Indices* for small investors is a portfolio in which 30% is attributed to French rentes and guaranteed colonial debt indices, 20% to the Paris city bonds index, 20% to the *Crédit Foncier* bonds index, 10% to the unguaranteed colonial debts and 20% to the index of shares in main French railway companies (see Tables 1–4 and Table 6 for each advised portfolio composition).

The *Optimal Portfolio Stocks* for small investors is the combination of stocks belonging to the eight above-mentioned categories, which maximizes the Sharpe ratio. In the *Advised Portfolio Stocks* portfolio, 30% is attributed to one security or more from the guaranteed French rentes and colonial debts categories, 20% to one security or more from the Paris city bonds category, 20% to one security or more from the *Crédit Foncier* bonds category and 20% to one security or more from the main French railway company share category.

Table 6 details the composition of the advised portfolios: it cross-references Tables 1–4 with the categories we built. When the existence of a risk-free asset is taken into account for the building of portfolios (Assumption A2), the weight of the 3% French perpetual rente is set to zero and the weights of other categories are recalculated so that the sum of the weights of all the categories is equal to one.

Table 6. Composition of the advised portfolios.

	Index name	Small investors	Middle-class investors	Well-off investors	Large Fortunes investors
1	3% perpetual French rentes				5%
2	3% redeemable French rentes	30%	25%	20%	10%
3	Colonial loans guaranted by French government				5%
4	Unguaranted Colonial debts	10%	10%	5%	
5	Paris City bonds	20%	10%	10%	3%
6	Bonds Issued by the Crédit Foncier	20%	10%	10%	3%
7	2,5% Bonds in main railways companies	20%	15%	10%	5%
8	3% Bonds in main railways companies				5%
9	Bonds issued by foreign railways companies				5%
10	Bonds in Industrial and miscellaneaous French companies		10%	10%	10%
11	Shares in a 6 main railways companies		10%	15%	6%
12	Shares in Algerian railways companies				3%
13	Shares in secondary railway network companies				2%
14	Shares in foreign railways companies				3%
15	Shares in French banks				5%
16	Share in life insurance companies			5%	3%
17	Share in fire insurance companies				2%
18	Shares in foreign banks				5%
19	Shares in collery companies				3%
20	Shares in metalworking, steelworks and building companies			5%	3%
21	Shares in transportations, tramways and electricity companies				3%
22	Shares in various indutrial companies				2%
23	Debts of low-risk countries		10%	10%	5%
24	Debts of moderate-risk countries				3%
25	Debts of high-risk countries				2%
	Total	100%	100%	100%	100%

Source: Neymarck, 1913.

When we work on indices, where Neymarck suggests that one proportion should be divided among several indices, we weight each of these indices equally[20]. For example, Neymarck advises small investors to invest 20% of their portfolio in bonds issued by the main French railway companies. We thus consider that these investors split this investment equally between the 2.5% bonds and 3.5% bonds issued by main French railway companies.

4.3. Portfolio risk and return analysis

Table 7 illustrates the clear hierarchy between the four investors, which is consistent with Neymarck's hypothesis: investors with greater means and thus wider investment opportunities obtain portfolios with higher return and higher risk. We note the same outcome in each case (indices or stocks) under our two assumptions A1 and A2 (see Table 7).

Table 7 shows the performances of optimal and advised portfolios for each type of investor under assumptions A1 and A2, when considering indices or securities. For each portfolio, it details the monthly average return (Return), the associated standard deviation (Risk) and the number of indices or securities involved. The Sharpe ratios are given under assumption A2.

Under assumption A1, when considering indices and following Neymarck's advice, investors could obtain an annual return of about 2.1% for small investors, 2.6% for middle-class investors, 3.3% for well-off investors and 4.5% for investors with large fortunes. When working

Table 7. Portfolios performances according to investor type.

A1: No risk free asset									
	Optimal (risk)	Indices				Optimal (risk)	Stocks		
Investors	Small	Middle-Class	Well-Off	Large Fortunes	Investors	Small	Middle-Class	Well-Off	Large Fortunes
Return	0.187%	0.235%	0.449%	0.564%	Return	0.223%	0.288%	0.534%	0.634%
Risk	0.543%	0.615%	0.664%	0.825%	Risk	0.438%	0.538%	0.549%	0.627%
Number	5	6	9	9	Number	6	7	15	17
	Advised	Indices				Advised	Stocks		
Return	0.172%	0.214%	0.274%	0.374%	Return	0.201%	0.264%	0.349%	0.414%
Risk	0.543%	0.615%	0.664%	0.825%	Risk	0.438%	0.538%	0.549%	0.627%
Number	8	11	18	25	Number	12	16	23	37
A2 : The 3% French Rente is the risk free asset									
	Optimal	Indices				Optimal	Stocks		
Investors	Small	Middle-Class	Well-Off	Large Fortunes	Investors	Small	Middle-Class	Well-Off	Large Fortunes
Return	0.206%	0.412%	0.838%	0.838%	Return	0.222%	0.510%	0.645%	0.716%
Risk	0.681%	1.220%	1.281%	1.281%	Risk	0.422%	0.805%	0.689%	0.755%
SHARPE	0.051	0.197	0.521	0.521	SHARPE	0.120	0.422	0.689	0.723
Number	2	2	5	5	Number	6	2	15	26
	Advised	Indices				Advised	Stocks		
Return	0.172%	0.218%	0.218%	0.385%	Return	0.199%	0.265%	0.393%	0.519%
RISK	0.548%	0.625%	0.676%	0.845%	RISK	0.435%	0.539%	0.626%	0.829%
SHARPE	0.00	0.08	0.16	0.25	SHARPE	0.07	0.02	0.35	0.42
Number	7	10	17	24	Number	35	50	20	39

on securities, the range of return is from 2.4% to 5%. Under assumption A2, the range of return is from 2.1% to 4.6% when working on indices and from 2.4% to 6.2% when stocks are considered. This hierarchy is consistent with Neymarck's predictions. As we mentioned earlier, Neymarck reports that small investors should only seek returns of between 2% and 3%, whilst bigger investors can seek for returns of up to 4.5% or 6%.

Similarly, our findings indicate that the Sharpe ratios of the advised portfolios increase with the wealth of investors. For instance, the value of the Sharpe ratio when considering indices under assumption A2 is about 0.0019 for small investors and reaches a value of 0.25 for investors with large fortunes (0.08 for middle-class investors, 0.16 for well-off investors). The performances of the portfolios built according to Neymarck's guidelines therefore confirm the ranking announced by the analyst, both in terms of risk and in terms of return: the richer the investor, the riskier and the more profitable his portfolio will be. This result suggests that the benefit of diversification is therefore clearly exploited by the analyst.

4.4. Structure of the advised portfolios compared to efficiency

Figure 2 shows the efficient frontier built on all indexes and the advised portfolios obtained under assumption A1. It provides a general idea of the position of each advice portfolio regarding the distance to the global efficient frontier and not surprisingly, shows that none of these portfolios are efficient. If we compare each portfolio with the optimal portfolio (on the efficient frontier) bearing the same risk, there is a very similar lack of return. The value is 0.163 for small investors, 0.191 for middle-class investors, 0.173 for well-off investors and 0.19 for rich investors.[21]

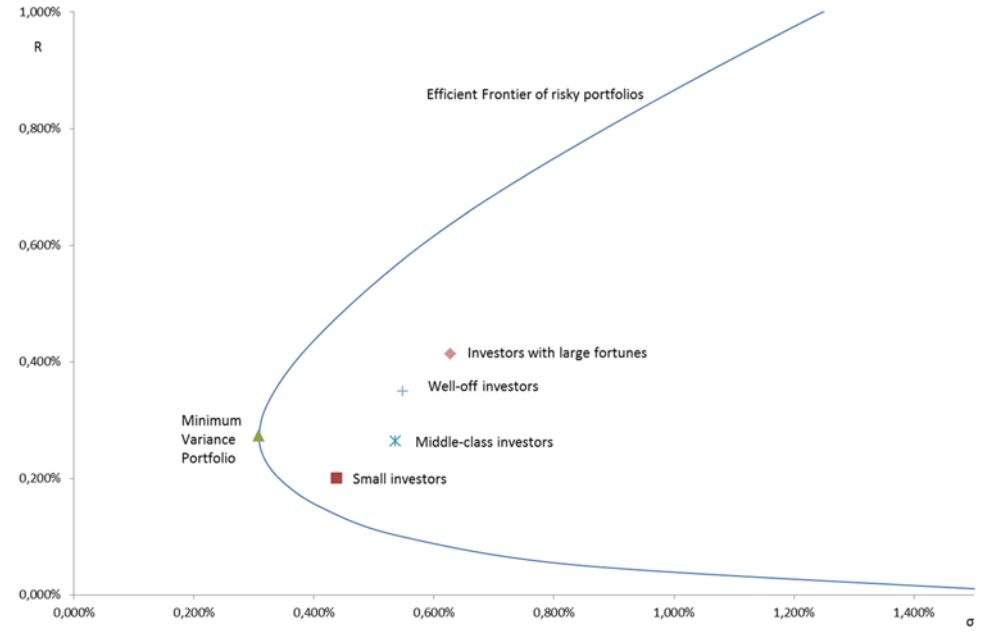

Figure 2. Advised portfolios and the efficient frontier.

To analyze the lack of efficiency of Neymarck's suggested portfolios in greater detail, we compare the optimal portfolios to the portfolios advised by Neymarck (using indices or stocks) for each category of investors (with four different investment universes). Under assumption A2, loss of efficiency is measured by comparing the level of the Sharpe ratios. Under assumption A1, we compare the portfolio advised by Neymarck with efficient portfolios that have the same risk.

There is a clear loss of efficiency for each category of investors in the advised portfolios compared to the same categories in the efficient portfolios (see Table 7). For instance, under assumption A2, Sharpe ratios for the well-off investor's advised portfolios are equal to 0.163 (indices) and 0.354 (stocks), whilst the optimal portfolio Sharpe ratios for the same investor category are equal to 0.521 (indices) and 0.689 (stocks), i.e. three and two times higher than the advised portfolio values, respectively. Table 7 confirms these results under assumption A1 for each category of investors. Using indices, the return for the well-off investor's advised portfolios is about 0.274% and the risk is 0.664%. The optimal portfolio with the same risk (0.664%) has a return of 0.449%. The return of the optimal portfolio is therefore 0.17 lower than that associated with the advised portfolio.

We next consider the optimal portfolio structures to pinpoint the main reasons for the lack of performance in the advised portfolios, aiming to identify the sectors within the advised portfolios that were overweighted or underweighted with respect to the level of risk proposed by the analyst for each category of investors. Table 8 shows the composition of the *Optimal Portfolio Indices* under assumption A1 for each type of investor defined by Neymarck.

The first results show that the advised portfolios systematically involve a much higher number of indices than the corresponding optimal portfolios (Table 8, and 'number' lines in Table 7). For instance, Neymarck advises small investors to invest in eight different categories,

Table 8. Optimal Portfolio according to the type of investor under assumption A1.

		Small		MC		WO		Large Fortunes	
Index	Name	Advised	Optimal (risk)	Advised	Optimal (risk)	Advised	Optimal (risk)	Advised	Optimal (risk)
1	3% perpetual French rentes		0%		5%		0%	5%	0%
2	3% redeemable French rentes	30%	48%	25%	17%	20%	15%	10%	8%
3	Colonial loans guaranted by French government		0%		0%		0%	5%	0%
4	Unguaranted Colonial debts	10%	1%	10%	0%	5%	0%		0%
5	Paris City bonds	20%	0%	10%	21%	10%	0%	3%	0%
6	Bonds Issued by the Crédit Foncier	20%	30%	10%	16%	10%	0%	3%	0%
7	2,5% Bonds in main railways companies	20%	5%	15%	25%	10%	25%	5%	18%
8	3% Bonds in main railways companies		15%		2%		0%	5%	0%
9	Bonds issued by foreign railways companies							5%	0%
10	Bonds in Industrial and miscellaneaous French companies			10%	0%	10%	4%	10%	9%
11	Shares in a 6 main railways companies			10%	0%	15%	0%	6%	0%
12	Shares in Algerian railways companies							3%	0%
13	Shares in secondary railway network companies							2%	0%
14	Shares in foreign railways companies							3%	0%
15	Shares in French banks						9%	5%	15%
16	Share in life insurance companies					5%	16%	3%	21%
17	Share in fire insurance companies						4%	2%	3%
18	Shares in foreign banks							5%	0%
19	Shares in collery companies						6%	3%	10%
20	Shares in metalworking, steelworks and building companies					5%	0%	3%	0%
21	Shares in transportations, tramways and electricity companies						0%	3%	0%
22	Shares in various indutrial companies						4%	2%	3%
23	Debts of low-risk countries			10%	14%	10%	19%	5%	13%
24	Debts of moderate-risk countries							3%	0%
25	Debts of high-risk countries							2%	0%
	Total	100%	100%	100%	100%	100%	100%	100%	100%

yet the Modern Portfolio Theory states that their portfolios should be composed of five categories to reach a higher level of return. He also encourages well-off investors to distribute their holdings across eighteen categories and suggests that investors with large fortunes should spread them across 25 categories, yet the optimal portfolios of these two investor types are composed of nine categories of assets.

These results are driven by the fact that some indices are clearly dominated by others and add nothing to the diversification. For instance, the small investor's portfolio is exclusively composed of safe-base investments. The categories it contains are very close and are all strongly correlated (see Supplementary material, Appendix 1 and Figure 1). This indicates that the indices included in the optimal portfolios are either those that are the least inter-correlated or those that slightly dominate other indices. The redeemable French rente is an attractive bond, since it is not only among the least risky and the least correlated categories, but is also located in the most profitable category. The 'unguaranteed colonial debts' index

Table 9. Composition of the aggregated optimal portfolios.

		Small investors		Middle class		Well-off		Large fortune	
		Advised	Optimal (risk)	Advised	Optimal (risk)	Advised	Otimal (risk)	Advised	Optimal (risk)
A	French rentes and Colonial debts	40%	49%	35%	22%	25%	15%	20%	8%
A	Paris City bonds	20%	0%	10%	21%	10%	0%	3%	0%
A	Bonds Issued by the Crédit Foncier	20%	30%	10%	16%	10%	0%	3%	0%
A	Bonds in main railways companies	20%	21%	15%	27%	10%	25%	10%	18%
Total	A (SAFE BASE)	100%	100%	70%	86%	55%	40%	35%	26%
B	Bonds issued by foreign railways companies						0%	5%	0%
B	Bonds in Industrial and miscellaneaous French companies			10%	0%	10%	4%	10%	9%
Total	B	0%		10%	0%	10%	4%	15%	9%
C	Shares in French, Algerian and Foreign railways companies			10%	0%	15%	0%	14%	0%
C	Shares in French and Foreign banks and French Insurance companies					5%	29%	15%	38%
C	Shares in French and Foreign indutrial companies					5%	10%	11%	14%
Total	C	0%		10%	0%	25%	38%	40%	53%
D	Debts of foreign countries			10%	14%	10%	18%	10%	13%
Total	D			10%	14%	10%	18%	10%	13%
GLOBAL		100%		100%	100%	100%	100%	100%	100%

is excluded from the optimal portfolio; this index is attractive in terms of return but is strongly correlated to the other indices and is also the least profitable category in terms of risk/return trade-off.

It is worth noting that this type of analysis is achieved via the precise evaluation of risk, return and correlations across indices. Although analysts at the beginning of the 20th century were familiar with these concepts, it was impossible for them to attain this level of detail (see also Rutterford & Sotiropoulos, 2016).

To go one step further, we adopted a more general approach by analyzing the aggregate composition of the *Optimal Portfolios Indices* under assumption A1 for each type of investor. These compositions are shown in Table 9. The safe base (Category A) is composed of the two 3% French rentes (indices 1 and 2), the two colonial debts indices (indices 3 and 4), Paris city bonds (index 5), *Crédit Foncier* bonds (index 6) and the 2.5% and 3% railway bond indices (indices 7 and 8). 'Shares in French, Algerian and foreign railway companies' include all the railway share indices, namely indices 11 to 14. 'Shares in French and foreign banks and French insurance companies' include all the bank and insurance shares indices, namely indices 15 to 18. 'Shares in French and foreign industrial companies' include all the industrial shares indices, namely indices 19 to 22. Finally, 'debts of foreign countries' include the three foreign debts indices, namely indices 23 to 25.

The compositions of the optimal portfolios (bearing the same risk) show that the optimal proportion dedicated to the safe base for middle-class investors is much higher than the proportion advised by Neymarck (86% and 70%, respectively). For this category, the optimal

portfolio is exclusively composed by categories A and D ('safe base' and 'debts of foreign countries'). Diversification on the stock market and other bonds does not seem necessary for this category of investors.

For the two richest categories of investors, the proportion invested in category A is lower than the proportion advised by Neymarck. The safe base is 41% for well-off investors and 26% for investors with large fortunes, whereas Neymarck advised investing much more, i.e. 55% for well-off investors and 35% for investors with large fortunes. Neymarck therefore seems to have overestimated the positive role played by the safe base on the risk/return trade-off for rich investors. Similar observations can be made for category B. The compositions of the optimal portfolios also show that Neymarck underweighted the optimal proportions dedicated to category C (category of shares), which represents 50% of the optimal portfolio for the richest investor and 38% of the optimal portfolio of the well-off categories. Table 9 shows that within category C, the 'Shares in French, Algerian and Foreign railways companies' are clearly overweighted by the analyst. It is worth noting that the French government guaranteed a minimum dividend value to the shareholders of main French railway companies and the Algerian railway companies, making them a potentially attractive investment. The proportion of wealth invested in 'Shares in French and Foreign banks and French Insurance companies' is strongly underestimated by Neymarck in this category.

Finally, Neymarck's advice is a little over-cautious regarding investment in the 'Debt of foreign countries' index, particularly for well-off investors. Table 8 shows that this is due to the proportion of wealth invested in index 23 ('Debt of low-risk country'). This index is attractive in terms of risk/return trade-off and the level of correlations (see Table 5 and Supplementary material, Appendix 1). The compositions of the optimal portfolios show that the optimal proportion invested in this index is expected to be 14% for middle-class investors (compared to 10% in advised portfolios), 19% for the well-off (vs. 10%) and 13% for investors with large fortunes (vs. 5%).

Overall, we can therefore consider that Neymarck overestimated the positive role played by the safe base for rich investors and that the diversification of the portfolio he implemented led him to overweight certain indices such as the railway shares guaranteed by the French government, while underweighting the role played by shares in 'French and foreign banks and French insurance companies' and foreign bond markets.

5. Conclusion

To the best of our knowledge, this article describes the first test of portfolio advice given by a French financial analyst in the early 20th century to evaluate how sound, effective and efficient this advice was. Our analysis focused on Neymarck's book (1913) *Que doit-on faire de son argent?*, in which he suggests a portfolio composed of categories of securities listed on the Paris Stock Exchange for each of four categories of investor wealth.

In a first step, we created a custom-made database using data for all the types of securities listed on the Paris Stock Exchange before 1913 and reported in *L'Économiste Français*. The database is split into 25 categories based on Neymarck's categories of securities, and contains the monthly returns of 139 securities listed continuously on the Paris Stock Exchange from January 1903 to December 1912. We consider this database to be a reliable

indicator of public financial information. We then compared Neymarck's advised portfolios with the performances of these Paris Stock Exchange indices. Our findings reveal that Neymarck correctly identified the least risky categories of assets, namely the safe base, and successfully evaluated the overall risk of each sector.

We then considered risk-averse investors following the Modern Portfolio Theory and built optimal portfolios following two main assumptions (presence or absence of a risk-free asset). For each type of investor, we considered the investment universe to be limited to the categories suggested by Neymarck.

This study shows a hierarchy in Neymarck's advised portfolios. The investors with less resources create portfolios with lower risk and return, whilst richer investors have portfolios with higher risk and return but also a higher Sharpe ratio. The results reveal that these portfolios exploit the benefits of diversification. This paper also demonstrates a systematic underweighting of the safe base by Neymarck for richer investors. The portfolio implemented by Neymarck led him to overweight some indices (i.e., railway shares guaranteed by the French government) while underweighting the role played by the shares of some companies (namely shares in French and foreign banks and French insurance companies).

However, the aforementioned imperfections enabled us to make some assumptions about how Neymarck composed his portfolios and particularly about how he estimated the risk and return of securities. Indeed, it seems that although he had correctly identified the least risky securities, his estimates were conceptual rather than based on rigorous calculus. This may have led Neymarck to suggest investing in too many categories of securities, whereas the optimization process requires much fewer. It is also important to note that Neymarck did not have access to any technology permitting the easy calculation and compilation of statistics to obtain optimal portfolios. His advice reflects the state of financial knowledge of the time, which Edlinger and Parent (2014) describe as a common-sense approach to portfolio theory at the beginning of the 20th century.

Ultimately, our results should be seen as a complement to the recent series of works on the composition of pre-WW1 UK portfolios. Our results illustrate what Rutterford and Sotiropoulos (2016) call the 'UK-French connection' favouring diversification. Indeed, the quality assessment of the advice provided by Neymarck is consistent, to a certain extent, with the MPT findings. Our results provide reliable evidence based on Neymarck's financial advice documents that rigorous portfolio selection techniques were proposed to French investors.

Notes

1. Bignon and Miscio, (2010, p. 397) recall that Neymarck advised investors to check the identity and interests of the management and journalists of a journal before trusting it.
2. For an analysis of investor financial portfolio strategies in England during the second half of the nineteenth century, see Sotiropoulos and Rutterford (2018) and Rutterford, Sotiropoulos, & van Lieshout (2017).
3. According to Neymarck, (1913, p. 348), 'For risk division to be effective there must be several placements of different types: national or local government loans, railway stock, various industrial companies and so on […] but this is not enough […] the diversification and decrease of risk should be carried out by distributing investments across stock from various countries'.
4. For instance, he describes the 'stock for additional income' as 'exposed to more vagaries than […] sound investments', and considers that they could boost the average income of a portfolio because they are 'likely to see capital gains' (1906, pp. 75, 81–82).
5. A more detailed description of this advice can be found in the second part of the paper.

6. Arbulu, 1998; Parent & Rault, 2004; Gallais-Hamono, 2007; Vaslin 2007; Rezaee, 2010; Lebris & Hautcoeur, 2010.
7. Paul Leroy-Beaulieu, who became a Professor at the Collège de France, published many books dealing with economics that revealed the concerns of French society prior to World War One. He also founded his own journal, *L'Économiste Français*, in 1873. He managed it until his death, supplying the readers of the journal with articles and information about economics, business and finance. Paul Leroy-Beaulieu presented and developed his advice in a successful handbook entitled *L'Art de Placer et Gérer sa Fortune* (1906).
8. We decided against using the *Cours Authentique*, published every day by the Compagnie des Agents de Change, because we assumed that this daily publication was designed for professionals operating on the Paris Stock Exchange rather than for ordinary investors. In addition, not all securities were listed on a daily basis. For example, a third of the available securities were not exchanged on July 1st 1912, and were therefore not quoted in the edition of *Cours Authentique* published that day.
9. Note that although Neymarck suggests investing 10% of funds in industrial French and foreign bonds, he does not add foreign industrial bonds to the portfolio of investors with large fortune, despite it is the largest portfolio. Edlinger and Parent (2014) therefore consider that he advises well-off investors to invest 10% in industrial French bonds alone.
10. «At the outset, can we ever be certain that we will choose the best assets? It is difficult to label assets as goods and rank them with numbers so that people can say, «buy N° 1 assets rather than N° 2 assets. A given asset may be the best one at one moment in time, but not at another. For example, a state fund may be the best asset to acquire when an event makes the price fall to a moderate level, yet it had not been the best value asset on the previous day. We can therefore say that an asset is good, very good, or excellent, but we cannot affirm that it is absolutely the best » (Neymarck, 1913, p. 368).
11. As a major part of our analysis is run using indices, this choice has no impact on our main conclusions.
12. See Table 4.
13. Note that asset category 13 is the only index made by just one security. This asset category weights 2% of one portfolio advised by Neymarck and is never included in the optimal portfolio. The results are not modified by the presence or absence of this category.
14. The bank shares index (18) is particularly interesting for the portfolio, since it shows very little additional risk for much higher return.
15. Note that the out-of-sample performance of this strategy is clearly debated. DeMiguel, Garlappi, and Uppal (2009) conclude that the out-of-sample performance of the sample-based mean-variance model (and its extensions designed to reduce estimation errors) is not consistently better than the 1/N rule ratio (called naïve diversification) in terms of Sharpe ratio. For a comparison between buy-and-hold and naïve strategies before WW1, see also Sotiropoulos and Rutterford (2018). This is tested in the next section.
16. 'Toutes les valeurs, sans aucune exception, présentent des risques ; l'expression *valeurs de tout repos, valeurs de toute sécurité* n'est qu'une expression; en réalité, les placements mobiliers de même que les placements immobiliers, présentent des aléas…'.
17. Over the period considered (1903–1912), we identified four securities that were less risky than the 3% French *Rentes*: one Paris city bond and three bonds issued by the *Crédit Foncier*.
18. 'Ce livre ne s'adresse pas aux professionnels de la Bourse' (Neymarck, 1913, p. V).
19. Our main conclusions are not modified by this choice.
20. This choice of distribution has very little effect on our results.
21. Note that by extending our data from January 1913 to July 1914, the results dealing with the *ex-post* performance of Neymarck's advice against the performance of the mean variance optimization over two periods (one year and eighteen months) are mixed. The results show that the advice of Neymarck outperform the optimization for two of the four investor categories (small investors and middle-class investors) and that the *ex-post* returns are very close for a third category (well-off investors). For instance, over a horizon of 18 months, the Sharpe ratio associated to the portfolio advised by Neymarck for the 4 categories of investors was 0.89, 1,08, 1,58 and 1.22, respectively. For the mean-variance portfolio, these values were 0.75, 1.02, 1,61 and 1.92, respectively.

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