Individual Investors and Portfolio Diversification in Late Victorian Britain: How Diversified Were Victorian Financial Portfolios?

Journal Item

Individual Investors and Portfolio Diversification in late Victorian Britain: How Diversified Were Victorian Financial Portfolios?

Janette Rutterford

The Open University Business School, Walton Hall, Milton Keynes, MK7 6AA, UK.

Tel.: +44(0) 1908 655 879, +44(0) 1908 655 812

Email: janette.rutterford@open.ac.uk

Dimitris P. Sotiropoulos

The Open University Business School, Walton Hall, Milton Keynes, MK7 6AA, UK.

Tel.: +44(0) 1908 655 879, +44(0) 1908 655 206

Emails: dimitris.sotiropoulos@open.ac.uk

Acknowledgements

We would like to thank Ann Carlos and the two anonymous referees for their suggestions and critical comments on the first version of this paper. The responsibility for any remaining errors or omissions is of course ours alone. This paper draws upon research undertaken as part of a collaborative research project: 'Women Investors in England and Wales, 1870-1930' funded by the UK's Economic and Social Research Council (Award: Res-000-23-1435). We gratefully acknowledge the support of the collaborators on this project − David Green, Josephine Maltby and Alastair Owens − as well as research assistants Stephen Ainscough, Carien van Mourik and Claire Swan.

[Draft: October 2017]

Abstract: This paper investigates Victorian investor financial portfolio strategies in England and Wales during the second half of the nineteenth century. We find that investors held on average about half of their gross wealth in the form of 4 or 5 liquid financial securities, but were reluctant to adopt fully contemporary financial advice to invest equal amounts in securities or to spread risk across the globe. They generally held under-diversified portfolios and proximity to their investments may have been an alternative to diversification as a means of risk reduction, especially for the less wealthy.

Keywords: Diversification, portfolio theory, portfolio characteristics, portfolio risk.
JEL Classifications: N23, N83, G11, G15.

Introduction

Investors diversified their portfolios long before the advent of modern portfolio theory (MPT) in the mid-twentieth century. For the UK, there is a consensus in the literature that "the practice of spreading capital among numerous investments was being adopted" at least from the last quarter of the nineteenth century (Cheffins 2010, p. 127; Foreman-Peck and Hannah 2011, p. 1222, Kennedy 1987, p. 145), with studies even investigating diversification as early as in the aftermath of the Glorious Revolution in the late seventeenth century (Carlos *et al.* 2015). The diversification principle is quite simple in its naïve version – put equal amounts in a number of different securities − and its adoption by active investors could thus seem a "natural and inevitable" result (Cole 1935, p. 58). Pre-MPT approaches to diversification, often framing themselves as "scientific investment" (Jefferys 1977, p. 416) or investment as an "exact science" (Lowenfeld 1907) put forward a more sophisticated set of investment rules. By World War I, investors were applying the concept, if not the mathematics, of correlation, and the recommendations made by contemporary advisers were consistent with the recommendations of MPT with respect to portfolio selection strategies (see also Rutterford and Sotiropoulos 2016).

To date, there has been very limited empirical research into how UK investors attempted portfolio diversification before MPT. Most discussions go no further than simply acknowledging the existence of portfolio diversification by UK investors from the late nineteenth century onwards.[1] Research has been hampered by the lack of data at the micro level, still a critical issue for any study of contemporary financial transactions.

A limited number of studies offer some evidence from early stock exchange security transactions and related asset holdings (portfolios), but without explicitly discussing diversification. For example, Earle has studied the portfolio holdings of 375 middle-class individuals who died between 1665 and 1720 and emphasizes the rising share of investment in government debt and corporate securities during the so-called Financial Revolution of the late seventeenth century (Earle 1989, p. 146).

[1] See, for example, Cheffins (2010) and Rutterford and Sotiropoulos (2016).

Based on death duty records between 1870 and 1902, Green et al. investigated the composition of wealth by age and gender stressing that shares became more important over the life course for both men and women (Green et al. 2009). Rutterford *et al.*, looking at 223 share records of 47 companies registered in England and Wales over the period 1870 to 1935, captured the gradual rise of share ownership of male and female investors (Rutterford *et al.* 2011).

Early portfolio diversification is explicitly discussed only by Carlos *et al.* (2015) and Kennedy and Britton (1985). Carlos *et al.* compiled a dataset of share ownership for those joint-stock companies whose security prices were listed in the commercial newspaper, the *Course of the Exchange*.[2] On the basis of their sample, Carlos *et al.* examined individual portfolio holdings in the 1690s as well as between 1718 and 1723. They found that about 80% of active investors in these equities held shares in just one company: a sign of poor diversification (Carlos *et al.* 2015, p. 1). Kennedy and Britton (1985) is probably the only existing study explicitly looking at Victorian portfolios in Scotland. They examined a sample of 477 financial portfolios from probate records between 1876 and 1913, comparing them with the efficient frontier (for which they used sectoral economic outputs instead of financial returns). Their discussion does not extend beyond the fact that Scottish individual investors held sub-optimal portfolios; a finding that tallies nicely with Kennedy's argument that biases in Victorian capital markets and poor diversification opportunities hindered financial investment from reaching risky yet dynamic economic sectors (Kennedy and Britton 1986, p. 72; Kennedy 1987, p. 144).

Perhaps due to a lack of historical information on individual investment decisions at the micro level, systematic empirical research on portfolio holdings appeared only after the 1970s (in other words, after the formulation of MPT and of a special case of MPT, the Capital Asset Pricing Model or CAPM).[3] Blume and Friend

---

[2] This is a rather small sample of eight companies that also does not cover all opportunities available to investors at the time, such as home and overseas government bonds, local utility securities, and unlisted shares in joint-stock firms or the businesses of friends and family.

[3] The MPT is generally associated with Markowitz (1952). The Capital Asset Pricing Model (CAPM), mostly associated with the names of Sharpe (1964) and Lintner (1965), was the 'logical' next step. It approached the risk of an individual asset through the lens of diversification theory. The risk of every financial security comprises two components: systematic risk and unsystematic risk. The unsystematic risk element is idiosyncratic and can be reduced through diversification. The systematic risk element is related to market variation as a whole and cannot be diversified away. Thus, it is only the systematic

(1975), using US survey data for 1962 and income tax records for 1971, showed that a large number of households held poorly diversified equity portfolios (see also Blume et al. 1974). Goetzmann and Kumar (2008), using 1990s discount brokerage data, found evidence of under-diversified equity portfolios (especially among younger, low-income, less-educated and less-sophisticated investors). Other research based on surveys of consumer finances also reports weak diversification among households in the 2000s (Polkovnichenko 2005; Kelly 1995).

Apart from Kennedy and Britton (1985), there are to our knowledge no other studies which use financial portfolio data to explicitly discuss diversification in the late nineteenth century. This period is particularly important. Given the global distribution of capital, diversification was being widely recommended by financial analysts at the time. Also, during this period, international diversification could be achieved with low currency risk given the gold standard regime. In addition, there was an increasing number of limited liability companies in the wake of the 1856 and 1862 Companies Acts, and a growing number of types of domestic and international securities (ordinary shares, preferred shares and fixed interest securities) and sectors listed on both the London Stock Exchange (LSE) and on provincial stock exchanges.

A few studies emphasize the importance of portfolio diversification in the late nineteenth century in the context of financial developments. They attempt to explain some stylized facts in UK financial history on the basis of modern portfolio theory, such as the preference for non-domestic stocks[4] (major outflows of capital from the UK) or the preference for railway stocks (Mitchell et al. 2012), relying on market returns and sectoral indices, not on actual individual holdings, to argue in a hypothetical fashion that diversification would have had gains had investors chosen to diversify. Edelstein (1982), for instance, found that foreign holdings earned on average 1.58% risk-adjusted return per annum more than domestic holdings (using an international CAPM model over the period 1870 to 1913). Goetzmann and Ukhov, extending Edelstein's analysis, considered whether investors during this period may have instinctively taken account of the historic correlations (for the period 1870 to

risk which is relevant in determining the return. There is no premium for bearing risks that can be eliminated through diversification.

[4] See Goetzmann and Ukhov (2006), Chabot and Kurz (2010), and Edlinger *et al.* (2013). Edelstein's (1982) intervention pioneered this line of thought.

1913) between different asset classes when choosing their portfolio asset allocation. They argue that the optimal percentage of overseas securities for investors to have held before the outbreak of World War I was not far from the actual proportion of all foreign securities listed on the LSE in nominal terms (see Goetzmann and Ukhov 2006).[5]

Following Goetzmann and Ukhov, Edlinger et al. (2013) argue that, for French investors, a preference for European investment would have been in line with optimal portfolio analysis, and that late nineteenth century investors' disregard of European securities in favour of other foreign investments was suboptimal in terms of the risk-return trade off. Chabot and Kurz (2010) reach a similar conclusion to that of Goetzmann and Ukhov. Mitchell, Chambers and Crafts (2012) identify the optimal portfolio percentages, not for international investments, but for British railways, which investors should have held in the decades up to World War I.

None of the above research had access to individual investor portfolios with which to confirm their macro level results. In contrast, this study draws upon a sample of portfolio holdings carefully reconstructed from existing probate records from 1870 to 1902. This is the first study to investigate the diversification of *actual* investor portfolios during the second half of the nineteenth century.

The geographic distribution of risk: Naive diversification from the 1870s

Investors are generally assumed to be risk averse; maximizing their expected investment return (generally agreed to be the total of income and capital gain over a particular period) for a given level of risk. Alternatively, they are assumed to be satisfied with the least possible risk relative to the return they seek. The measure most

[5] Linking optimal diversification across asset classes to the actual distribution of London Stock Exchange (LSE) officially listed securities is an important contribution to the literature. However, one should be very cautious in the interpretation of the results. Portfolio optimization is highly sensitive to how many asset classes are included in the sample and to the time span used to calculate the average returns, risks and covariances (Black and Litterman 1992, p. 28). There was also significant foreign ownership in some LSE-listed securities with some loans issued in a number of countries (see Platt 1986, p. 32, p.36). Finally, to have a complete picture of whether UK capital exports were optimal, we would also need to take into consideration the provincial stock exchanges along with LSE's junior unofficial market (Thomas 1973, Platt 1986, Hannah 2015).

commonly used to quantify risk is the standard deviation of returns. Markowitz (1952) developed a formal model of portfolio selection, combining the statistical definition of risk with a risk-averse assumption of investor behavior. This application of a mean-variance model to the portfolio selection problem laid the ground for modern portfolio theory, triggering, inspiring and influencing a vast amount of research in finance. The main insight is simple: when it comes to the analysis of portfolio risk, one needs to take into account not only the individual components' risks but also their interactions. Markowitz's mean-variance model was designed for a single period. Subsequent research has attempted to generalize the single period model to a multi-period one under various assumptions about investor utility functions and dependency of returns between periods (Elton and Gruber 1997).

Investors were not helpless nor did they lack investment advice before the formulation of MPT.[6] The investment approach of spreading risk across a number of securities was widely promoted in investment publications from the 1870s. In these publications, financial advisers and analysts offered detailed recommendations on how to combine different investments in a portfolio. These recommendations increased in sophistication over time. By 1914 only the mathematical optimization of Markowitz' model was lacking in terms of portfolio best practice in the UK.

Indeed, from the early 1870s, a number of pamphlets and articles advised investors to add to their portfolios as many risky securities, in equal weights, as were required to generate a targeted yield. According to contemporary financial terminology, this strategy is known as naïve diversification.[7] For example, after acknowledging the British investor's preference for none but British government securities, *Chadwicks*' *Investment Circular* in 1870 argued:[8]

---

[6] For an extensive analysis of this point see Rutterford and Sotiropoulos (2016).

[7] Recent empirical research offers evidence that naïve diversification, or alternatively the so-called *1/N* rule of portfolio weights (*N* is the number of different securities), out-performs optimal portfolio strategies. Due to the complexity of financial markets, it seems that the gain from optimal diversification is more than offset by investor estimation errors (DeMiguel 2009). Thus, it appears that recommending a strategy of naïve diversification was a relatively sophisticated approach to improving the return risk trade-off.

[8] Chadwicks, Adamson, Collier & Co. (Chadwicks) was a firm of accountants based in Manchester, but also with offices in London (see Thomas 1973, pp. 66, 123). In the 1870s they specialized in issuing prospectuses on a series of firms from different industries. *Chadwicks' Investment Circular* was issued monthly, from 1870 to 1875. They started the journal using their existing client base (of 5,000 investors). There is no doubt that the above-mentioned ideas of diversification reached a wide audience of financial investors, with possible significant impact.

> We are now too much alive to our own interests to place our trust in Consols alone [...]. Moreover, Railways, and even Foreign Stocks, have been found to pay better in the long run. We hold that, by a careful selection from the various media of investment, very remunerative returns in the shape of interest may be obtained; while, by a proper division of risks, not only may the *security* for the principal be rendered perfectly satisfactory, but there may be a good prospect that the invested capital will steadily increase in value.[9]

The authors of *Chadwicks*' *Investment Circular* also provided empirical examples of how such "proper division" of risks worldwide might work in practice, preferring portfolios of five securities of different types (such as home railways and foreign stocks) to be held in equal amounts by market value, and chosen to target a particular yield for the portfolio.[10] Similar advice was offered in *Beeton's Guide to Investing Money with Safety and Profit*, published in 1870.[11] Investment books, magazines, pamphlets and newspaper articles made investors systematically aware of the benefits of spreading risks at home and abroad through naive diversification: add as many risky securities, in equal weights, as required to generate a targeted yield with an emphasis of spreading portfolios overseas.[12] Several investment trust prospectuses also promoted the idea of international diversification during the same period.

The Geographic Distribution of risks: Scientific investment in the early 1900s

From the beginning of the twentieth century, a more sophisticated top-down approach[13] to portfolio diversification was gradually developed by investment advisers such as Henry Lowenfeld. The focus was now explicitly on the idea of correlation and on reducing portfolio risk by proper selection of uncorrelated but

---

[9] *Chadwicks' Investment Circular* 1870, pp. 30-1.
[10] *Chadwicks' Investment Circular* 1870, p.32.
[11] *Beeton's Guide to Investing* allowed choice from a wide range of countries and types of security and suggested portfolios of from three to five securities, not all equally weighted (Beeton 1870, pp. 26, 54).
[12] Rutterford and Sotiropoulos (2016).
[13] A 'top down' investment strategy starts with the opportunity set of investable securities, in this case global stock markets and, from this to select first the countries in which to invest, then the sectors, then individual securities. This is in contrast to a 'bottom up' approach which selects preferred individual securities without specifically trying to spread risk across countries or sectors.

equally volatile securities. This strategy continued with the concept of international diversification and further expanded and elaborated insights and techniques already in place by the 1870s. The key difference from naïve diversification, was that instead of selecting securities one by one, the "scientific approach" was to divide the world into regions and select one or more securities related to that region. This was also called "geographical distribution of capital."

Geographical diversification strategies were actively promoted by a number of contributors to the *Financial Review of Reviews*, a monthly magazine first published in 1905, and in textbooks such as *Investment an Exact Science*, by Henry Lowenfeld (1907), followed-up by others.[14] Lowenfeld did not identify an efficient set of portfolios according to modern portfolio theory calculations, nonetheless he offered a sophisticated analytical framework for the main principles and building blocks of financial diversification. He explained in detail a top-down approach to portfolio construction: by targeting a particular level of yield at the portfolio level but also by reducing capital risk through the choice of relatively uncorrelated securities. Historical analysis of returns, price volatility and correlation were all taken into account in the portfolio selection. Lowenfeld was very influential; his diversification approach was translated into French and German as well as being promoted by others.[15]

The top-down approach concentrated on global diversification. The implicit but fundamental assumption was that the global financial market was fragmented and, thus, security prices and returns were "dominantly influenced by the trading conditions of the particular country in which they are principally held and dealt in" thus following that country's business cycle (Lowenfeld 1907, p. 61; see also Crozier 1910). Securities from the same (domestic) market were thought of as more likely to be positively correlated. While diversification was perceived as a "systematic method of averaging risks" (Lowenfeld 1907, p. 61; Hobson 1914, p. 234) or, alternatively, as

[14] For an extensive discussion of these issues see Rutterford and Sotiropoulos (2016).
[15] His intervention became so popular that it was presented as such in 1914 to the French financial public by Francois Maury in a pamphlet entitled *Le Placement Stable* (Maury 1914a). Maury replicated and reproduced Lowenfeld's main arguments and also offered investment advice. Maury's journal, *Finance-Univers*, contained case studies of how to reorganise portfolios according to Lowenfeld's method (Guebhard 1914). For other approaches to scientific investment, see Crozier (1910), May (1912) and Withers (1930).

a method to neutralize and balance risks against each other (Crozier 1910), in practice it became a method of "geographical distribution of capital." International diversification was thought to offer more beneficial covariances than domestic diversification as it allowed investors to "obtain as great a contrast as is possible in the trade influences which govern each one of his holdings" (Crozier 1910, p. 90).

The Data

Data on individual portfolios are hard to obtain and scarce even in contemporary research on financial transactions. For the post-1960s period, there are a number of empirical studies of individual (or household) portfolios typically using relatively recent data from surveys, tax returns or brokerage accounts.[16] We use probate records for the period 1870 to 1902. Probate records are records of wealth used for taxation on death. From 1796, legacy duty was levied on moveable property, and the surviving residuary accounts for the assessment of this tax that have survived provide detailed information on an individual's personal wealth at death.[17] The residuary account series in this paper contains information for a sample of 1,446 individuals who died in England and Wales between 1870 and 1902. Although only a small portion of the total actually submitted, the sample itself appears to be reasonably representative of the broader population from which it was drawn. A comparison of the number of accounts for each county with the total number of adult deaths in 1881 confirms that there is no geographical bias in the series (Rutterford *et al.* 2011, p. 177). The valuation of personal assets in the probate data was based on the market price that prevailed at the time of probate and is, therefore, an accurate measurement of worth. The data also refer to individuals who owned sufficient assets at the time of their death to warrant the submission of accounts for the assessment of death duties. Only those individuals who died leaving personal property worth at least £5, or £10 in

[16] For a discussion on data collection methodologies see: Campbell (2006, pp. 1555/57) and Blume and Friend (1975).
[17] The methodology for extracting information from probate records is described by Green *at al.* (2009) and Green *et al.* (2011). Our analysis concentrates on the sub-sample of Green *et al.*'s sample of estates at death which included financial securities.

London, had to file for probate and even those with smaller estates were often exempt from paying death duties. Of the 1,446 individuals in the probate sample, only 507 held financial securities of any type, and it is this sample of 507 that we use in our analysis. We should also bear in mind that any evidence derived from end of life data will have an inevitable age bias towards the elderly.[18]

Our sample offers good coverage not only of individual financial portfolios but also of all other assets and liabilities at death. For each individual, the dataset contains personal characteristics (age, gender, marital status, and address of residence), as well as gross wealth (gross estate). Gross wealth includes non-financial assets and financial securities. The financial securities were divided in the probate files into seven categories: canals, ships or shares of ships, railway shares, and 'other shares', as well as foreign, colonial and UK government stock. For each security listed, the probate archives reported the name and market value of the security, allowing us to estimate the number of holdings and value of each portfolio, as well as the sector and country to which each holding related. However, detailed information on security type for every non-government security is not always complete. Where details on the security type are missing, we can, in some cases, determine the exact security held, as, for example, when a firm only has ordinary shares as capital or where it states 'debenture' and there is only one type of debenture in the firm's capital. However, this is not always possible. In practice, this means that we cannot use individual security returns and market prices for all securities to estimate overall portfolio performance. About one fourth of the total of 2,316 securities in the portfolios of our sample is unspecified with regard to security type (ordinary share, preferred share, debenture or loan stock); 221 from a total of 507 portfolios are affected by incomplete information as to security type. The larger portfolios of wealthy investors, with more holdings per portfolio, are more affected by missing information. As a result, the complete and incomplete portfolio subsamples do not mirror the full sample.

[18] In the absence of systematic information about financial portfolios during earlier phases of the life course, we are forced to rely on this end of life evidence with which to draw conclusions in the following analysis.

Table 1 gives some characteristics of our sample of investors who died between 1870 and 1902, in particular number of observations, age at death and, for women, marital status. To capture changes over the period, the data are also divided into four sub-periods of approximately equal duration: 1870-1878, 1879-1886, 1887-1894, and 1895-1902. The sample of 507 investors is almost equally divided between male (263) and female (244), a finding that reinforces the (underestimated) importance of women investors in the Victorian era.[19] As expected, single women (139) and widows (86) were more numerous than married women (16), comprising 92% of the total number of women investors in the sample. Until the Married Women's Property Acts (MWPA) of 1870 and 1882, a married woman's legal identity was covered by her husband (coverture). Unmarried women (single and no-longer married/widows) were legal individuals in their own right, not requiring, for example, a male signature for financial transactions. Women who married after the MWPAs were able to retain inheritances and hold shares in their own names.[20] However, given the age profile of the women in the sample, it is likely that most women of that age profile who did marry, did so before the MWPA of 1882, if not before that of 1870.

The average age of death was 63 for men and 67 for women, with an overall average of 65. The average age at death for the sample rose throughout the period from 61 in the first sub-period to 67 in the last sub-period. On average, 67% of investors lived for more than 60 years. Most investors in the sample probably held securities for some time, gradually increasing their investments and/or the number of holdings in their portfolios. The implication for investment is that portfolios may have been held for some time before death.[21]

[TABLE 1 NEAR HERE]

[19] See also Rutterford *et al.* (2006), Maltby and Rutterford (2006).
[20] The MWPA of 1870 did not allow married women to own real estate in their own name. Married women also required their husbands' permission to own assets separately. It was not until the MWPA of 1882 that married women fully acquired the same rights as single women with respect to owning financial assets (Maltby and Rutterford 2006, pp. 115-116).
[21] As discussed in the multivariate regression analysis below, age does not seem to be a decisive factor for men with respect to diversification measures, whereas age is a factor for women.

Table 2 shows some descriptive statistics for the basic asset categories of gross wealth for our investors. All reported asset categories show very high positive skewness, indicating significant wealth polarization amongst this sample of UK investors. The polarization is also evident in the differences between mean and median values. The market value of the average portfolio was £5,301 (£529,900 in 2017) while the most valuable portfolio was worth £260,402 (c. £26 million in 2017).[22] This portfolio was held by Mr Joshua Milne Heap, who died in 1890 at the age of 65 and had 91 different stocks comprising mostly UK and non-UK railway securities. The value of this portfolio was high in relation to the rest of the sample. For instance, the third largest portfolio in value terms belonged to Mr Thomas Wainer, who died in 1883, and contained 18 securities worth £77,668 (including a range of different securities: Consols, gas, railways, insurance, canals and an investment trust). The largest female portfolio belonged to Mrs Mary Gould, a London widow who died in 1872, comprising 18 securities worth £63,596 and spread between Consols and different types of UK securities, including railways and canals.

[TABLE 2 NEAR HERE]

On average, financial assets amounted to around 50% of total wealth but the range varies from almost zero to 100%. The median is higher than 50%, thus the majority of those individuals who chose to hold financial securities as part of their gross wealth invested more than 50% of their total gross wealth in such investments, with real estate the next most important asset. Liabilities[23] represented a relatively small proportion of overall wealth. The majority of investors in our dataset had liabilities representing less than 10% of total gross wealth (the median was 1.5%). Thus, the difference between gross and net wealth was small for these late nineteenth century investors.

[22] Female portfolios averaged £2,981 (£298,000 in 2017) and male portfolios averaged £7,442 (£744,000 in 2017). For further information on gender differences in portfolio values, see Rutterford and Sotiropoulos (2016, p. 296). The 2017 values were calculated using real prices from 1886 (the median year of death of the sample) on measuringworth.com.

[23] For a definition of liabilities, see notes to Table 2.

Portfolio diversification

In Table 3, we use two measures to examine the level of diversification of the 507 portfolios in the sample. The simplest, and the most commonly used, measure of diversification is the number of holdings in a portfolio.[24] The underlying assumption is that "the greater the number of issues, the greater the potential for diversification" (Blume *et al.* 1974, p. 31). Panel (a) of Table 3 shows that the average number of holdings is 4.56. Thus, the average individual UK investor in our sample held between 4 and 5 different securities. The difference between the mean and the median number of holdings indicates significant positive skewness, suggesting that the majority of investors had portfolios with fewer than 4 holdings. Indeed, the median number of holdings for the sample is 2. The relatively high standard deviation implies high dispersion in the number of holdings in individual portfolios. In our sample, the number of holdings varies between 1 and 91. These findings suggest that a large number of UK portfolios in the late nineteenth century were under-diversified. As we can see from panel (b) of Table 3, almost 40% of total portfolios included just one security, while almost 80% of portfolios − the great majority − included no more than 5 securities. However, 11% of portfolios included more than 11 securities.

[TABLE 3 NEAR HERE]

Panel (b) of Table 3 also reports portfolio holdings estimated by Carlos *et al.* (2015) for early 1690s and 1720s portfolios. Of course, our results are not directly comparable. Carlos *et al.* (2015) compile their portfolios from the shareholder records of the listed stock of only eight large joint stock firms and thus exclude other marketable financial securities of the time. Investment choices at that time were relatively limited by comparison with the late nineteenth century, when the nature of stock exchanges in the UK was very different, as were the diversification options available to ordinary investors.[25] However, the proportion of investors in our sample

[24] See for instance Blume and Friend (1975, p. 586); Goetzmann and Kumar (2008, p. 436).
[25] For instance, at the beginning of our sample (in 1870) there were 539 companies, with nominal capital of £36.9 million, registered under the Companies Act in England. By 1902, the number of

with just one holding remains quite high at 40% (as compared with 87% for Carlos *et al.*'s sample). Victorian portfolios were still under-diversified.

Table 3 lists the results of some post-1960 studies of US household and individual investor diversification. Although there are some caveats[26] in comparing our sample with more recent US data, it is clear from Table 3 that under-diversification remained an issue well into the late twentieth century. In fact, Victorian UK investors compare rather well with late twentieth-century investors in terms of diversification. According to Blume and Friend's (1975) sample, US households' average number of equity holdings in 1962 was just 3.41, while the median number of holdings was two. In a different sample from 1971 (Blume *et al.* 1974, p. 37), the US average number of equity holdings was 4.5, higher than the 1962 average for US households, but very similar to the average number of security holdings of UK investors almost a century earlier. Goetzmann and Kumar (2008, p. 437) estimate that US retail brokerage clients between 1991 and 1996 held on average four equity securities. More recent surveys of the consumer finances of US households have estimated a median number of equity holdings of 2 until 2001, when it rose to 3 (Kelly 1995; Polkovnichenko 2005). Thus, UK investors in our sample engaged in more financial diversification than did their US counterparts after the 1960s. Portfolios both now and then are on average under-diversified. Table 3 panel (b) shows that 78.5% of Victorian investors held no more than 5 securities in their portfolios. This is comparable to the corresponding 75.6% of US investors with no more than 5 holdings in 1991-96 and to the 71% of US households that held no more than 4 stocks in 1971.

registered companies had increased to 3,596 with £147.6 million of nominal capital (Stock Exchange Official Intelligence, London, 1903).

[26] First, these post-1960s US studies are focused on equities and exclude fixed income securities. Victorian stock exchanges, however listed a considerable number of fixed income securities which were an important element of financial portfolios at the time. Second, according to our estimates, UK stock exchange investors in 1901 represented about 1.6% of the total population, with an equivalent figure of 15% for the US in the early 1970s, that is, roughly ten times bigger in relative terms (Rutterford and Sotiropoulos 2017, Table 2).

Portfolio concentration and under-diversification

Counting the holdings in a portfolio as a measure of diversification gives equal importance to naively diversified (equally weighted) portfolios and to unbalanced portfolios. Thus we use a second measure of diversification. This is the sum of the squared portfolio weights, or *SSPW*, the values of which are shown in Table 3 for the various samples of investors. Following Blume *et al.* (1974), Blume and Friend (1975), and Goetzmann and Kumar (2008), the *SSPW* is given by the following expression:

$$SSPW = \sum_{i=1}^{N} (w_i - w_m)^2 = \sum_{i=1}^{N} \left(w_i - \frac{1}{N_m} \right)^2 \approx \sum_{i=1}^{N} w_i^2 \qquad (1)$$

where N is the number of holdings in the portfolio, N_m is the number of securities in the market portfolio, w_i is the portfolio weight assigned to security i in the portfolio, w_m is the weight assigned to a security in the market portfolio ($w_m=1/N_m$). *SSPW* thus captures the diversification level of a portfolio by its deviation from the market portfolio. Since the weight of each security in the overall market portfolio is very small, this diversification measure is in practice equal to the sum of the squared portfolio weights. *SSPW* identifies unbalanced portfolios, capturing the extent to which the value of a portfolio is concentrated in a few securities. For example, a portfolio invested equally in two securities would have an *SSPW* of 0.5, whereas an unbalanced one invested 90% and 10% in two securities would have an *SSPW* of 0.82. A portfolio following Lowenfeld's recommendation for a global, top-down portfolio with ten equal investments, say, would have an *SSPW* of 0.10. Generally, the lower the *SSPW* measure, the greater the level of diversification and the closer to the type of naive portfolio diversification recommended by financial advice at that time.

The information in Table 3 allows us to compare the *SSPW* for investors with different numbers of holdings. The number of holdings is (negatively) related to *SSPW* values; for example, for portfolios containing more than 11 securities, the *SSPW* falls to 0.13, implying a good level of diversification, close to the *SSPW* for an equally weighted portfolio invested in 10 holdings which would have an *SSPW* of 0.10. In contrast, an unbalanced portfolio of ten holdings, with, say, 5% invested in each of nine holdings and 55% in one holding would have an *SSPW* of 0.32. Our sample *SSPW* results of a mean of 0.66 and a median of 0.70 are also similar to the

results of more recent studies. They are slightly lower than the *SSPW* of 0.71 found by Blume and Friend (1975) for their 1962 US sample, although they are higher both than the Blume *et al.* (1974) *SSPW* estimate of 0.52 for the 1971 US sample and the Goetzmann and Kumar *SSPW* estimates for the mid-1990s, which range between 0.47 and 0.56.

[TABLE 4 NEAR HERE]

Portfolio concentration is reported in Table 4. The average and the median value of the largest holding and the two largest holdings expressed as the ratio to total portfolio value are given for different deciles of the financial wealth distribution. These two measures capture how concentrated (unbalanced) were the portfolio weights in our sample. The higher the concentration of financial investment in one or two securities, the greater the difference from equal weights. Table 4 offers further evidence of the unbalanced structure of portfolios. It suggests that even wealthy investors were reluctant to equally weight their portfolios into different financial holdings. On average, investors in the top two deciles held portfolios with more than 10 securities but concentrated about 44% of their financial wealth in a single holding. At least 50% of the top two deciles of investors invested more than 32% of their portfolio value in one security. Investors in the two top deciles invested on average about 61% of their portfolios in two securities. The overall average weight of the largest holding was 71.9% and the average sum of the two largest security weights was 85.3%.

Investors appear to have been reluctant to adopt even the recommended naive diversification strategy, thereby exhibiting resistance to the 1/N rule. Nevertheless, our results compare with the findings of Blume and Friend for the 1962 sample of US households. In our sample, half of the investors invested more than 81% in a single security, relative to 90% estimated by Blume and Friend, and 100% in one or two securities, which was the same in the 1962 US sample (see the median figures in the last row of Table 4; Blume and Friend 1975, p. 589). So, Victorian investors were overall under-diversified but exhibited similar behavior to that of the US household sector in the second half of the twentieth century.

[TABLE 5 NEAR HERE]

In Table 5 we focus on portfolios with just one or two holdings, representing about 60% of investors in our sample, almost equally distributed by gender. These are mostly less wealthy investors. Due to the extreme polarization of the wealth distribution, the average value of portfolios with one or two securities amounts to only one fifth of the average portfolio value for the whole sample and, thus, this under-diversified 57.8% of investors represents only 11.6% of portfolio investment in total. The majority of this investment (83%) was domestic, with only 17% invested in overseas securities. This compares with 28% invested overseas by the investors as a whole. Half (50%) of portfolio wealth was invested in UK corporate securities other than railways, with a majority in the form of equity.[27] The preference for UK non-railway securities in under-diversified portfolios is striking. It may indicate some risk-seeking behavior but perhaps also a preference for locally-listed UK firms. Such behavior was notably higher amongst male investors. Female investors preferred placing relatively more in government and railway securities. These findings run contrary to the argument that Victorian investors (as opposed to *investment*) were biased "towards safe, well-known securities in general, a great number of which were foreign, and away from riskier, smaller, but ultimately from an economy-wide viewpoint, much more profitable ones" (Kennedy 1987, p. 145). The relatively less wealthy majority of Victorian investors in our sample held under-diversified portfolios but also preferred less safe non-railway UK corporate securities.[28]

Victorian portfolios across time: sectoral analysis

Given that we have a spread of investor portfolios from 1870 to 1902, our sample allows us to explore variations over time in asset allocation and in portfolio choice.

[27] Under-diversified portfolio holdings were split 44.0% corporate (Railways and Other) ordinary or preferred shares and 37.7% fixed interest corporate securities. The remaining 18.4% of corporate security holdings were unspecified. There were no unspecified securities in the government security category.

[28] Not all these securities in our dataset were listed. Some may have been issued by unquoted family companies. Geographical proximity engendered trust or informal networks, which may have provided an alternative risk reduction strategy to the more conventional spreading of risk across uncorrelated securities (see Rutterford *et al.* 2017).

Here we focus more on investors as a particular 'sector' in the UK economy and only marginally discuss intra-sectoral variation in financial behavior. In other words, our aim is to explain some general characteristic of Victorian investors as a body separate from other market participants such as banks and different types of institutional investors.

In the first panel of Table 6 we trace diversification measures across four, eight-year sub-periods. We show that, from the late 1880s, there was a significant increase in the average number of securities held. From 3.2 for 1870-1878, the average number of holdings almost doubled to 5.8 by the turn of the century. It would appear that such diversification became more popular with the rising importance of stock markets (the so-called 'equity culture'),[29] as well as becoming more practicable with the increasing portfolio size (not reported in the table). Increasing diversification over time is also reflected in the figures for the median number of holdings (from 2 to 4 over the period) and the average *SSPW* (from 0.74 to 0.57). The median number of holdings of the last two periods is greater than the median number of holdings of US households in the early 2000s.[30]

[TABLE 6 NEAR HERE]

We now examine how investment in our sample was split internationally between different sector and regional asset categories over time. There are significant differences in the portfolio compositions, as is to be expected given the rapid changes in investment opportunities over the period 1870 to 1902. In the first sub-period, 50.6% of the combined portfolios was invested in government bonds, compared with 23.6% in railways. By the third sub-period, these numbers were reversed, with only 14.3% in government securities and 55.0% in railways; with a second reversal in the fourth sub-period, when British railway securities fell in value, by more than half from 42.0% to 19.2% in our combined sample portfolios. Investment in foreign and colonial government securities was highest in the first sub-period, 1870-1878,

[29] Michie 1987, Rutterford *et al.* 2011.
[30] Improvements in the diversification measures appear linked to the overall improvement in investor wealth (not reported in Table 6), as reflected by the increase in the median gross wealth and median financial wealth. See also the regression analysis below.

coinciding with a peak in 1872 of net annual outflows of British savings into foreign assets (Edelstein 1982, p. 29). There was another peak, less pronounced, in 1890 (ibid.), reflected in Table 6 by the greater percentage investment in colonial government bonds and non-domestic railway securities for the last two sub-periods. The percentage invested in other corporate sectors was relatively steady during the whole period, ranging between 25.0% and 30.9%, despite the rapid growth in importance of these sectors over time.

For comparison, the importance of these categories on the London Stock Exchange (LSE) for the same sub-periods is also shown in Table 7. In other words, we follow Goetzmann and Ukhov (2006) in comparing our portfolios with the actual distribution of LSE officially-listed securities. This comparison allows us to explore to what extent investors as a whole in our sample chose to buy securities listed on the LSE in proportion to their importance. In our sample, the portfolio weights are based on market values, and investors do not necessarily hold only LSE officially-listed securities. In other words, the 'market' for our investors includes not only the LSE but also the provincial stock exchanges and the non-negligible LSE's "junior market."[31] To make a more meaningful comparison, we have used the *Bankers' Magazine* (BM) market value indices, available after 1880, to translate LSE par values to market values.[32] Table 7 reports LSE aggregate sectoral market value weights based on BM indices. Unfortunately, detailed data on paid-up capital of the provincial stock exchanges and the LSE unofficial list market do not exist, so we must be cautious when comparing Tables 6 and 7. As a general rule, however, we know that the LSE was dominated by government and railway securities, while provincial stock exchanges and the LSE's junior market placed relatively more emphasis on local domestic companies (Thomas 1973, p. 114; Hannah 2015). Given that the investors in our sample did not limit their choices to LSE-listed securities, we would expect their portfolios to be more domestic-biased than aggregate LSE figures.

[TABLE 7 NEAR HERE]

[31] See Hannah (2015, pp. 25-8).
[32] For more information on the BM indices see the note to online Appendix Table A2.

As revealed by the BM indices (see online Appendix Table A2), government bonds were traded on average around par for the whole period. Foreign government bonds' market value consistently averaged around 15% below par. UK railway securities remained on average 30% above par, whilst foreign and colonial railway securities traded below par. Market values for the securities in the remaining sectors hovered generally somewhat above their par values for the whole period under consideration. Finance security market values, however, exceeded three times their par values. Given that government and railway securities dominated the LSE up to 1902, sectoral shares based on market values, instead of nominal values, do not change the picture substantially. Yet, differences are non-negligible.

Investors in our sample held more low-risk UK government bonds than the LSE figures in Table 7 would suggest, had they invested in sectors in proportion to market value. However, the standard deviation is very high, indicating substantial variation in risk preferences amongst UK investors. UK government bonds were the mainstay of trustee portfolios and considered relatively risk free. They were also in short supply,[33] representing only 12.0 % by value of the LSE official list compared with 18.8% by value of our sample of portfolios combined. Our investors also held more colonial government stock by value than their importance on the LSE official list suggested. The most striking difference between Tables 6 and 7 is in the importance of non-domestic non-colonial government securities, which in our sample is significantly lower than the LSE market value numbers. On average, 4.8% of the total financial wealth of our sample was invested in foreign government stock, corresponding to an average of 5.4% per portfolio, although with a high variance across investors. These figures are significantly different from the LSE market value weighting which averaged 31.9% over the period. There are a number of possible reasons why investors did not put nearly one third of their financial investment into foreign bonds. First, such bonds, although listed on the LSE, were also sold to overseas investors as well as UK investors. Second, foreign bonds traded at a greater discount to par value than did UK government or colonial bonds (as shown in online Appendix Table A2). Given risk aversion, UK investors might prefer to subscribe for

[33] The amount of UK government stock in issue fell from the peak of the Napoleonic Wars to the end of the nineteenth century.

and hold UK and empire government securities, which were consistently trading around par, rather than exposing themselves to the risks inherent in the significant market discount to par of foreign government stock. For example, Spanish 4 per cents fell from 70 to 48 between 1895 and 1898.[34] More generally, investors were probably less inclined to hold non-UK government securities[35] than other institutional investors, despite the relatively higher real returns (Edelstein 1982).

At the same time, while the *unweighted* average percentage of domestic railways in the individual portfolios in our sample (Table 6) is in line with the UK railway market share in the LSE official list of 16.6%, there is a huge variation across individual portfolios, as evidenced by a very different weighted average portfolio share for our investors of 28.9%. This difference can be explained by the fact that wealthy investors, in the top quarter of the gross wealth distribution, showed a higher preference for domestic railways than the rest.[36] There is also a striking difference in foreign railway holdings between investors in our sample (5.0%) and LSE market value figures (14.9%). However, one key reason for this is that British investors were not alone in buying these securities. Many US railway stocks, for example, were listed on the New York Stock Exchange as, for example, those issued by Pennsylvania Railroad.

Adopting Markowitz's approach to determine the optimal percentages for UK and non-UK railway securities in a portfolio (using fifteen years of historical returns data to estimate risks, returns, and correlation coefficients), Mitchell *et al.* (2012) found that the optimal percentage in railway securities in a global portfolio for a UK investor was 29.3% between 1884-1886, peaked at 43.8% between 1887-1894, falling to 37.6% between 1895-1902 (Mitchell *et al.* 2012, p. 823). In our sample, we can see (Table 6) that railway shares peaked in the third sub-period but plummeted towards

---

[34] See Lowenfeld (1909, p. 52) for a discussion of the risks of buying foreign government bonds.
[35] Colonial debt was less liquid but highly prized by banks (Chavaz and Flandreau 2015; Goodhart 1972). Still, UK investors were relatively more willing to hold it than foreign debt.
[36] See online Appendix Table A3. This result is consistent with recommendations by commentators such as Lowenfeld. For wealthy investors with more than sufficient income, he recommended the safest securities, which he deemed to be railways, municipals, gas and waterworks companies. The higher the yield required, the more the investors should venture into riskier securities, such as preference shares, and possibly ordinary shares (provided no debt). But for those who were happy with a modest yield, railways and infrastructure securities were sufficient. For a more detailed categorisation of investors according to wealth and income and the specific investment strategies for each category, see Lowenfeld (1909, Ch. II).

the end of the century, when, domestic realized returns in the sector fell considerably (as opposed, for instance, to very high realized returns of world railways, mainly in the US and Latin America, see Edelstein 1982, p. 153). Thus, the railway share in overall investment in our sample shows a similar trend to the optimal railway exposure calculated by Mitchell *et al.*, both in domestic and non-domestic securities. Investors in our sample included the highest amount in railways at the very time that it was optimal to do so according to the Markowitz model. Yet, from our sample, this might be due to wealthy investors' preference for domestic railway securities and not to average investor behavior.

Turning to financial sector securities, 11.5% of our sample's portfolio wealth was invested in financial firms (comprising the financial, land and investment; investment trust; and financial sectors[37]) relative to 5.5% in the LSE. The average weight of financial firms in an individual portfolio was much larger for the whole period at 19.7%. The very high standard deviation indicates high variance in holdings of financial firm securities among Victorian investors. This high variance is explained by the fact that less wealthy investors in the first two quartiles of the gross wealth distribution showed a relatively greater preference for financial sector securities (see online Appendix Table A3). Those relying on a buy and hold strategy could also count on high capital gains in relation to par values: initial share subscribers would have seen their securities triple their value for banks and insurance companies (online Appendix Table A2).

Infrastructure absorbed almost 10% of the sample's portfolio investment and represented 14.0% of the average portfolio; these figures are higher than the corresponding LSE figure of 3.9%. Indeed, infrastructure has the highest individual sector average investment of 9.2% in our sample after UK government and UK railway securities. This cannot be explained by the real returns, which were on average lower than both (light and heavy) industry and finance (Edelstein 1982). Infrastructure securities were over-represented in provincial stock exchanges in relation to the LSE, hence their actual weight in the overall UK market was higher than for the LSE and probably closer to the number shown in Table 6. Provincial

[37] Investment trusts were means of indirect diversification but their overall capitalization was negligible, being lower that 1% of total LSE capitalization in terms of nominal value in 1902.

stock exchanges listed numerous gas, water and electricity companies; shipping companies were a significant part of the Liverpool stock exchange list; and many foreign telegraph companies were listed on both the Liverpool and Manchester stock exchanges (Thomas 1973, p. 120-9). Differences between London-based and provincial investors as to the attractiveness and availability of infrastructure investments could be a factor in the very high variance between individual portfolios for this sector.

With regard to the remaining aggregated economic sectors reported by the Stock Exchange Official Intelligence, the results in our sample in Table 6 are by and large comparable to the market value LSE figures. However, in all cases, there are significant differences among investor portfolios, as indicated by very high standard deviations. For instance, the average portfolio weight of light industry is considerably higher than the overall share invested in that sector, reflecting high variance among portfolios. The very large variances of portfolio weights for almost all the asset categories of Table 6 invite a multivariate regression analysis to capture the important intra-sector variation.

Variation within Victorian portfolios

This section analyses the intra-sectoral variation of portfolio choices on the basis of investor-level cross-sectional regression analysis. The regression results shown in Table 8 are based on the following equation:

$$Y_i = \beta_0 + \sum_{j=1}^{N} \beta_j \cdot X_{ji} + \sum_{k=1}^{M} \beta_{N+k} \cdot Z_{ki} + u_i \qquad (2)$$

In the first 2 specifications, we use as dependent variables Y_i the two diversification proxies defined above: the number of portfolio holdings (model 1) and the sum of squared portfolio weights or *SSPW* (model 2). In the third specification, the non-domestic portfolio weight is the dependent variable, while the final logit specification has as a dependent variable a dummy, which takes the value of one if the portfolio contains only corporate securities other than railways and is zero otherwise. The list of explanatory variables includes several investor characteristics X_j (age, gender,

marital status, gross wealth and London residency[38]) as well as some proxies for sophistication Z_k (foreign dummy, industry concentration and investment trust dummy, in line with relevant studies) that are likely to reflect levels of investor financial sophistication (see Goetzmann and Kumar 2008, p. 453). Appendix Table A1 offers a detailed definition of all the variables used in the regressions of Table 8.

[TABLE 8 NEAR HERE]

As column 1 in Table 8 shows, the number of portfolio holdings (a crude measure of diversification) is related to investor gender and gross wealth. As expected from the previous discussion, these regression results show that wealthy investors held more diversified portfolios. Male investors held on average more securities in their portfolios than did female investors. Neither London investors nor the urban geography of investors appears to affect diversification. With respect to investor characteristics, the wealth effect is the only one that survives in model (2) when we use the *SSPW* as dependent variable (according to its definition, the *SSPW* is inversely proportional to diversification, so the negative sign indicates the very same effect: wealth is positively related to diversified portfolios). This implies that gross wealth was the only decisive factor for *balanced* diversified portfolios (the *gender dummy* coefficient is not statistically significant in model 2).

As sophistication proxies we use a *foreign dummy*, which takes the value of one if the investor holds at least one non-domestic security in the portfolio; an *investment trust dummy*, which is set to one if an investor includes an investment trust in the portfolio (indirect diversification); and *industry concentration*, which has been designed to capture the industry tilt (see Goetzmann and Kumar 2008, p. 453; Fama and French 1997) and measures the largest industry weight in the investor's portfolio. The coefficients for all sophistication proxies are statistically significant in both specifications (1) and (2) at the 1% level and have the expected signs, except for the investment trust dummy in the first specification which is significant at the 10% level. Investors who were aware of the benefits of (international) diversification held more

[38] In the period under consideration, investors showed a preference for securities from local firms and stock exchanges (Rutterford *et al.* 2011).

securities and more balanced portfolios. On the other hand, the negative sign of the *industry concentration* coefficient in model (1) indicates that investors with large stakes (relative to their portfolio wealth) in a particular firm were more likely to avoid naïve diversification, preferring to hold more concentrated portfolios.

In specification (3) we see that gross wealth is not related to the portion of portfolio wealth invested in overseas securities. However, we also see that residence does affect preference for overseas securities. London residents invested, on average, 15.8% more in non-domestic securities, which means that investors outside London were more attracted by domestic (and probably local) securities.[39] Gender also affects preference for overseas securities. Women had higher non-domestic portfolio weights than men, thus showing greater interest in overseas investments. Also, the higher the portfolio concentration, the lower the non-domestic portfolio weight: unbalanced and security-concentrated portfolios were associated with domestic firms. In the logit specification (4) of Table 8, we see that portfolios including only securities other than government stock and railways were held by less wealthy investors. Specification (4) also shows that, on average, men and investors outside London were more inclined to hold portfolios with only non-railway corporate securities. Overall, we could assert that less wealthy investors were more willing to take more risk (diversifying less and being more attracted by corporate securities) and investors outside London were relatively more attracted by local corporate listings. These findings are in line with those reported in Table 5.

[TABLE 9 NEAR HERE]

Table 9 categorizes portfolios according to possible combinations of holdings in three broad asset categories: government, railways, and other corporate. The largest group of investors in Table 9, comprising 35% of the total sample (predominantly less wealthy investors and men), held mostly UK corporate securities other than railways. At the higher portfolio values, investors held a broader range of securities and diversified internationally. Female investors showed a relatively greater preference for

[39] This is in line with the findings of local investment bias and informal relations of trust by Rutterford *et al.* (2017) and Franks et al. (2009).

portfolios consisting of only government stock and railway securities compared with men, perhaps because some portfolios were held as trusts, with women, especially widows, more likely to be the beneficiaries. Although trust portfolios could include securities not on the 'permitted investments' list if provided for in the trust deed, it is likely that many trust portfolios in this period confined themselves to certain UK and colonial government and railway bonds.

Of the total of 507 portfolios, two thirds included corporate non-railway securities, and so could not have been trust portfolios limited to permitted investments in the Trustees' Investment Acts. For men and women, the percentage of such portfolios was 72.6% and 59% respectively. However, we cannot say how many, if any, of the 507 portfolios were trust portfolios limited to permitted investments. The use of permitted, relatively safe investments held in trust was seen as a way of keeping risk to acceptable levels. In our sample, 18.5% of investors held only government bonds, and 11.6% only UK government bonds. This can be viewed as an alternative approach to risk reduction when compared with portfolio diversification. However, as mentioned above, the relatively large group who held only corporate non-railway securities were neither following recommendations for trust portfolios nor recommendations by contemporary commentators to spread risk across a broad range of sectors.

Conclusions

From the 1870s, UK investors were encouraged by financial advisers to diversify their portfolios and split them equally between different holdings (1/N rule) taking into account the global market. Gradually, after the turn of the twentieth century, a more top-down approach (which included all regions of the world in the investment opportunity set and securities from each region in a portfolio) was developed to assist investors in seeking beneficial correlations in the context of global distribution of risks. This study is the first systematic attempt to analyze the diversification strategies of late Victorian investors in England and Wales drawing upon a sample of 507 actual portfolios at death from the period 1870-1902.

Probate records in our sample are almost equally divided between male and female, reinforcing the importance of women investors in the Victorian era. Victorian investors, in the sample, on average held around half of their gross wealth in financial investments, holding between 4 and 5 securities in their portfolios. The number of holdings in the median portfolio was two, indicating poor diversification for the majority of investors. Almost 40% of investors held just one security, while almost 80% held no more than 5 securities. However, in terms of the number of holdings, Victorian investors compare well with post-1960s US household financial behavior.

Comparing the unweighted average portfolio in our sample with different LSE asset categories in (estimated) market values, there are some notable differences. For example, Victorian investors invested relatively less in foreign (non-colonial) government securities and relatively more in domestic railways (particularly the case for wealthier investors). The (unweighted) average portfolio weights invested in financial firms, light industry and infrastructure were high at 19.7%, 10.2% and 14.0% respectively, a total of 34.9%. However, there were substantial differences between investor portfolios, so that the total portfolio investment flowing to these three sectors, as measured by the weighted average of the portfolios, was actually much lower at the level of 23.7%. It seems that less wealthy Victorian investors were more open to investment in provincial and LSE unofficial securities, the majority of which were domestic.

The recommendation to hold securities in equal portfolio weights was generally ignored by late Victorian investors, even by wealthy investors. As expected, diversification was related to gross wealth; men held on average more securities than did women, but both held equally unbalanced portfolios. Residents outside London and less wealthy investors were more willing to hold securities of domestic financial firms and industries other than railways. This probably indicates a local preference effect, which is in line with relevant research (Rutterford *et al.* 2017). It appears that less wealthy investors were more prepared to buy risky corporate securities, but as Rutterford *et al.* (2017) have pointed out, geographical proximity engendered trust or informal networks, which may have provided an alternative risk reduction strategy to the more conventional spreading of risk across uncorrelated securities. Indeed, a group comprising 35.1% of the total sample that mostly includes less wealthy male investors, invested almost exclusively in UK non-railway corporate securities. On the

other hand, female investors showed a relative preference for government stock and railway securities. At higher portfolio values, investors were more willing to follow contemporary advice, spreading risk across a number of securities (with 11% of portfolios having 11 or more securities) and diversifying internationally, with a focus on government securities and railways. However, the levels of international diversification were not as high as recommended, in 1907, by Lowenfeld.

All in all, 57.8% of the Victorian investors in our sample held portfolios with no more than 2 holdings, a sign of poor diversification. It would appear that most UK investors left the application of sophisticated security selection rules to investment professionals, only partially adopting a global distribution of risks strategy. Small investors may also have been unable to diversify as much as they wished, given relatively high transaction costs for small size trades. Overall, investors *did* diversify their portfolios across domestic and overseas markets, but not to the extent recommended by contemporary advice.

Appendix Table A1. Variable definitions for regressions.

Variables	Description
Decade	Categorical variable equals 1 if died in the 1870s, 2 if died in the 1880s, 3 if died in the 1890s, and 4 if died in the 1900s.
Investor characteristics	
Age	Age at death.
Gender dummy	Dummy equals 1 if the investor is female.
Married dummy	Dummy equals 1 if the investor is married.
Gross wealth (log)	The logarithm of gross wealth.
London resident dummy	Dummy equals 1 if the investor lives in London.
Urban geography	Categorical variable according to the place of residence: Rural=1, Small Urban=2, Medium Urban=3, Large Urban=4, Very Large Urban=5, London=6.
Sophistication proxies	
Foreign dummy	Dummy equals 1 if the investor has at least one non UK security in the portfolio.
Industry concentration	The largest industry weight in the investor portfolio.
Investment trust dummy	Dummy equals 1 if the investor has at least one investment trust security in the portfolio.
Dependent variables	
Number of holdings in the portfolio	The number of different securities in the portfolio.
Sum of squared portfolio weights	See definition in the main text.
Non-domestic portfolio weight (%)	The value of non-domestic holdings as % of the portfolio value.
Corporate (other than railways) dummy	Dummy variable equals 1 if the portfolio contains only corporate securities other than railways.

References

Beeton, S. *Beeton's Guide to the Stock Exchange and Money Market*. London, 1870.

Black, F., and R. Litterman. "Global Portfolio Optimization." *Financial Analysts Journal* 48, no. 5 (1992): 28-43.

Blume, M. E., J. Crockett, and I. Friend. "Stockownership in the United States: Characteristics and trends." *Survey of Current Business*, November (1974): 16-33.

Blume, M. E., and I. Friend. "The asset structure of individual portfolios and some implications for utility functions." *The Journal of Finance* XXX, no. 2 (1975): 585-603.

Campbell, J. Y. "Household finance." *The Journal of Finance* 61, no. 4 (2006): 1553-1604.

Carlos, A. M., E. Fletcher, and L. Neal. "Share portfolios in the early years of financial capitalism: London, 1690-1730." *Economic History Review* 68, no. 2 (2015): 574-599.

Chabot, B. R., and C. J. Kurz. "That's where the money was: Foreign bias and English investment abroad, 1866-1907." *The Economic Journal* 120, September (2010): 1056-1079.

Chavaz M., and M. Flandreau. "'High & Dry': The liquidity and credit of colonial and foreign government debt and the London Stock Exchange (1880-1910)." Working Paper. CEPR Discussion Paper, DP11679 (2016). Available: http://cepr.org/active/publications/discussion_papers/dp.php?dpno=11679

Cheffins, B. R. *Corporate ownership and control: British business transformed*. Oxford: Oxford University Press, 2010.

Cole, G. D. H. "The Evolution of Joint Stock Enterprise." In *Studies in Capital and Investment*, edited by G. D. H. Cole, 1935.

Crozier, J. B. *Notes on the First Principles of Investment*, 1910.

DeMiguel, V., L. Garlappi, and R. Uppal. "Optimal Versus Naive Diversification: How Inefficient is the 1/*N* Portfolio Strategy?" *The Review of Financial Studies* 22, no. 5 (2009): 1915-1953.

Earle, P. *The making of the English middle class: Business, society and family life in London, 1660-1730*. London: Methuen, 1989.

Edelstein, M. *Overseas Investment in an Age of High Imperialism: the United Kingdom 1850-1914*. New York: Columbia University Press, 1982.

Edlinger, C., M. Merli, and A. Parent. "An optimal world portfolio on the eve of World War I: Was there a bias to investing in the new world rather than in Europe?" *The Journal of Economic History* 73, no. 2 (2013): 498-530.

Edlinger, C., and A. Parent. "The beginnings of a 'common-sense' approach to portfolio theory by nineteenth-century French financial analysts Paul Leroy-Beaulieu and Alfred Neymarck." *Journal of the History of Economic Thought* 36, no. 1 (2014): 23-44.

Ellis, A. "The 'quantitation' of stock exchange values." *Journal of the Royal Statistical Society* 51, no. 3 (1888): 567-598.

Elton, E. J., and M. J. Gruber. "Modern portfolio theory, 1950 to date." *Journal of Banking & Finance* 21 (1997): 1743-1759.

Fama, E. F., and K. R. "French. Industry Costs of Capital. " *Journal of Financial Economics* 43, (1997): 153–193.

Foreman-Peck, J., and L. Hannah. "Extreme divorce: the managerial revolution in UK companies before 1914." *Economic History Review* 65 (2011): 1-22.

Franks, J., C. Mayer, and S. Rossi. "Ownership: Evolution and Regulation." *The Review of Financial Studies* 22, no. 10 (2009): 4009-4056.

Goetzmann, W. N., and A. Kumar. "Equity portfolio diversification." *Review of Finance* 12 (2008): 433-463.

Goetzmann, W. N., and A. D. Ukhov. “British Investment Overseas 1870-1913: A Modern Portfolio Theory Approach.” *Review of Finance* 10 (2006): 261-300.
Goodhart, C. A. E. *The Business of Banking, 1891-1914*. London: Weidenfeld and Nicolson, 1972.
Green, D., A. Owens, J. Maltby, and J. Rutterford. “Lives in the balance? Gender, age and assets in the late nineteenth century England and Wales.” *Continuity and Change* 24, no. 2 (2009): 307-335.
Green, D. R., A. Owens, C. Swan, and C. van Lieshout. “Assets of the Dead: Wealth, Investment, and Modernity in Nineteenth and Early Twentieth-Century England and Wales.” In *Men, Women, and Money: Perspectives on Gender, Wealth, and Investment, 1850–1930*, edited by D. R. Green, J. M. Maltby, A. Owens, and J. Rutterford, 54-80. Oxford: Oxford University Press, 2011.
Guebhard, P. “Le Pratique du Placement. – Examen et Réorganisation d’un Portefeuille.” *Finance-Univers*, (15 February 1914): 27-50.
Hannah, L. “Rethinking Corporate Finance Fables: Did the US Lag Europe Before 1914?” Working Paper, CIRJE Discussion Papers (2015). Available: http://www.cirje.e.u-tokyo.ac.jp/research/03research02dp.html
Hobson, C. K. *The Export of Capital*. London: Constable and Company Ltd, 1914.
Jefferys, J. B. *Business organization in Great Britain 1856-1914*. New York, 1977.
Kelly, M. “All their eggs in one basket: Portfolio diversification of US households.” *Journal of Economic Behavior and Organization* 27, (1995): 87-96.
Kennedy, W. P., and R. Britton. “Portfolioverhalten und wirtschaftliche Entwicklung im späten 19. Jahrhundert: Ein Vergleich zwischen Großbritannien und Deutschland; Hypothesen und Spekulationen.” In *Beiträge zur quantitativen vergleichenden Unternehmensgeschichte*, edited by R. H. Tilly. Stuttgart : Klett-Cotta, 1985.
Kennedy, W. P. *Industrial Structure, Capital Markets and the Origins of British Economic Decline*. Cambridge: Cambridge University Press, 1987.
Lintner, J. “The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets.” *The Review of Economics and Statistics* XLVII, no. 1 (1965): 13-37.
Lowenfeld, H. *Investment an Exact Science*. London: The Financial Review of Reviews, 1907.
Lowenfeld, H. *All About ... Investment*. London: The Financial Review of Reviews, 1909.
Markowitz, H. “Portfolio selection.” *Journal of Finance* 7, no. 1 (1952): 77-91.
Maltby, J., and J. Rutterford. “‘She possessed her own fortune’: women investors from the late nineteenth century to the early twentieth century.” *Business History* 48, no. 2 (2006): 220-253.
Maury, F. *Le Placement Stable: Ses Bases, Ses Règles, Ses Résultats*. Paris: Finance-Univers and Librairie Félix Alcan, 1914.
May, G. “The investment of life assurance funds.” *Journal of the Institute of Actuaries* 46 (1912): 134-168
Michie R. C. “Options, Concessions, Syndicates, and the Provision of Venture Capital, 1880–1913, ” *Business History* 23, no. 2 (1981): 147-164.
Michie, R. C. *The London and New York Stock Exchanges 1850-1914*. London: Allen & Unwin, 1987.
Mitchell, B, D. Chambers, and N. Crafts. “How good was the profitability of British railways, 1870-1912?” *Economic History Review* 64, no. 3 (2012): 798-831.
Morgan, E. V. *Studies in British Financial Policy, 1914-25*. London: Macmillan & Co. Ltd, 1952.
Platt, D. C. M. *Britain's Investment Overseas on the Eve of the First World War*. London: The Macmillan Press Ltd., 1986.
Polkovnichenko, V. “Household Portfolio Diversification: A Case for Rank-Dependent Preferences.” *The Review of Financial Studies* 18, no. 4 (2005): 1467-1502.

Rutterford, J., and J. Maltby. "'The widow, the clergyman and the reckless': women investors in England, 1830-1914." *Feminist Economics* 12, no. 1-2 (2006): 111-138.
Rutterford, J., D. R. Green, J. Matlby, and A. Owens. "Who comprised the nation of shareholders? Gender and investment in Great Britain, c. 1870-1935." *Economic History Review* 64, no. 11 (2011): 157-187.
Rutterford, J., and D. P. Sotiropoulos. "Financial diversification before modern portfolio theory: UK financial advice documents in the late nineteenth and the beginning of the twentieth century." *The European Journal of the History of Economic Thought* 23, no. 6 (2016): 1-25.
Rutterford, J., and D. P. Sotiropoulos. "The Rise of the Small Investor in the United States and United Kingdom, 1895 to 1970." *Enterprise and Society*, (2017; forthcoming).
Rutterford, J., Sotiropoulos, D. P., and C. van Lieshout. "Individual investors and local bias in the UK, 1870–1935." Economic History Review, (2017; forthcoming).
Sharpe, W. F. "Capital asset prices: A theory of market equilibrium under conditions of risk." *The Journal of Finance* XIX, no. 3 (1964): 425-442.
Stebbings, C. *The Private Trustee in Victorian England*, Cambridge, 2002.
Thomas, W. A. *The Provincial Stock Exchanges*. London and New York: Routledge, 1973.
Withers, H. *The Quicksands of the City, and a Way through for Investors*. London, 1930.

Table 1. Investor Summary Statistics for the Probate Sample.

Panel (a) Age at death

		Age at death				
	obs.	mean	% over 60	% over 40	max	min
1870-1878	154	61	58	90	93	15
1879-1886	115	66	76	92	89	23
1887-1894	121	67	69	94	93	24
1895-1902	117	67	68	95	92	26
Total	507	65	67	93	93	15
			Male			
1870-1878	90	60	57	87	92	23
1879-1886	54	65	78	89	89	24
1887-1894	61	65	70	89	93	24
1895-1902	58	63	59	92	86	26
Total	263	63	65	89	93	23
			Female			
1870-1878	64	62	60	95	93	15
1879-1886	61	67	74	94	89	23
1887-1894	60	68	69	98	90	34
1895-1902	59	70	76	98	92	39
Total	244	67	69	96	93	15

Source: Probate sample, see the text.

Panel (b) Categories of female investors

	Female				
	single	married	unknown	unknown (has children)	widow
1870-1878	36	3	0	0	25
1879-1886	33	4	2	0	22
1887-1894	37	7	0	0	16
1895-1902	33	2	1	0	23
Total	139	16	3	0	86

Source: Probate sample, see the text.

Notes: Age at death is available for 457 of 507 investors. The marital status is not reported for men.

Table 2. Descriptive statistics for gross wealth categories for the sample.

Asset categories (£)				
	mean	median	stdev	skewness
gross wealth	10,754	2,321	26,130	5.8
liabilities	837	46	3,851	8.0
net wealth	9,918	2,135	25,089	6.0
portfolio value	5,301	794	16,575	10.1
real estate	2,324	25	8,592	6.4
cash	591	128	1,910	9.5
life assurance	211	0	1,451	13.6
monies and interest due to deceased	1,692	103	5,589	6.2
portfolio value as % of gross estate	50.6	53.5	31.6	-0.1
liabilities as % of gross estate	9.2	1.5	24.5	6.0

Source: Probate sample, see the text.

Note: All values are in £. Financial portfolios include all liquid securities other than cash: that is, both equity (ordinary and preferred shares) and debt (debentures or Consols). *Cash* is a proxy for general cash savings including any type of cash in the house, in the bank, in the office or anywhere else. The category *monies and interest due to deceased* includes different types of debt (i.e. rents, mortgages, bonds and bills, and book debts) and the related interest payments owed to investors at the time of death. The *gross wealth* is the gross estate. It includes: monies and interest due to deceased, real estate, portfolio (all financial securities), life assurance, cash and the sum of chattels (this one is not reported in the table). The *net wealth* is equal to gross wealth minus total *liabilities*. The latter comprises all debts (ordinary debts, mortgages and bonds and bills) and related interest payments owed by the deceased.

Table 3. How diversified were Victorian investors?

Panel (a) Diversification measures.

	Diversification indices					
	mean	median	stdev	skewness	min	max
number of holdings, our sample	4.57	2.00	7.29	5.78	1	91
Blume and Friend 1962 sample	3.41	2.00				
Blume et al. 1971 sample	4.50					
Goetzmann and Kumar 1991-96 sample	4.00	3.00				
SSPW, our sample	0.66	0.70	0.34	-0.32	0.03	1.00
Blume and Friend 1962 sample	0.71	0.82				
Blume et al. 1971 sample	0.52					
Goetzmann and Kumar 1991-96 sample	0.47-0.56					

Source: Probate sample, see the text.

Panel (b) Distribution of portfolios among different holding bands.

	number of holdings per portfolio				
	1	2-5	6-10	over 11	all
% of portfolios, our sample	38.66	39.84	10.45	11.05	*100.00*
% of portfolios, Carlos et al. sample during the 1690s	*87.39*	*12.61*	*0.00*	*0.00*	*100.00*
% of portfolios, Carlos et al. sample, 1718-23	*79.03*	*20.97*	*0.00*	*0.00*	*100.00*
*% of portfolios, Blume and Friend 1971 sample**	*34.11*	*36.95*	*18.21*	*10.72*	*100.00*
% of portfolios, Goetzmann and Kumar 1991-96 sample	*28.20*	*47.28*	*15.36*	*9.16*	*100.00*
average SSPW, our sample	1.00	0.57	0.28	0.13	*0.66*

* The breakdown of holding bands is slightly different in Blume and Friend (1975): 1, 2-4, 5-9, over 10.

Source: Probate sample, see the text.

Notes: Carlos et al. (2015) use an "extremely loose definition of portfolio" aggregating across company-years and check whether an individual owned shares in more than one company at

any point in the period. This is not directly comparable to the definition of portfolio holdings in the other studies. Post-1960s US studies discuss household surveys or related data, while we have investors in our sample. Goetzmann's and Kumar's sample is from a major US discount brokerage house so: (i) not necessarily representative of the household sector, and (ii) does not necessarily contain the individual's entire financial wealth. Victorian portfolios include fixed income securities while the post-1960 US portfolios do not include bonds. As already defined, *SSPW* is the sum of the squared portfolio weights.

Table 4. Concentration of portfolios in our sample by wealth decile.

decile of gross wealth distribution	number of portfolio holdings		value of largest holding to portfolio value		value of 2 largest holdings to portfolio value	
	mean	median	mean	median	mean	median
1	1.3	1.0	95.2	100.0	99.6	100.0
2	1.6	1.0	90.9	100.0	98.6	100.0
3	1.8	2.0	81.1	88.1	96.8	100.0
4	2.2	1.0	86.0	100.0	94.0	100.0
5	2.6	2.0	75.5	84.8	89.9	100.0
6	2.8	2.0	75.0	82.6	91.6	100.0
7	3.7	2.0	68.5	75.0	84.4	100.0
8	5.6	4.0	59.7	53.8	76.0	79.4
9	9.9	8.0	39.7	31.7	57.8	55.7
10	14.0	9.0	47.9	41.0	64.5	65.2
All	4.6	2.0	71.9	81.4	85.3	100.0

Source: Probate sample, see the text.

Table 5. Under-diversified portfolios with one or two holdings.

	all investors	male	female
Observations	293	143	150
Observations % of the whole sample	57.8	28.2	29.6
average portfolio value as % of average portfolio value of the whole sample	20.1	24.2	16.1
portfolio investment % of total	11.6	6.8	4.8
average portfolio weights (%)			
UK government	21.6	16.4	26.5
non UK government	9.4	7.0	11.7
Total government	31.0	23.4	38.2
UK railways	11.4	9.0	13.8
non UK railways	4.6	3.0	6.1
Total railways	16.0	11.9	19.9
UK corporate other than railways	50.0	61.0	39.5
non UK corporate other than railways	3.0	3.7	2.4
Total corporate other than railways	53.0	64.7	41.9
Total UK	83.0	86.4	79.8
Equity (ordinary and preferred shares)	44.1	55.1	33.6
Fixed interest	37.5	25.2	49.1
Unspecified	18.4	19.7	17.3

Source: Probate sample, see the text.

Table 6. Composition of financial portfolios of our sample (% over time).

	1870-1878	1879-1886	1887-1894	1895-1902	all years		
Diversification measures							
No. of observations	154	115	121	117	507	–	–
Average number of holdings	3.2	3.7	6.0	5.8	4.6	–	–
Median number of holdings	2.0	2.0	3.0	4.0	2.0	–	–
Average SSPW	0.7	0.7	0.6	0.6	0.7	–	–
Sectoral composition (%)							
					All years		
	1870-1878	1879-1886	1887-1894	1895-1902	weighted av.	unweighed av.	st. dev.
UK government	31.9	23.4	5.9	21.4	18.8	17.3	34.8
Empire government	14.4	2.3	5.3	8.8	7.6	6.0	19.9
Foreign government	4.3	10.0	3.1	3.3	4.8	5.4	19.7
Total government	50.6	35.7	14.3	33.4	31.2	28.7	41.0
UK municipals	0.2	0.7	5.7	5.6	3.4	1.2	8.1
Non-UK municipals	0.0	0.0	0.0	0.1	0.0	0.0	0.2
UK railways	19.4	26.1	42.0	19.2	28.9	16.6	31.6
Empire railways	2.6	2.9	6.0	5.4	4.4	3.7	14.8
Foreign railways	1.6	3.2	6.9	7.8	5.0	3.0	12.2
Total railways	23.6	32.2	55.0	32.5	38.4	23.3	36.0
Finance	5.2	9.9	7.9	6.6	7.4	15.6	33.0
Financial, land and investment	0.6	4.2	5.9	1.6	3.4	2.8	12.8
Investment trusts	0.0	0.4	0.7	2.0	0.7	0.7	6.0
Total finance	5.8	14.5	14.6	10.1	11.5	19.7	35.9
Light industry	5.4	0.9	1.0	6.0	3.0	10.2	27.9
Heavy industry	2.4	0.9	1.3	2.1	1.6	1.6	9.1
Extraction	3.3	1.8	0.2	0.3	1.3	1.2	9.5
Infrastructure	8.4	12.7	7.8	9.4	9.2	14.0	29.4
Agriculture	0.0	0.1	0.0	0.0	0.0	0.0	0.1
Total other corporate	19.4	16.4	10.3	17.8	15.2	27.2	39.1
Unspecified	0.4	0.5	0.0	0.4	0.3	0.6	5.6
Total (%)	100.0	100.0	100.0	100.0	100.0	–	–
Total (£ million)	0.7	0.5	1.0	0.5	2.7	–	–

Source: Probate sample, see the text.

Notes: The sectors have been defined in line with Goetzmann and Ukhov (2006) and Mitchell et al. (2012). In particular: *finance* includes banks and insurance; *light industry* includes textiles, food, drink, and retail stores; *heavy industry* includes iron, coal, steel, and heavy fabrication, mechanical equipment, electrical equipment, building and construction materials, and chemicals; *infrastructure* (social overhead) includes electricity, gas, water, canals and docs, shipping, telephone and telegraph, tramways and omnibuses. Foreign assets are non-domestic non-colonial assets. UK government includes Consols (17% of total investment),

Nationals (2% of total investment) and those Municipals (3% of total investment) which could not be categorized in other economic sectors (such as, utilities, docks etc.). The column ‘unweighted av.’ shows the unweighted average for the whole period. This is different from the 'weighted av.' which measures the portfolio investment share of each asset category as a whole.

Table 7. London Stock Exchange listed securities (paid-up capital as % of total in market values).

	1884-1886	1887-1894	1895-1902	all years
UK government	15.7	13.2	9.4	12.0
Empire government	3.6	4.0	3.6	3.8
Foreign government	36.3	33.1	29.0	31.9
Total government	*55.7*	*50.3*	*41.9*	*47.6*
UK municipals	1.2	1.4	1.6	1.4
Non-UK municipals	0.4	0.6	0.5	0.6
UK railways	16.1	17.4	15.2	16.3
Empire railways	2.6	3.2	2.7	2.9
Foreign railways	14.5	15.0	15.0	14.9
Total railways	*33.2*	*35.6*	*32.9*	*34.1*
Finance	3.8	3.8	5.3	4.4
Financial, land and investment	0.7	1.0	1.2	1.0
Investment trusts*	NA	NA	NA	NA
Total finance	*4.5*	*4.8*	*6.5*	*5.5*
Light industry	0.6	2.6	8.9	5.0
Heavy industry	0.2	0.2	1.3	0.7
Extraction	0.4	0.5	2.4	1.3
Infrastructure	3.7	3.9	4.0	3.9
Agriculture	0.0	0.0	0.0	0.0
Total other corporate	*5.0*	*7.2*	*16.6*	*10.8*
Total (%)	100.0	100.0	100.0	100.0
Total (£ million)	5,202.1	6,396.2	8,726.1	5,685.6

* BM indices did not include investment trusts. The total nominal capitalization of the latter was very low in relation to overall LSE capitalization.

Sources: Stock Exchange Official Intelligence and *Bankers' Magazine* (our calculations).

Notes: The data were collected from issues of the *Stock Exchange Official Intelligence* (SEOI), which was systematically published only after 1881. Our calculations are based on BM indices reported in online Appendix Table A2, which are available only after 1884. For

definitions of different sectors see the notes to Table 6. Municipals have not been absorbed within government or relevant economic sectors as in Table 6. Their size is very small in relation to the other asset categories so the comparison between Tables 6 and 7 is not affected.

Table 8. Investor level cross sectional regressions.

	OLS regressions			Logit regression
	(1)	(2)	(3)	(4)
	number of holdings in the portfolio	sum of square portfolio weights	non domestic portfolio weight (%)	corporate (other than railways) dummy
decade	-0.243	-0.015	-0.197	0.058
	[0.186]	[0.012]	[1.408]	[0.104]
Investor characteristics				
Age	-0.021	0.001	-0.128	-0.011
	[0.019]	[0.001]	[0.111]	[0.007]
Gender dummy	-1.011**	0.028	7.739**	-0.900***
	[0.460]	[0.028]	[3.622]	[0.255]
Married dummy	0.246	0.03	2.415	-0.024
	[0.729]	[0.034]	[4.280]	[0.320]
gender*married	-0.981	-0.022	2.745	0.242
	[1.363]	[0.092]	[12.774]	[0.721]
gross wealth (log)	1.218***	-0.084***	-0.793	-0.323***
	[0.298]	[0.007]	[1.097]	[0.083]
London resident dummy	-0.012	0.074	15.834***	-2.183***
	[1.510]	[0.046]	[5.820]	[0.426]
Urban geography	0.205	-0.009	-1.061	0.187*
	[0.311]	[0.011]	[1.265]	[0.097]
Sophistication proxies				
Foreign dummy	1.363***	-0.262***		
	[0.440]	[0.028]		
Industry concentration	-0.097***		-0.294***	0.008*
	[0.009]		[0.067]	[0.004]
Investment trust dummy	9.135*	-0.211***	4.01	
	[4.666]	[0.036]	[7.150]	
Constant	2.824	1.404***	52.972***	3.041***
	[2.370]	[0.072]	[13.631]	[0.942]
Number of observations	448	448	448	448
R-squared	0.512	0.459	0.088	0.150

* = significant at the 10% level.

** = significant at the 5% level.

*** = significant at the 1% level.

Notes: Robust standard errors are reported in brackets for the OLS specifications. Standard errors are reported for the logit specification. A full list of the variables can be found in the Appendix Table A1. The age is available for only 448 investors out of 507 in our sample. The above regression results do not change if we exclude age and run the same regressions for the 507 portfolios.

Table 9. Portfolio diversification in relation to broad asset categories.

security categories			observations				av. no. holdings	av. portf. value as % of av. portf. value of the sample	% UK
government	railways	other corporate	all	% sample	male	female			
0	0	1	178	35.1	110	68	2.1	17.4	91.7
0	1	0	46	9.1	18	28	2.0	36.4	79.9
1	0	0	94	18.5	38	56	1.5	48.4	81.7
0	1	1	56	11.0	32	24	8.1	133.0	78.9
1	1	0	32	6.3	16	16	5.3	143.8	59.7
1	0	1	34	6.7	10	24	4.3	169.8	65.3
1	1	1	67	13.2	39	28	13.9	351.5	70.2
			507	100.0	263	244	4.6	100.0	72.6

Source: Probate sample, see the text.

Notes: The three left-hand columns describe all the possible permutations of three different broad security categories, with a 0 representing no holdings of each category and a 1 representing some holdings. The last column indicates the percentage of financial investment in UK securities. Government includes all domestic and non-domestic government securities along with those municipal securities which could not be grouped into other corporate category.

Online Appendix

Table A2. Market value indices (market value divided by nominal value) for several sectors of the London Stock Exchange based on the *Bankers' Magazine* sample.

	1884-1886	1887-1894	1895-1902	Unweighted average
UK government	1.012	1.010	1.044	1.024
Empire government	0.997	1.047	1.065	1.044
Foreign government	0.825	0.848	0.881	0.857
UK corporation stocks	1.032	1.101	1.143	1.104
Non-UK corporation stocks	1.189	1.124	1.048	1.107
UK railways	1.207	1.361	1.359	1.329
Empire railways	0.905	0.965	0.984	0.961
Foreign railways	0.846	0.859	0.866	0.859
Finance	3.200	3.398	3.798	3.519
Financial, land and investment	1.110	1.132	1.225	1.165
Investment trusts	–	–	–	–
Light industry	1.197	1.430	2.981	2.004
Heavy industry	0.896	0.896	1.653	1.199
Extraction	1.127	1.165	5.232	2.784
Infrastructure	1.559	1.676	1.989	1.778
Tea (agriculture)	1.231	1.303	–	1.245
All	0.987	1.026	1.097	1.047

Source: The *Bankers' Magazine*, several issues.

Notes: In 1887 the *Bankers' Magazine* started reporting monthly the market values of the main LSE sectors based on a sample of 338 LSE listed securities representing at that point about 50% of its total capitalization in nominal values. This sample stayed almost the same with very minor changes up to World War I. By the year 1902, the final year in our dataset, the BM sample contained 325 LSE-listed securities representing about the one third of the overall LSE capitalization in terms of nominal values. The securities were carefully selected by the experts of the magazine and we could assume that they offer a representative picture of the trends in LSE market values. More information about the origin of BM indices can be found in Ellis (1888), from where the pre-1887 figures have been taken (the years 1881-1883 are missing). Many studies have used the BM indices before, most notably Morgan (1952), Goodhart (1972), and Hannah (2015).

Table A3. Diversification indices and cross-sectional distribution of assets (%) by gross wealth quartile.

	Gross wealth quartile						
	I	II	III	IV	top 10%	top 5%	Total
Diversification measures							
Average number of holdings	1.5	2.3	3.6	10.9	14.0	19.4	4.6
Median number of holdings	1.0	2.0	2.0	8.0	9.0	14.5	2.0
Average SSPW	0.9	0.8	0.6	0.4	0.4	0.3	0.7
Sectoral composition (%)							
UK government	24.8	21.5	25.7	17.8	19.6	17.0	18.8
Empire government	9.2	6.9	13.7	6.9	7.1	7.9	7.6
Foreign government	2.7	6.3	7.6	4.4	3.9	4.7	4.8
Total government	36.7	34.7	47.1	29.2	30.5	29.6	31.2
UK municipals	0.9	0.1	2.3	3.6	3.5	3.6	3.4
Non-UK municipals	0.0	0.0	0.1	0.0	0.0	0.0	0.0
UK railways	12.0	16.4	15.1	31.2	31.5	34.4	28.9
Empire railways	3.8	5.9	5.7	4.2	3.4	3.4	4.4
Foreign railways	3.0	1.5	5.1	5.2	4.9	5.2	5.0
Total railways	18.8	23.9	25.9	40.6	39.8	43.0	38.4
Finance	19.5	14.7	7.5	6.9	7.4	5.7	7.4
Financial, land and investment	2.1	2.1	2.1	3.7	4.5	3.4	3.4
Investment trusts	0.7	0.1	0.4	0.8	0.5	0.7	0.7
Total finance	22.3	17.0	10.1	11.4	12.3	9.7	11.5
Light industry	4.2	5.6	4.0	2.8	2.4	3.1	3.0
Heavy industry	1.6	4.1	0.9	1.6	1.5	2.1	1.6
Extraction	1.0	0.8	0.7	1.4	1.8	2.4	1.3
Infrastructure	14.3	13.4	8.8	9.0	7.8	6.4	9.2
Agriculture	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total other corporate	21.1	23.9	14.5	14.9	13.6	14.0	15.2
Unspecified	0.2	0.4	0.1	0.3	0.3	0.1	0.3
Total (%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total (£ million)	0.0	0.1	0.3	2.3	1.7	1.2	2.7

Source: Probate sample, see the text.

Notes: For the definitions of the different asset categories see notes of Table 6 in the main text. Foreign assets are non-domestic non-colonial assets. The columns report weighted average percentages, that is, % of total investment per wealth band.