

A Century of Rich Returns

The London Business School's exhaustive study of world stock markets during the 20th Century challenges many accepted beliefs. Ian Orton explores the findings of the report.

Equities produced the best investment returns during the twentieth century in all major world stock markets, according to a report produced by the London Business School's Elroy Dimson, Paul Marsh and Mike Staunton in association with ABN AMRO. But the real returns associated with equities were much lower than previously thought.

This was especially the case in the UK during the first half of the century where, according to the LBS researchers, equity returns could have been overstated by as much as 100 percent. In the other 11 countries covered by the report, equity returns were on average overstated by 2.2 percent per annum over the course of the century.

Nonetheless, investors were still well compensated for carrying the higher risks associated with equity investment. In the UK the equities provided an annualised real return of 5.9 percent (with income reinvested) compared with 1.3 percent on bonds and 1 percent on bills (cash). Elsewhere, equities generated an annualised real return of 5.5 percent.

But according to the LBS researchers investors should expect lower returns on equity investment during the twenty first century. The risk premium associated with equities fell significantly over the past fifty years and will probably remain close to current levels. The good news is that current high equity valuations can be justified. Unfortunately, however, this means that there is little scope for a further re-rating.

Comprehensive

The LBS authors claim that 'The Millennium Book - A Century of Investment Returns' which contains their research into the performance of shares, bonds, bills and inflation during the twentieth century is more comprehensive, accurate and authoritative than any produced before.

'In addition to casting new light on the behaviour of stocks, bonds and equities during the twentieth century - and facilitating accurate international comparisons - the Millennium Book also casts light on a plethora of other topics of interest to investors.'

The research involved painstaking financial archaeology to construct new indices covering all the main investment asset classes as well as inflation in twelve countries - the UK, Germany, France, Holland, Italy, Sweden, Switzerland, Denmark, the US and Canada. These markets currently account for over 90 percent of world stock market value.

"To assess the future we need to understand the past and the present," said Mark Brown, chief executive of ABN AMRO Equities (UK). "Dimson, Marsh and Staunton provide the canvas that we need, and their report will be essential for every student of financial markets. The authors have written the first authoritative study of the long-term performance of the world's stock markets - and it challenges many accepted beliefs. Not least, they show that for large tracts of the twentieth century, the risks of equity investment were higher and the rewards lower than is suggested by recent performance figures."

In addition to casting new light on the behaviour of stocks, bonds and equities during the twentieth century - and facilitating accurate international comparisons, the Millennium Book also casts light on a plethora of other topics of interest to investors. This includes the importance of dividends, stock market concentration levels, and the extent to which sectoral representation in market indices changed over the century.

Given the changes currently affecting stock markets these are all extremely relevant. Quite apart from the valuation conundrum posed by the explosion of interest in high technology stocks there has been also increasing concern about the stock market concentration levels in the wake of recent mergers.

Nonetheless, the real value of the Millennium Book undoubtedly rests with its analysis of investment returns and risk premia. Most of this analysis

has previously been conducted almost exclusively from an Anglo-Saxon viewpoint and on the basis of limited data series, a failing that the Millennium

typically include the biggest companies within a particular stock market. This means that index back-histories tend to have an over-representation of successful companies that grew large enough to enter the index. Conversely, they usually have an under representation of companies that underperformed over the interval up to index launch.

The net result is that equity returns are often significantly overstated. This bias can be reinforced by the fact that researchers typically use data that is easiest to obtain instead of being the most relevant.

The LBS researchers claim that these problems are exemplified in the well known Barclays/CSFB Equity-Gilts Study. This is especially the case as far as estimates of real returns on UK shares over the first half of the twentieth century are concerned. According to the Barclays/CSFB Equity-Gilt Study the real annual return on UK shares between 1919-54 was 8.8 percent. The new LBS/ABN AMRO indices show that the real return over this period was just 3.8 percent (Figure 1).

This discrepancy arises because the Barclays/CSFB is narrow and unrepresentative, subject to survivorship bias, and backdated only to the end of World War 1 say Professors Dimson, Marsh and Staunton. Survivorship bias arose because the pre-1935 back history was based on companies that were large in 1935, and which had therefore tended to outperform (i.e., grow large) in earlier years.

In compiling indices that span the entire twentieth century the LBS researchers successfully avoided these pitfalls. The differences between the LBS estimates of annualised real equity returns - as derived from total return indices - and previous studies are shown in Figure 2.

There are sometimes considerable differences between the LBS estimates and previous studies. This is especially the case for France (5.3 percent) and Germany (4.5 percent). But much of this difference reflects the time period covered by the LBS/ABN AMRO indices. With the exception of the UK, US and Switzerland, all the other estimates are confined to the post-World War 2 period.

Figure 1: Comparison of pre-1955 returns with Barclays/CSFB estimates

Index calculation % pa	Nominal return	Real return
Barclays/CSFB index return 1919-1954	9.68	8.79
Less Bias from incorrect rights-issue adjustment	-0.37	-0.36
Less Bias in choosing companies with hindsight	-1.57	-1.56
Less Bias from choosing sectors with hindsight	-0.21	-0.20
Less Bias from choosing only 30 shares	-0.22	-0.22
Less Impact from electing to start after WW1	-1.12	-2.62
Correct estimate of index return 1900-1954	6.19	3.83

Source: Dimson, Marsh and Staunton (ABN AMRO/LBS)

Book conclusively rectifies. But, as well as rectifying these omissions, the Millennium Book also shows conclusively that far from being exceptional, UK and US stock market experience during the twentieth century was mirrored elsewhere.

New Indices

There is no shortage of studies of stock market performance. In the UK, for example, the Barclays Capital/CSFB Equity-Gilt Study has been produced annually since the late 1950s.

The problem, according to the LBS team, is that many of these studies are

Figure 2: Annualised real equity returns reported in prior studies

Country	Previous study*	Previous study		This study		Difference % pa
		Period	Real return	Period	Real return	
Australia	ASX	1974-	7.6	1900-	7.6	0.0
Canada	FARF	1950-	7.1	1900-	6.4	0.7
Denmark	Ibbotson	1970-	8.1	1915-	5.4	2.7
France	Barclays	1951-	9.3	1900-	4.0	5.3
Germany	Barclays	1952-	8.9	1900-	4.4	4.5
Italy	BCI	1974-	4.0	1900-	2.7	1.3
Japan	Ibbotson-Hamao	1971-	6.0	1914-	4.2	1.8
Netherlands	Barclays	1947-	9.4	1900-	6.0	3.4
Sweden	Ibbotson	1970-	11.6	1900-	8.2	3.4
Switzerland	Pictet	1926-	7.7	1911-	5.0	1.2
USA	Ibbotson	1926-	7.7	1900-	6.9	0.8
UK	Barclays	1919-	7.6	1900	5.9	1.7

* The previous studies are from the Ibbotson Yearbooks, Ibbotson Equity Risk Premia Reports, BZW/Barclays, Equity Bond Studies, Pictet and the Financial Analysts Research Foundation. For two markets indices are used that underpin published studies.
Source: Dimson, Marsh and Staunton (ABN AMRO/LBS)

inaccurate, because of survivorship and success bias. Published back-histories tend to have an almost total absence of companies that had disappeared by the time the index was launched. Indices that attempt to measure stock market performance over an extended time period contain just the survivors.

In addition, performance indices

International Comparisons

Figure 3 illustrates the long-term performance, in real terms, of the three major asset classes - equities, bonds and bills. In all 12 countries equities outperform bonds and bills by a substantial margin.

This is even the case in Italy, the poorest performing market. Equities produced annualised real returns of 2.7 percent compared with negative returns for both bonds and bills.

Countries that experienced major dislocations during the century as a consequence of two world wars all achieved equity market returns that were ahead of inflation.

Sweden was the best performing equity market, generating annualised real returns of 8.2 percent over the century. It was followed by other resource rich countries such as Australia (7.6 percent), the United States (6.9 percent) and Canada (6.4 percent).

The Netherlands and the UK also performed well, but other European markets performed less well. Despite its malaise during the 1990s - which saw its stockmarket well below the peaks achieved in the 1980s - Japanese equities managed to generate real equity returns of 4.2 percent per annum.

In the bond markets, France, Germany, Italy and Japan - the four worst performing countries - also had the lowest equity market returns. Quite clearly economic turmoil had a more dramatic impact on fixed income investors than on equity investors.

The Impact of Income

In any given year, capital gains or losses on shares tend to be much larger than dividend income. But over longer investment period income becomes much more important. Over very long time

horizons, the value of reinvested income totally dominates capital gains. This general finding holds true of all countries.

The LBS team calculated that over the twentieth century a UK equity portfolio with gross dividends reinvested would have grown to more than 100 times the value of a portfolio whose dividends were not reinvested.

tries, since yields differ substantially between markets.

Equities Are Risky

Current conventional wisdom tends to assume that the risks associated with equity investment are relatively low, compared with other asset classes. The Millennium Book dispels this illusion. Equity returns were far more volatile than both bonds or deposits.

Moreover, investors have at times faced large losses. In October 1987, US shares fell 23 percent in one day. Following the Wall Street Crash in 1929, shares fell by 60 percent in real terms from 1929-31. More recently, in 1973-74, UK investors suffered an even greater loss of -71 percent in real terms. But the largest losses recorded in the Millennium Book were in Germany and Japan at the end of World War 2, with real returns of -91 percent in Germany (1945-8) and -97 percent in Japan.

The volatility (standard deviation) of real equity returns in the UK over the twentieth century was 20 percent per annum. This means that one year in six, the real return on shares is likely to underperform expectations by 20 percent or more and vice versa.

Nonetheless, the UK stock market was less volatile than most others (Figure 4). The average volatility (standard deviation) for the 12 countries was 23 percent. Germany, Japan and Italy had the highest volatilities. Only Australia and Canada had volatilities that were lower than the UK.

Equity Risk Premiums

The equity risk premium is the difference between the return on equities and the return on risk free assets. It has a central role in projecting future equity returns; calculating the cost of equity capital for companies; valuing shares; project appraisal; and determining fair rates

Figure 3: Annualised real returns on major asset categories, 1900-2000

Country	Equities	Bonds	Bills
Australia	7.6	1.6	0.4
Canada	6.4	1.8	1.7
Denmark (from 1915)	5.4	2.7	2.8
France	4.0	-1.0	-3.4
Germany (98 yrs ex-1922/23)	4.4	-2.3	-0.6
Italy	2.7	-2.3	-4.1
Japan (from 1914)	4.2	-1.5	-2.1
Netherlands	6.0	1.1	0.7
Sweden	8.2	2.3	2.0
Switzerland (from 1911)	5.0	2.1	1.1
USA	6.9	1.5	1.1
UK	5.9	1.3	1.0

Source: Dimson, Marsh and Staunton (ABN AMRO/LBS)

An investment of £1 in the ABN AMRO/LBS UK equity index in 1900 with no reinvestment of dividends would have been worth £160.62 in 2000. Had all income been reinvested the same initial investment would have appreciated to £16,946.

Because of the impact of reinvested income on investment returns the ABN AMRO/LBS equity indices are computed on a total return basis. An

Figure 4: Arithmetic means and standard deviation of annual real returns

Country	Equities		Bonds		Bills	
	Arithmetic mean (%)	Standard deviation	Arithmetic mean (%)	Standard deviation	Arithmetic mean (%)	Standard deviation
Australia	9.1	17.7	2.6	14.5	0.6	5.6
Canada	7.8	17.0	2.3	10.7	1.8	5.2
Denmark (from 1915)	7.3	21.8	3.4	11.9	3.0	6.4
France	6.5	23.3	0.2	14.7	-2.7	11.5
Germany (98 yrs ex-1922/23)	9.3	31.6	0.2	16.0	0.0	10.5
Italy	6.8	29.6	-0.9	14.4	-2.9	12.1
Japan (from 1914)	9.4	31.4	1.4	21.1	-0.3	14.5
Netherlands	7.9	21.0	1.6	9.5	0.9	5.3
Sweden	10.5	23.1	3.0	12.7	2.2	6.9
Switzerland (from 1911)	6.9	20.5	2.4	7.4	1.2	6.2
USA	8.9	20.3	2.0	9.9	1.2	4.9
UK	7.8	20.1	2.2	14.6	1.2	6.6

Source: Dimson, Marsh and Staunton (ABN AMRO/LBS)

index that only records capital appreciation cannot be used to make comparisons over time, since the level of dividend yield fluctuates over the years. Nor can such an index be used to make comparisons across coun-

of return for regulated utilities.

In the UK, the annualised historical risk premium has averaged 4.9 percent relative to Treasury Bills and 4.6 percent compared with long-term bonds. This is slightly below the average for all 12 countries, which was 5.7 percent relative to bills.

The notion that only UK and US investors have been well rewarded for investing in riskier equity investments would therefore appear to be dumfounded. The US and UK are near the middle of the equity premia, whether the latter are estimated relative to inflation, bills or bonds (Figure 5).

The research shows that risk premia exhibited considerable variation during the century. As a consequence the choice of time period over which risk premia are calculated can also have a significant influence on results. Unfortunately, however, there is no consensus between analysts about which time period is the most relevant from the point of view of a contemporary investor.

Some analysts prefer to emphasise recent data, since it reflects the environment in which we now do business. Others take a different view asserting, for example, that technological revolutions are rare, and comparisons with past revolutions are at present particularly appropriate; or that market-wide speculative bubbles happen rarely, and long-term records are revealing about the aftermath of a bubble.

All market analysts agree, however, that repetition of certain historical events is so implausible that the past must be interpreted with care.

For the record risk premia were higher in the second half of the century than

in the first half. The unweighted 12 country average was 6.9 percent compared with 4.2 percent during the troubled first half of the century. Over the last 20 years the average has been higher still at 7.8 percent.

Figure 5: Annualised 10 year equity risk premia, 1900-2000

Equity premium %pa	Relative to inflation		Relative to bills		Relative to bonds	
	Arithmetic mean	Geometric mean	Arithmetic mean	Geometric mean	Arithmetic mean	Geometric mean
Australia	7.3	7.2	7.0	6.9	6.0	5.9
Canada	6.3	6.3	4.7	4.6	4.8	4.7
Denmark (from 1915)	5.3	5.3	2.2	2.1	2.0	1.9
France	3.4	3.2	7.8	7.5	5.1	4.8
Germany (98 yrs ex-1922/3)	4.3	3.9	5.6	5.2	7.5	7.1
Italy	2.1	1.7	7.2	6.8	5.4	5.0
Japan (from 1914)	4.8	3.9	8.0	7.7	7.3	6.6
Netherlands	5.5	5.3	4.8	4.6	4.4	4.2
Sweden	7.2	7.0	5.3	5.1	5.3	5.0
Switzerland (from 1911)	4.8	4.7	4.0	3.9	2.6	2.4
USA	6.4	6.3	5.5	5.3	5.0	4.9
UK	5.9	5.7	5.0	4.9	4.9	4.8

Source: Dimson, Marsh and Staunton (ABN AMRO/LBS)

Prospective Risk Premia

According to the LBS researchers there are two reasons for the high equity returns experienced over the last 50 years.

First, for all 12 countries, this was a long period of peace, prosperity and stability, coupled with productivity and efficiency growth, improved corporate management and governance, and extensive technological change. These factors have contributed to, and are now built into, higher stock prices.

Figure 6: Real bond returns

Country	Arithmetic Mean	Geometric Mean	Standard Deviation	Min Value	Min Year	Max Value	Max Year
Australia	2.6	1.6	14.5	-29.9	1951	60.5	1932
Canada	2.3	1.8	10.7	-25.9	1915	41.7	1921
Denmark	3.4	2.7	11.9	-16.6	1920	50.1	1983
France	0.2	-1.0	14.7	-43.7	1946	49.1	1927
Germany (98 yrs ex-1922/3)	0.2	-2.3	16.0	-100.0	1923	62.5	1932
Italy	-0.9	-2.3	14.4	-64.3	1944	28.1	1933
Japan	1.4	-1.5	21.1	-75.1	1946	70.7	1954
Netherlands	1.6	1.1	9.5	-18.1	1915	32.8	1932
Sweden	3.0	2.3	12.7	-37.0	1939	68.2	1921
Switzerland (from 1911)	2.4	2.1	7.4	-16.1	1918	35.9	1921
USA	2.0	1.5	9.9	-19.3	1918	35.2	1982
UK	2.2	1.3	14.6	-34.1	1915	61.2	1921

Source: Dimson, Marsh and Staunton (ABN AMRO/LBS)

Second, shares have also risen because of a fall in the required return due to the diminished invest-

ment risk that has accompanied these developments. In addition, investors now have far more opportunity to diversify, both domestically and internationally, than they did 100, or even 50 years ago. This may also have lowered their risk premium.

But this fall in the 'expected' risk premium has boosted share prices, causing the historically measured risk premium to rise. Looking forward, it will be the new and lower expected risk premium that will determine future stock returns.

Bond Returns

Long-term bonds are an important asset class. In many countries today, the size of the bond mar-

kets and the volume of trading in bonds exceeds those of equities. Nor is the importance of bonds a new phenomenon. At the start of the twentieth century, bonds seemed a natural and often the preferred investment for individuals and financial institutions.

Unfortunately, however, bonds performed poorly throughout the twentieth century. Across all 12 countries, the average real bond return was 0.6 percent per annum. The bond maturity premium (the difference between long-bond returns and the short-term interest rate) was also 0.6 percent.

Real bond returns were negative in Germany, Japan, Italy and France over the century, due mainly to high inflation during the first half of the century. German bonds were the worst performers. In 1923, hyperinflation resulted in a total loss of 100 percent for German bond investors.

Nor was this the only dreadful time for bond investors. One of the repercussions of World War 2 was the division

of Germany, together with associated currency reforms. As a result of these processes, German bond investors faced a loss of 90 percent in nominal terms. The real bond return that year was -92.3 percent.

So much for the convention that government bills are assumed to be risk free, and bonds are less risky than equities! There can be extreme circumstances where this ceases to be true.

Denmark (2.7 percent), Sweden (2.3 percent) and Switzerland (2.1 percent) generated the best annualised real returns on bonds (Figure 6). The UK was middle-ranked in terms of average real bond yields (1.3 percent). It was above average, however, in terms of volatility with a standard deviation of 14.6 percent, just marginally behind that of France. Japan had the highest standard deviation of annual real bond returns at 29.1 percent, while Switzerland had the lowest, at just 7.4 percent.

There is evidence to suggest that bond returns do regress to the mean. Germany, France, Italy and Japan, which had negative real bond returns over the century as a whole, were amongst the best performing bond markets over the last fifty years.

Industry Composition 1900 vs. 2000

The LBS database enables the researchers and analysts to consider a number of topics that have often been beyond the scope of other studies of long-term investment performance. Although data is limited to the UK the results of the analysis conducted by the LBS team should be of interest to individuals who invest in non-British securities.

This is particularly the case as far as sectoral composition and concentration levels are concerned.

In today's markets, investors want to have exposure to the sectors that are destined to grow. Yet despite the current

focus on technology, at the end of 1999 only 5 percent of the value of the FTSE 100 was accounted for by information technology companies, and investment professionals consider it risky to tilt a portfolio towards highly rated stocks.

In this respect, there are definite parallels with the situation 100 years ago when the sectoral composition of the London stock market is examined. High growth sectors were conspicuous by their absence.

Nearly 70 percent of the top 100 companies at the start of the century was in sectors that now account for only 16 percent of the FTSE 100. At the start of the twentieth century, railways made up nearly 50 percent of the top 100. Now they account for just 0.3 percent (Figure 7).

By contrast, telecoms accounted for 2.5 percent of the top 100 in 1900 com-

Figure 7: Sector composition using end-century classification

Sectors using industry classifications from 2000	Sector composition of top 100 companies at start of 1900%	Sector composition of FTSE 100 constituents at start of 2000%
Telecoms	2.5	18.4
Banks	15.4	16.6
Oil and gas	0.2	12.3
Pharmaceuticals	0.0	11.0
Insurance	1.9	6.0
Media and photography	0.6	5.1
Information technology	0.0	5.0
Utilities	3.1	3.9
Mining	6.7	2.9
General retailers	0.3	2.4
Sectors that are small in 2000	69.2	16.4
Total	100.0	100.0

Source: Dimson, Marsh and Staunton (ABN AMRO/LBS)

pared with 18 percent today. Similarly, pharmaceuticals and oils, which are very big sectors today, were scarcely present in 1900.

Nonetheless, there are some similarities. Banks, breweries and distilleries, and utilities have broadly similar weightings at the start and end of the century. Moreover, FTSE 100's low weighting in "traditional manufacturing" is not new. This sector was not very important in stock market terms, even at the start of the twentieth century.

FTSE 100 companies now account for 79 percent of the total UK equity market. Within the top 100 companies,