Are Lost Decades in the Stock Market Black Swans?

Blake LeBaron *
International Business School
Brandeis University

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*International Business School, Brandeis University, 415 South Street, Mailstop 32, Waltham, MA 02453 - 2728, blebaron@brandeis.edu, www.brandeis.edu/~blebaron. The author is also a research associate at the National Bureau of Economic Research. This paper summarizes results from, LeBaron, Searching For Lost Decades in U.S and Global Equities, working paper, Brandeis International Business School, 2012.

1 Introduction

The day to day fluctuations in global stock markets are well known to investors. The chance of losing money on any given day in the market is only slightly less than even odds. However, as the time horizon expands equity returns begin to reveal lower risk, and many investors have felt very safe betting on long run returns. Just how much risk are long run investors bearing? This question can be posed in many different ways, using a range of statistical procedures. In this note I will use a single very simple number to assess this long range risk, the probability of a "lost decade."

The term "lost decade" can mean many different things. It is often connected to overall economic performance, or the change in the well being of workers. Here, I will concentrate only on the performance of financial markets over a ten year span. If an investor put one dollar into a broad index of U.S. stocks in January of 2000, and held this for ten years, reinvesting dividends, then this investor would have ended up with less than one dollar from this investment. In other words, a lost decade of equity investing.

In this brief I will explore various estimates of decade losses in equity markets both in the U.S. and globally. Using several very long range data sets I conclude that lost decades are not black swan events, and should be taken very seriously in investors' portfolio planning.[1]

2 Long range U.S. returns

To get a reasonable estimate of decade length returns, I will need to construct long return series. A long return history is built by merging two stock return data sets. The first is the monthly returns series described in Schwert (1990) which extends back to 1802. The second is the annual series, beginning in 1871, constructed by Shiller, and used in Shiller (2000).[2] Shiller's data set also includes inflation series from 1872 on. This is augmented with inflation series obtained from "Measuring Worth."[3] Figure 1 displays the compounded ten year returns earned in U.S. equity markets over the sample period beginning in 1802. Nominal lost decades are a relatively infrequent event, but they do occur.

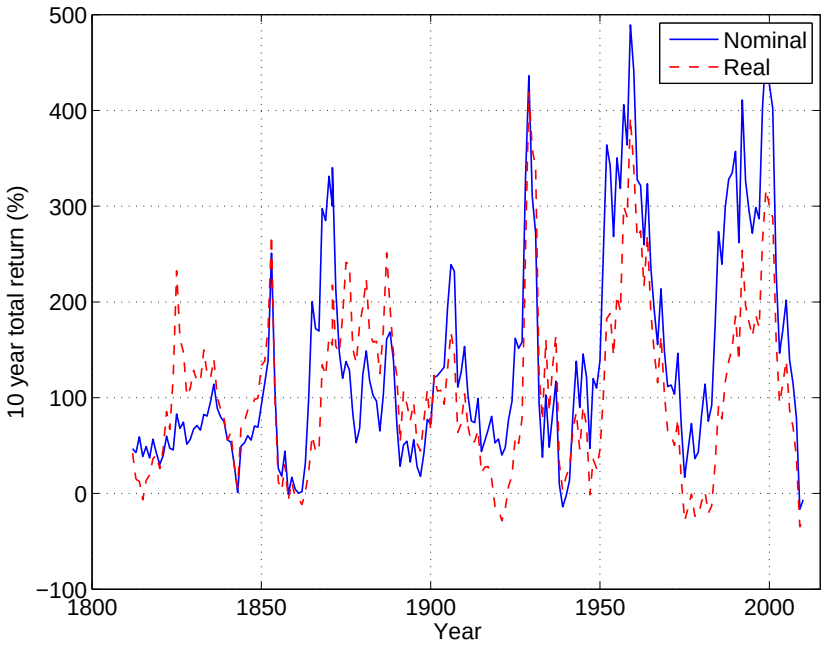
This figure is informative, but not useful for giving a quantitative assessment of loss probabilities. To do this, a bootstrap, or resampling procedure is performed. Historical

[1] It should be noted that there is extensive research on long range properties of the equity premium. This is the spread of equity returns over a benchmark risk free return. The lost decade estimate is related, but does not race stock returns against bond returns. Therefore, it sidesteps the tricky question of what exactly is a risk free rate of return estimated in old time series.

[2] Both of these data sets are available at the authors' websites.

[3] See http://www.measuringworth.com/ for full information on the methodology behind the early inflation estimates.

Figure 1: **Preceding Decade Returns**



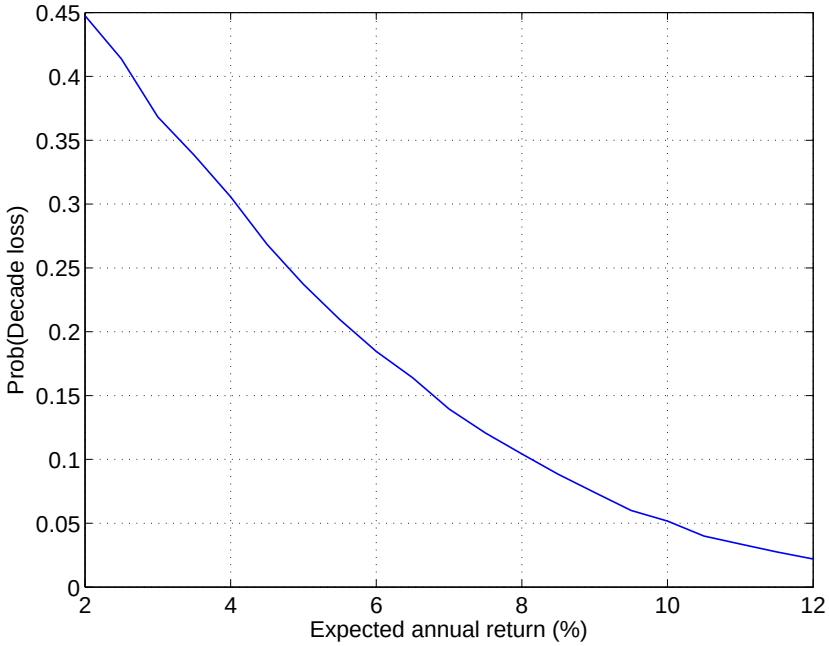
stock returns are used to generate a new random series by drawing with replacement from the original data set. This mechanism is can be thought of as taking each annual return value, writing it on a ball, and throwing it into an urn. To generate a new series, draw a ball, record the return, and then replace the ball in the urn before drawing again. Repeat this procedure many times to create a new random history. This procedure assumes that annual returns are independent, but it makes no assumptions about their distribution. A very long history, 250,000 years, is built, from which overlapping decades of compounded returns are used to estimate the probability of a decade loss. The first two rows of table 1 present the estimated probability of a decade loss. For nominal returns this is just a little over seven percent, and for real returns, twelve percent. In either case the probability of a loss is not trivial.

Table 1: *Probability of Decade Loss*

Series	Probability
Nominal returns	0.072
Real Returns	0.120
Dependent real returns	0.106
Value weighted global	0.165
Equal weighted global	0.100

Obviously, this estimate depends on assumptions about the expected return on the market going forward. These first two rows are based on the sample estimates of the mean nominal and real return. However, investors may have their own estimates for future returns. Figure 2 presents estimates of decade losses (y-axis) versus a range of equity return assumptions. Using this figure, you can use your own estimate of expected returns over the next decade, and convert it into a decade loss probability. For example, an assumed return of eight percent yields a loss probability of about 0.1. If one drops the expected return assumption down to six percent, then this probability increases to almost 0.2.

Figure 2: **Decade Loss Probabilities**



The probabilities presented thus far are relatively large. Could there be something in the data that we are ignoring that might reduce these? One possibility is for some sort of long range dependence in the data, or long range mean reversion, where negative returns tend to be followed by positive returns. If this were the case, then the probability of drawing a losing decade could be reduced, since large falls in the market would often be followed by strong recoveries. The third line of table 1 uses a bootstrapping method which draws blocks of data rather than individual returns. This is known as the stationary bootstrap, and it attempts to adjust for dependence in a time series. In this case the urn is filled with sequences of returns rather than individual returns allowing the data itself to speak to the possibility of strong return reversals. The decade loss probability in this case falls from 0.12 to 0.106, not a very dramatic reduction in the loss probability.[4]

3 Long range global markets

The U.S. perspective gives only a limited view for investors. How might investors view these probabilities if they had access to similar long range data on other countries? Fortunately, such data is available. Dimson, Marsh & Staunton (2002) have compiled annual returns series for the 20th century for a set of 18 developed countries.[5] For each country I performed the same decade loss estimation as I did for the U.S. The results of this are summarized in figure 3 which shows a histogram of the decade loss estimates across this set of countries.

With a real return loss probability of 0.12, the U.S. sits on the far left side of this distribution. In terms of long range equity returns over the last century the tail risk for the U.S. has been lower than for other developed countries. If U.S. investors predict some reversion toward global equity performance in the future, then an increase in the predicted loss probability is warranted.

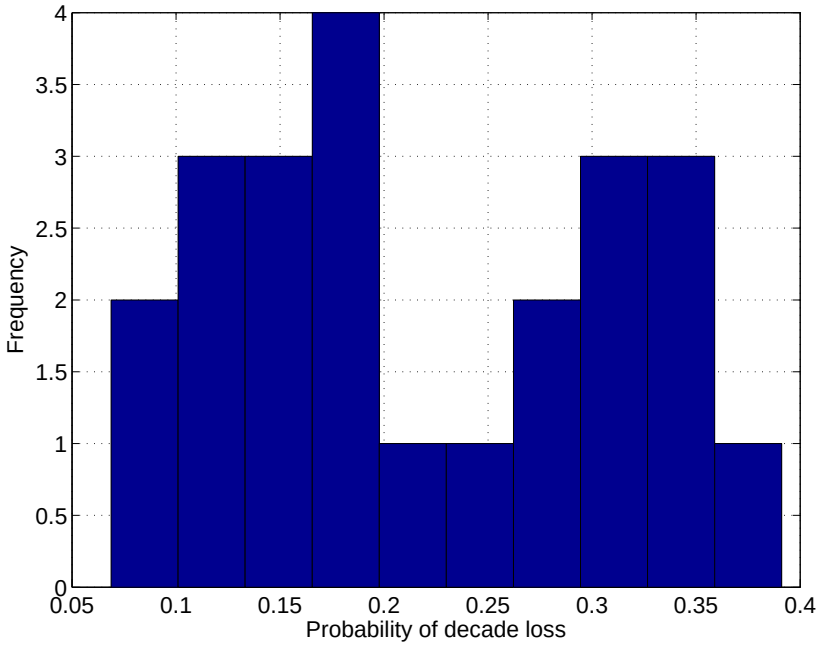
Although global investing for most individuals was not prevalent in the early part of the twentieth century, it is interesting to explore the performance of international portfolios. Estimates of the loss probabilities of two diversified global portfolios are given in the last two rows of table 1 A diversified value weighted portfolio gives a loss probability of 0.165, and an equal weighted portfolio reduces this to 0.100. Value-weighted diversification does not appear to help investors much on this extreme dimension, and there is only marginal improvement from the equal weighted portfolio.[6]

[4] See LeBaron (2012) for more details and extensive tests.

[5] Another important study of the international cross section of returns is Jorion & Goetzmann (1999).

[6] In comparing with the earlier U.S. results, it is important to note that the global portfolios use a different, and shorter time series,

Figure 3: **Country Loss histogram**



4 Summary

There is no question that investing in stocks is risky. This risk is usually rewarded with superior returns relative to other asset classes. Just how much additional risk do equity investors bear at the medium horizon of a decade? If investors care about the simple probability of losing money on their investments, then this probability is low, but not trivial. U.S. investors should be prepared for real losses on their portfolios of close to ten percent. If we interpret the past century of international returns as informative for all global investors, then these probabilities would be even higher. Informed investors ought to prepare for lost decades being more frequent than a "black swan."

starting in 1900.

References

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