GLOBAL FINANCE BRIEF

Are Lost Decades in the Stock Market Black Swans?

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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. But what is the real risk exposure of these long-run investors?

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; suppose 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. Would this investor have ended up with less than one dollar from this investment? In other words, would this investment have been a "lost decade" of equity investing?

In this brief I will explore various estimates of decade long losses in equity markets both in the U.S. and globally. Using several very long history 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

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.[2] This figure is informative, but not useful for giving a quantitative assessment of the *probability* of a lost decade. To do this, requires a bootstrap, or resampling procedure. Historical stock returns are used to generate a new "history" by drawing stock returns with replacement from the original data set. This procedure can be thought of as taking each annual stock 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. Repeating this procedure many times creates a new "history."[3] Using

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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. To get a reasonable estimate of decade returns, I construct a long return series. This long 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). Both of these data sets are available at the authors' websites. Shiller's data set also includes inflation series from 1872 on. This is augmented with inflation series obtained from "MeasuringWorth." See http://www.measuringworth.com/ for full information on the methodology behind the early inflation estimates.

3. This procedure assumes that annual returns are independent, but it makes no assumptions about their distribution.

Figure 1: **Preceding Decade Returns**
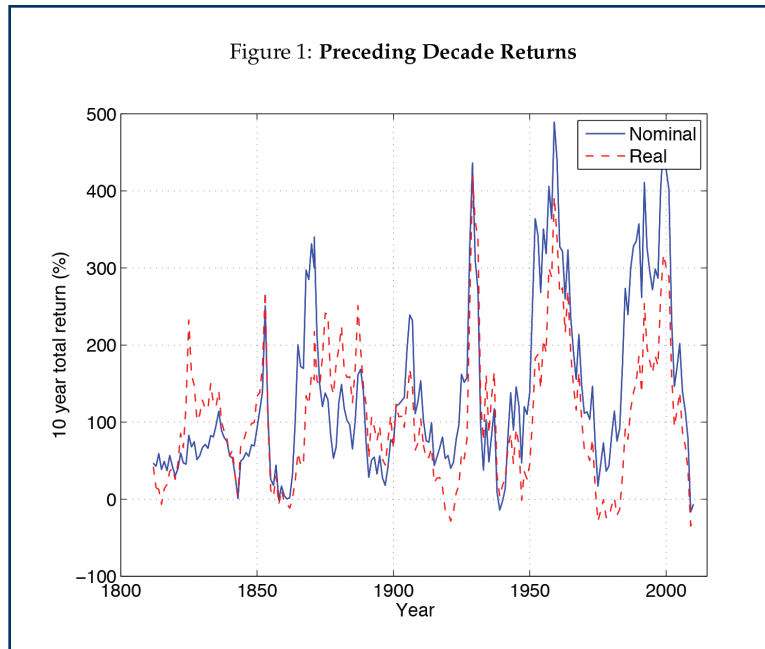
this procedure, I build a return history of 250,000 years from which I create overlapping decades of compounded returns so as to estimate the probability of a lost decade. The first two rows of table 1 present the estimated probability of a lost decade. For nominal returns this is just a little over seven percent, and for real returns, twelve percent. In either case the probability that an investor loses wealth over the course of a decade is not trivial.

Table 1: *Probability of a Lost Decade*

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 estimates of the mean nominal and real return from the historical sample. However, investors may have their own estimates for future returns. Figure 2 presents estimates of decade losses (y-axis) versus a range of assumptions on equity returns. Using this figure, you can use your own estimate of expected returns over the next decade, and convert it into a probability of a lost decade. For example, suppose you assume a return of eight percent, the probability of a lost decade is about 10 percent. A lower expected return assumption, say 6 percent, increases the probability of a lost decade to almost 20 percent.

The probabilities presented thus far are relatively large. Could there be something in the data that we are ignoring that might reduce these chances? Some form of long range dependence might be able to reduce the probability of a lost decade. An example of this would be when large decreases in stock prices are likely followed by strong recoveries. The third line of table 1 uses a bootstrapping method that draws blocks of data rather than individual returns. This is known as the stationary bootstrap,

Figure 2: **Probability of a Lost Decade**
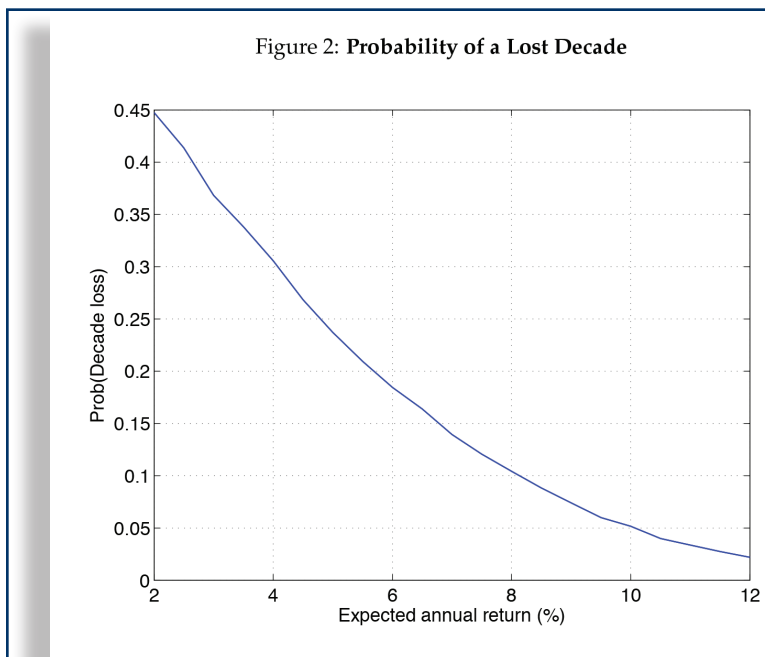
and it attempts to adjust for dependence in a time series. In this case the urn is filled with sequences of returns rather than individual returns allowing the data to correctly replicate mean reversion if it exists in the return series. The lost decade probability falls only from 12 percent to 10.6 percent, 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 estimation of the probability of a lost decade 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 12 percent, the U.S. sits on the far left side of this distribution. Therefore, in terms of long range equity returns over the last century, the decade loss probability for the U.S. has been *lower* than for other developed countries. If investors perceive a regression to the mean in equity returns, then they should predict lower returns, and higher loss probabilities going into the future. If the regression to the mean assumption is valid, the U.S. will move closer to the center of the distribution in figure 3 with higher lost-decade probabilities.

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 globally-diversified value-weighted portfolio gives a loss probability of 16.5 percent, and an equal-weighted portfolio reduces this to 10 percent. Value-weighted diversification does not appear to help investors much, and there is only marginal improvement from the equal-weighted portfolio in terms of black swan probabilities.[6]

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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, starting in 1900.

Figure 3: **Country Loss histogram**
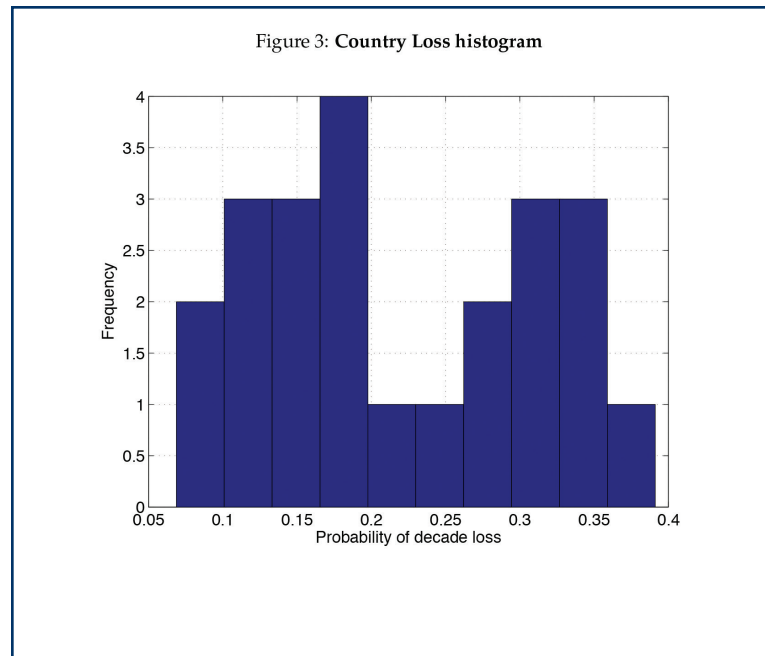
4 Summary

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 holding their portfolios for 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.

5 References

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