

Chapter 3

The Performance History of U.S. Equity Markets

This Chapter surveys the performance history of the stock market. It is an important component of our national fabric, and serves as a leading indicator¹ of the nation's economic health. True, the economy does not stagger with every drop in the market, but a prolonged drop in the market affects all its segments. Understanding the history of the stock market is also important if we are to glean any patterns from its performance that can help guide our investment goals, strategies and expectations.

The history of the market is replete with surprises, melancholy, and great performances. Our evidence confirms that, in the long run and in most sub-periods of its history, no investment has surpassed the risk-adjusted rate of return yielded by the U.S. stock market. The current travails of the market are but a bump on the road to superior performance, therefore, that perhaps present the great buying opportunity that many may have missed during the market's 1990s high-flying performance.

Specifically, this chapter seeks answers to two questions:

- What has the stock market's returns been like, in the 1990s and before, through history? and*
- Have these returns been worth chasing, in terms of the risks posed by inflation on one hand and the market's gyrations on the other?*

The idea here is to see if history can guide us about the returns we can expect, and the risks they entail, when we invest in stocks. Therefore, this Chapter is divided into three sections that survey the market's history, starting with its present bear run in the first section, the bull run of 1990s in the second section, and the market's two-century history in the third section.

The goal, throughout this Chapter, is to see whether the investors' success in the U.S. equities market so far has been fortuitous or reflects the workings of some fundamental truths about the market's overall performance that cannot be dismissed as happenstance.

3.1 The Y2K² Strikes, with a Bear Market

This section surveys the ongoing “bear” phase of U.S. stock market’s two-century history — a run that, having begun in early 2000, was more than two years long by mid-year 2002 and, though not the longest in the market’s history, has already produced steep declines. The *blue chip* Dow³ is poised for a rare three consecutive years of negative returns, if the second half of 2002 fails to offset the losses that have already occurred in the first half of the year. But then, over time, neither this nor any other index can move independent of the market and the economy. A closer look at this bear run of the market will thus help us focus on three issues: the returns that investors receive, the macroeconomic environment that makes these returns possible, and the demographics that set the priorities and time horizon for investments.

3.1.1 The market and its sectors:

Exhibit 3.1 traces the price-performances of some of the broad U.S. stock market indexes during this bear-run. Note how precipitously all these indexes had fallen by mid-2002 from their early-2000 peaks, the technology-heavy NASDAQ Composite having lost the most. Despite transforming the global geopolitical arena dramatically, the terrorist events of September 11, 2001 appear to have had little lasting effect on this trend. Indeed, since the closure of the market for a few days in the immediate aftermath, all these indexes initially dropped precipitously, reaching new lows on September 21, but soon recovered and temporarily peaked by March-April 2002. That hardly lasted, however, as the market resumed its earlier, declining, trend that had begun two years earlier.

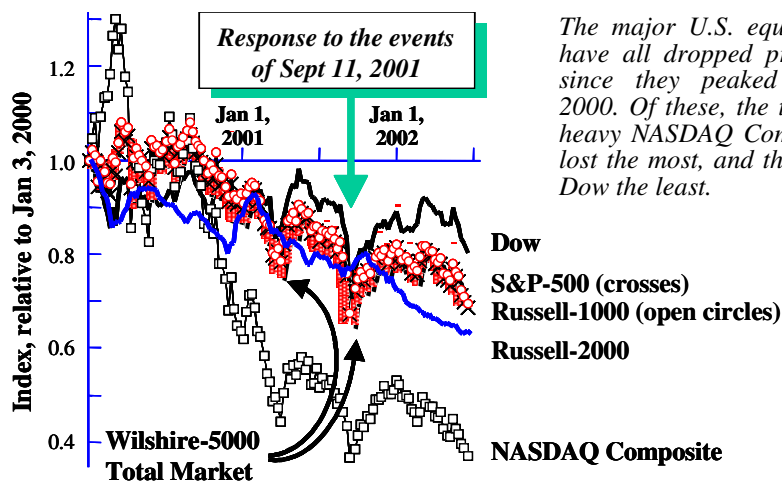


Exhibit 3.1:

The major U.S. equity indexes have all dropped precipitously since they peaked in early-2000. Of these, the technology-heavy NASDAQ Composite has lost the most, and the blue-chip Dow the least.

At the time of this writing in mid-year 2002, it remains to be seen if the market has already bottomed or is yet to establish the lowest levels in this bear run. The Dow seems poised to revisit the September 21, 2002 low of 8235.8 that it reached in response to the September 11, 2001 events, an end towards which the far broader S&P-500, Russell-1000 and Wilshire-5000 indexes appear to be galloping even faster.

Clearly, the chain of events that began with the preparations for Y2K has been of greater consequence to the investors and the market than the events of September 11, 2001. That it was a bubble waiting to burst is evident from the fact that neither Fed's aggressive interest-rate cuts in 2001, nor President Bush's \$1.35 trillion tax cut, have yet been able to stem the market's slide. The market's woes began with the early-2000 implosion of the equity-price bubble: the dotcoms heralded this collapse but the contagion soon spread to the technology sector before engulfing the entire market. The corporate and Wall Street excesses, seen in the scandals that have led to the fall of such one time titans as Enron, Anderson, WorldCom, Tyco, Adelphia, Quest, Bethlehem Steel, Global Crossings, Xerox, and the like, have sapped the investors' confidence further. Add to these the looming bursts of possible bubbles in the foreign exchange and real estate markets, and a gloomier investment scene would be hard to picture.

Indeed, if you compare the midnight mass at the St. Peter's Basilica on December 31, 999, with the passage of 1999 into 2000 a millennium later⁴, you would notice a striking similarity. Those present at that ancient event felt relieved when the world continued unaffected by the change in that year's digital code. Likewise, the equities market perhaps felt a similar relief when the dreaded Y2K bug failed to bite, an event that it celebrated by taking the prices of many stocks and their indexes to stratospheric heights. That jubilation was premature, however. Investors who saw in the nonoccurrence of a calamity the sign that the market's ascent would continue were betting on a trend that, having begun in the mid-late 1990s, was tiring itself out already. Most of those gains soon fizzled, therefore, as gravity inevitably reasserted itself in order to let the market eventually revert to its historic pattern of 10-12% average annual rise.

It is not that all the stocks have lost, or lost equally, since January 2000. The performances of some broad market and sector indexes, compared in Exhibit 3.2, clearly show that the indexes and sectors that had appreciated the most in the market's bull run have since lost the most. This may illustrate the market's tendency to revert to the mean. Of the broad market indexes, for instance, the Dow did not rise as much during 1995-99 as the NASDAQ Composite and S&P-500 indexes. Not surprisingly, therefore, the latter two have led the decline since their 2000 peaks, not the Dow. Likewise, the

AMEX Internet index was a top performer during 1995-1999, when it grew at a 52.64% annual rate, whereas the Philadelphia Gold and Silver index, which then fell at a -8.33% annual rate, was a leading laggard. But if we extend this period to the end of June 2002, then these rates change to 2.06% for the AMEX Internet index and -4.66% for Philadelphia Gold and Silver index. The former has obviously depreciated appreciably since March 2000 whereas the latter has appreciated.

Exhibit 3.2:

Comparing the price performances of selected broad market indexes and sector indexes since Jan 3, 2000. They are listed here in descending order of index appreciation for the period of Jan 3, 1995 through June 28, 2002.

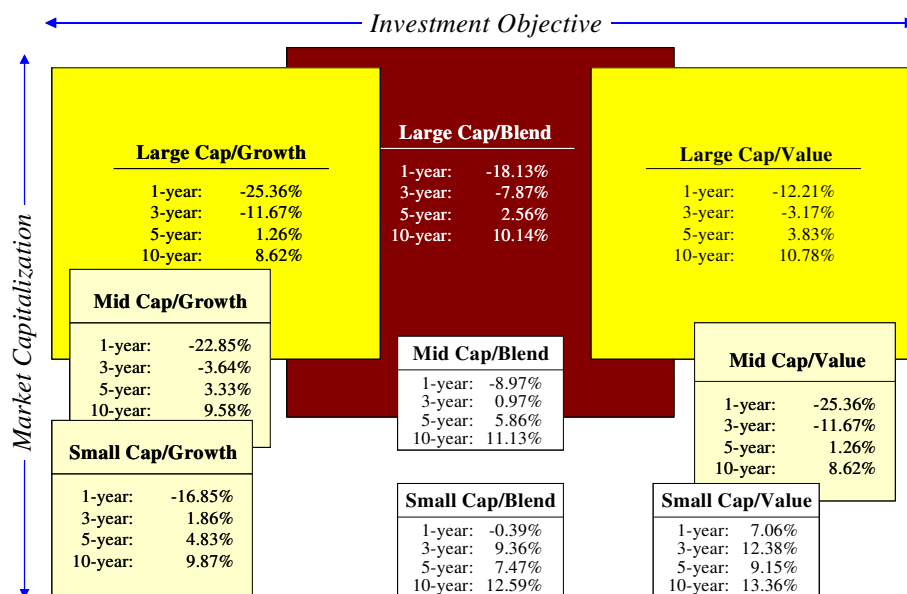
Index	Index appreciation in the year ...			Annualized growth from Jan 3, 1995 to ...	
	2000	2001	2002*	Jun 28, 2002	Dec 31, 1999
Selected Broad Market Indexes					
Dow Jones Industrial Average	-6.17%	-7.10%	-7.76%	12.43%	24.53%
S&P-500	-10.14%	-13.04%	-13.78%	10.79%	26.19%
Wilshire-5000 Total Market	-11.85%	-12.06%	-12.46%	10.18%	24.98%
NASDAQ Composite	-39.29%	-21.05%	-24.89%	9.46%	40.49%
Russell-1000	-4.20%	1.03%	-5.29%	8.71%	15.34%
Selected Sector Indexes					
S&P Homebuilding	52.79%	31.95%	9.77%	18.56%	10.13%
NASDAQ Biotechnology	20.41%	-16.20%	-44.48%	16.55%	41.28%
Philadelphia Semiconductor	-18.16%	-9.44%	-24.44%	15.17%	38.80%
NASDAQ Financials	-27.91%	-2.09%	-10.20%	12.91%	31.43%
Dow Transportation	-1.03%	-10.41%	3.42%	8.57%	15.11%
GSCI Energy	40.90%	-41.09%	31.18%	6.72%	8.38%
Dow Utilities	45.45%	-28.68%	-6.82%	5.52%	9.13%
AMEX Internet	-51.24%	-47.81%	-44.74%	2.06%	52.64%
Philadelphia Gold and Silver	-24.36%	5.87%	34.89%	-4.66%	-8.33%

* only the first one-half of the year, i.e., until June 28, 2002.

The alternative to using indexes to assess relative performances of the market's different segments during this bear-run is to see the returns realized by the equity mutual funds. Exhibit 3.3 does so by comparing Morningstar's⁵ statistics on the annualized trailing returns on diversified mutual funds. These data cover 5864 of the 7891 funds in Morningstar universe of mutual funds and account for \$2.3 trillion in assets, i.e., 83.4% of the total assets of all the mutual funds analyzed. Morningstar groups these funds into a 3x3 matrix along the dimensions of market capitalization⁶ (large-caps: the largest 5% of 5000-plus equities by market capitalization, small-caps: the bottom 5%, and mid-caps the remaining equities) and investment objective (the growth stocks tend to have high price-to-earnings and price-to-book

value etc. ratios, and future growth prospects, compared to the smaller price-to-earnings and price-to-book value ratios but higher dividend yields of the value stocks).

Exhibit 3.3: Performance of equity mutual funds categorized by market capitalization and growth versus value criterion. The size of the block reflects net assets of the fund category, i.e., largest: \$774 billion, large \$499-554 billion, small \$93-143 billion, and smallest \$44-77 billion.



Source data from:
<http://screen.morningstar.com/quarterend/Q22002/QEFundCategoryReturns.html>

These data offer an interesting insight. The small-cap value funds are best performers here, and the large-cap growth funds the worst, whether we look at the past 1 year record or 10. But, despite their apparent immunity to the market's bull versus bear states, small-cap value funds account for less than 3% of the total assets. Why this reluctance to embrace such stellar performers? The reason is volatility. Judging from the 1926-2001 statistics in Ibbotson Associates' 2001 Yearbook⁷, for instance, the expected annual returns on small-company stocks range from -48.9% to 87.7% at a 95% confidence level, compared to the expected annual returns of -26.6% to 53% for the large-company stocks. Investing in the small stocks clearly involves a roller-coaster ride. As will be discussed in Chapter 5, this illustrates a simple fact, that investors demand higher returns on the equities that entail greater risks, forms the core of modern financial theory and is precisely what the capital assets price model (CAPM) is based on.

3.1.2 A “Buying” Opportunity!

The tendency of returns to revert to their long-term averages, seen so clearly in Exhibit 3.2, is at once a reassuring and yet worrisome aspect of the market’s behavior during its current bear run. Though steep, the considerable drops suffered by the broad market indexes since their March 2000 peaks have only brought their average annualized growth rates closer to the historic rates. Take the S&P-500 index, for instance. Based on the data in Ibbotson Associates’ 2001 Yearbook, its total annual returns (i.e., capital appreciation and dividend-reinvestment) during the 1926-2001 period have averaged 10.7% per year, over two-thirds of which came from capital appreciation and the rest as dividends. But these returns averaged a whopping 25.13% in the 5-year period from 1995 to 1999, so much so that, despite its 9.1% and 11.9% drops in 2000 and 2001, a \$1000 investment in this index on January 3, 1995 still amounted to \$2813.49 on December 31, 2001, and \$2443.23 on July 1, 2002, the latter because of a 13.16% drop in the first half of 2002. This is the reassuring part. These drops have already brought the average total annual returns on this index for the last 10 years to 11.43%, a figure that is considerably close to the historic mean. The worrisome part is the implicit possibility that the market’s periods of stellar performance tend to be punctuated by those of sub-average returns.

Looking once again at the S&P-500 total return index, for instance, it can be seen in Exhibit 3.4 how strongly negative the correlation⁸ of returns for the trailing (or past) and forward (or next) 20-year holding periods has been through the 1871-2001 history of the index⁹. This shows the market’s strong tendency to revert to the mean. With such stellar returns in the 1990s, therefore, there is a good chance that the market will give substantially sub-average returns in the future.

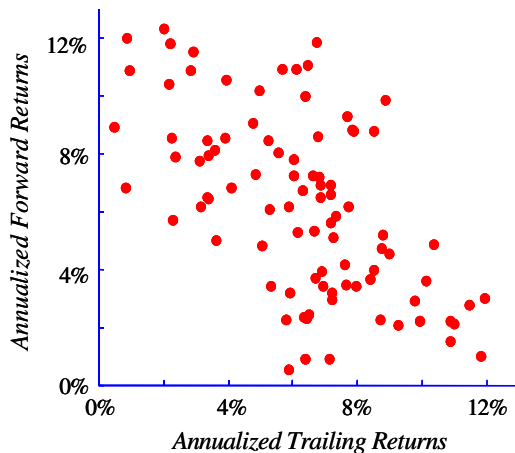


Exhibit 3.4:

Total returns for 20-year trailing and forward holdings on the S&P-500 index show a strong negative correlation (= -0.59). The periods of stellar growth are likely to be followed, therefore, by those of mediocre to poor returns. The returns here are real, having been adjusted for inflation, and cover the entire 1871-2001 history of S&P-500 index.

Source data:
<http://www.globalfindata.com>

How low might these sub-average returns turn out to be? Exhibit 3.4 tells us that they are unlikely to be negative, if held for 20 years or longer — note the total absence of any negative returns here. Another guidance that this Exhibit offers is the mean of these returns: they average to $6.26 \pm 0.52\%$ per year at the 95% confidence level. As will be shown later in this Chapter, this is a stable estimate, and is statistically indistinguishable from the $6.59 \pm 3.23\%$ mean of annual returns, and $6.77 \pm 1.32\%$ mean annualized return for 5-year holdings, over the market's history¹⁰. Compared to the 15-20% returns that the 1990s had deluded the investors into expecting from the market, even this average rate seems paltry, not to speak of returns inferior to this. But then, with the annual U.S. inflation at 1.2%, 1-year U.S. Treasury bill at 2.1%, 10-year Treasury securities at 4.86% and 30-year Fannie Mae, Ginnie Mae funds and corporate bond index at 6.4-7%, even a 5-7% annual rate of return over the long haul implies a decent enough premium¹¹ on the total return index.

The fear that future returns on the market may not match the historic average of 7% per year, adjusted for inflation, that Social Security Administration's Office of Chief Actuary assumes¹² for the next 75-year time horizon, has been central to the ongoing debate on the future of the Social Security program. This rate, based on Ibbotson Associates' Yearbook and Jeremy Siegel's popular book¹³ on investing in the stocks, is higher than what our analyses later in this Chapter show. Our analyses yield rates higher than what the equilibrium future rate may turn out to be¹⁴, based on the Gordon growth model explained in Box 3.1, and the extrapolation of historic price, earnings and dividend data. But this is not an issue that defines whether equity investing would be healthier for or detrimental to the future of our social security system. Instead, as will be

Box 3.1: The Gordon Growth Model

The Gordon growth model provides a simple way to value an equity as also the market. The price (P) here is the present value of the future cash stream. If this cash stream comes as dividend (D) that grows at the annual rate 'g', and 'r' is the annual rate for discounting that future cash receipt to its present value, then,

$$P = \frac{D}{1+r} + \frac{D(1+g)}{(1+r)^2} + \frac{D(1+g)^2}{(1+r)^3} + \dots$$

$$= \int_0^{\infty} D e^{-(r-g)t} dt = \frac{D}{r-g}$$

because this cash flow can continue *ad infinitum*, the life-expectancy of a business, or of the market, being infinite.

Successful firms do not pay out all their earnings (E) in dividends, and plow the retained earnings back in order to finance growth. In the equilibrium state, or over the long term, the sustainable rate for $g = ROE \times RR$, where ROE is the return on equity ($= r$, which is also called the *capitalization rate*, if market value = book value), and RR is the *retention rate* ($= 1 - D/E$). These mean that

$$P = D/(r-g) = E/ROE \quad \text{or} \quad P/E = 1/ROE$$

This also explains why the P/E ratio is so important, i.e., the larger the P/E ratio, the smaller the firm's return on its equity and the more stressed the firm's management.

shown in the next chapter, our rationale here is that risk-adjusted returns on equities have been historically superior to those on fixed income instruments. We therefore set this issue aside, for now, and address two other questions that are more immediately related to this discussion of the market's current bear run: one, if a long-term investor can expect to retrieve the paper money lost in this bear run and two, if this is not the right time to invest.

Indeed, caught in the market's continued hemorrhage is the plight of the patient but hapless investor whose concern is no longer whether the boom era of dotcom millionaires will return but whether the wealth already lost can be retrieved, if ever. Consider, for instance, someone who invested in the market when the S&P-500 index peaked at 1527.46 on March 24, 2000 and has thus lost over one-third of that investment by June 28, 2002. How long might it take for such a person to recoup this loss? To answer this question, Exhibit 3.5 summarizes the time that the S&P-500 total return index has taken in the post-World War II period to recover from its 10% or deeper drops. Only real or inflation-adjusted returns are used here. Also, in order to compare realistically with the present situation, included here are only those of the market's troughs that coincided with the business cycle troughs¹⁵.

Exhibit 3.5: Recovery times and growth rates for the market's rebound from losses during economy-wide downturns in the post-World War II period

Stock Market Trough	Associated Business Cycle Trough	Market's drop from its last peak	Recovery Time	The annualized growth rate during recovery
June 1949	Oct 1949	10.60%	3 months	44.82%
Dec 1957	April 1958	16.80%	7½ months	29.43%
June 1970	Nov 1970	38.70%	2½ years	19.58%
Sep 1974	Mar 1975	54.90%	8½ years	9.37%
Mar 1980	July 1980	31.60%	3 years	12.66%
July 1982	Nov 1982	32.60%	8 months	59.18%
Oct 1990	Mar 1991	20.20%	3½ months	77.36%
Current?	?	>35.2% (?)	?	...

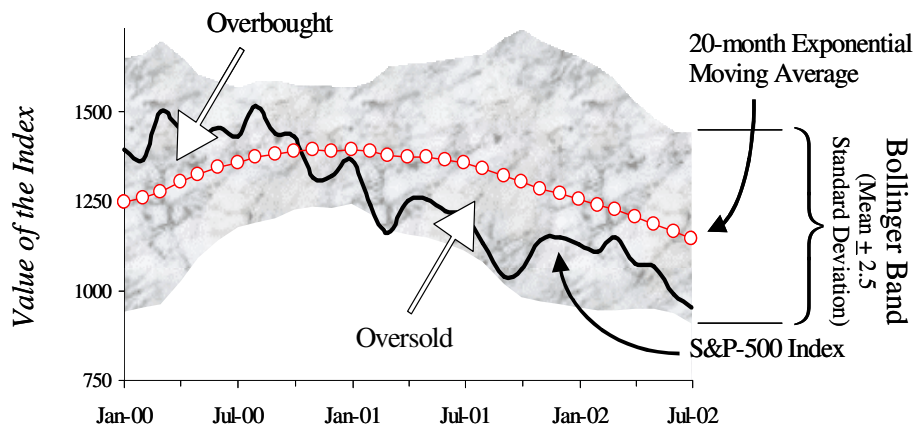
The growth in all these recovery phases has been rapid. Clearly, if this history is any guide as to what we can expect at the end of the current bear-run, then Exhibit 3.5 has answered the questions that we had posed earlier. One, even the 'worst-case' scenario of investing in the market at its peak does not have to become a nightmare, so long as the time horizon for investment is long or the *patience capital* is not squandered, as would surely occur if one sells off at the market's bottom and thus lock in the losses. Two, whether or not the returns over the next decade or century will be as good as they have been in the past, the returns immediately at the end of this bear run

are likely to be far from anemic — note that the slowest rates in Exhibit 3.5 are 9.37-12.66% per year! A downturn such as the one we now have is perhaps the type of buying opportunity that investors usually dream about. Incidentally, one need not be a computer wizard in order to estimate these rates. A crude estimate can be made from the *rule of 70*, an empirical formula an investor should always carry at the back of the head, i.e., *the time a number would take to double in value is 70 divided by the rate of growth*.

The *technical* concepts of moving averages and Bollinger bands provide a convenient tool to identify a “buying opportunity”. Exhibit 3.6 illustrates this for the S&P-500 index. The index remained above its 20-month moving average through the first quarter of 2000 but has stayed below that level ever since. The first period usually exemplifies an overbought or overvalued market and the latter an oversold or undervalued one. In such a *technical analysis*, the support for market’s floor is identified at the lower end of the Bollinger band, set at *mean minus 2.5 times the standard deviation* (the band’s upper end is set, likewise, at *mean plus 2.5 times the standard deviation*). As will become apparent when we discuss the properties of a normal distribution model in section 2.3, this band contains almost 99% of the observations. Exhibit 3.6 thus shows that, by mid-year 2002, the market was already seeking its floor for the third time during its current bear run. Once it finds that bottom, the question would be whether it is *a bottom* or *THE bottom*. Being based on the current statistics, this *floor* is hardly inviolate, however. Rather, it is a dynamic number that adjusts itself continually to the evolving market fluctuations.

Exhibit 3.6:

Technical analysis shows that the market has been ‘oversold’ since November 2001 and has already tested its floor several times during the ongoing bear run.

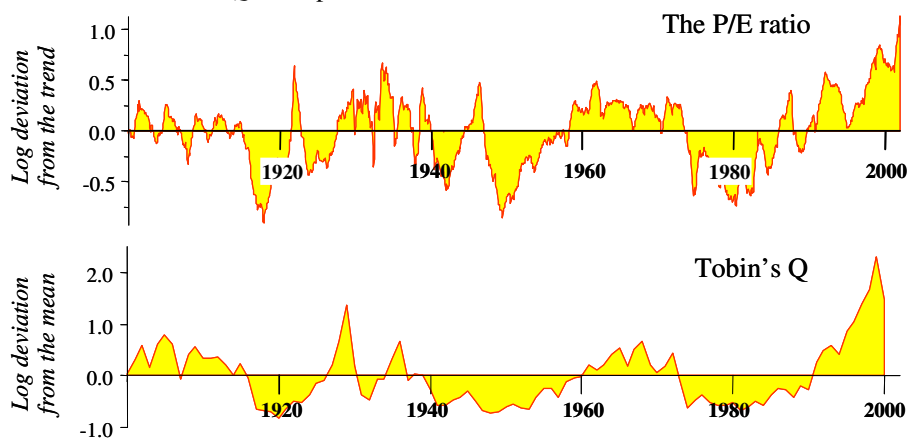


This search for the bottom of the market is where *technical* analysis meets *valuation* analysis, simply because an oversold market or equity is also an undervalued one. After all, it is not that the galloping overvaluation of the 1990s market had raised no alarms until the bubble eventually burst in early 2000. Recall, for instance, the Fed chairman Alan Greenspan's famous 1996 quote, "*irrational exuberance*". Of the predictions about where the market was headed then, the two most successful calls were made in the popular press using two valuation measures: the P/E (price-to-earnings) ratio¹⁶ and Tobin's Q¹⁷. Exhibit 3.7 graphs the 20th century history of these ratios for the S&P-500 index. Notice how both the ratios were rising to their historic highs in the late 1990s.

Exhibit 3.7: The top panel shows the variation of P/E ratio (as log deviations from the trend) and bottom panel shows that of Tobin's Q (as log deviations from the mean) for the S&P-500 index. The data sources are:

P/E ratios: http://aida.econ.yale.edu/~shiller/data/ie_data.htm

Tobin's Q: <http://www.smithers.co.uk>



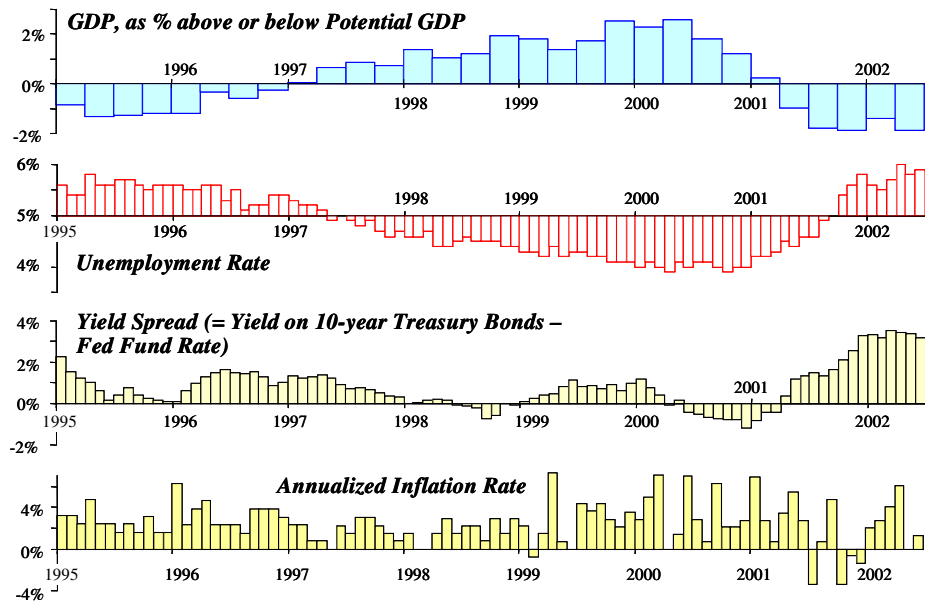
Correct as these calls were, they have also exposed a problem with the valuation models. The P/E ratio did not peak with the market in early 2000, for instance, but in mid-year 2002 when the prices had already popped sharply. Why? Because earnings tumble when the overall economy shrinks, and if they drop faster than the prices then P/E ratio can only rise. How good a valuation measure would this ratio be, then, if it does not distinguish the market's rise from its fall? Add to this the fact that, as was mentioned in the endnote earlier, aggregate prices of the equities in S&P-500 index have risen faster than earnings, while the corresponding dividends have grown the slowest. The graph for the P/E ratio in this Exhibit shows its deviations from the resulting trend, therefore, not the ratio itself. Likewise, as for Tobin's Q, seeking to identify its peaks as the harbingers of market's doom makes it

hard to reconcile its lows during 1940-60 with the June-October 1949 and December 1957-April 1958 market and business cycle troughs. Perhaps we could argue that this parameter is not as effective in a depressed economic environment as when the economic times are good. But that only begs the question whether a reliable measure should not work in all the contingencies. A better alternative would then be to examine the macroeconomic environment under which the market functions.

3.1.3 The Macroeconomic and Demographic Factors:

The determination by Business-Cycle Dating Committee of NBER (National Bureau of Economic Research), in November 2001, that the U.S. economic activity had peaked in March 2001, also meant determining that the present recession had begun on that date. A recession is an economy wide slump that depresses employment, personal income, sales and industrial production. That the equity markets too would be depressed, then, is hardly a revelation. Thus, the market's present bear run merely reflects the fact that the GDP (Gross Domestic Product¹⁸) had three quarters of negative growth in 2001 and is yet to recover from the recession. This also explains the market's impressive growth in the late 1990s. As is evident from Exhibit 3.8, the GDP was operating above its potential from 1998 through 2000.

Exhibit 3.8: As GDP was operating above its potential from 1998 through the first half of 2001, it is likely that an overheating economy could not have sustained the market's continued rise.

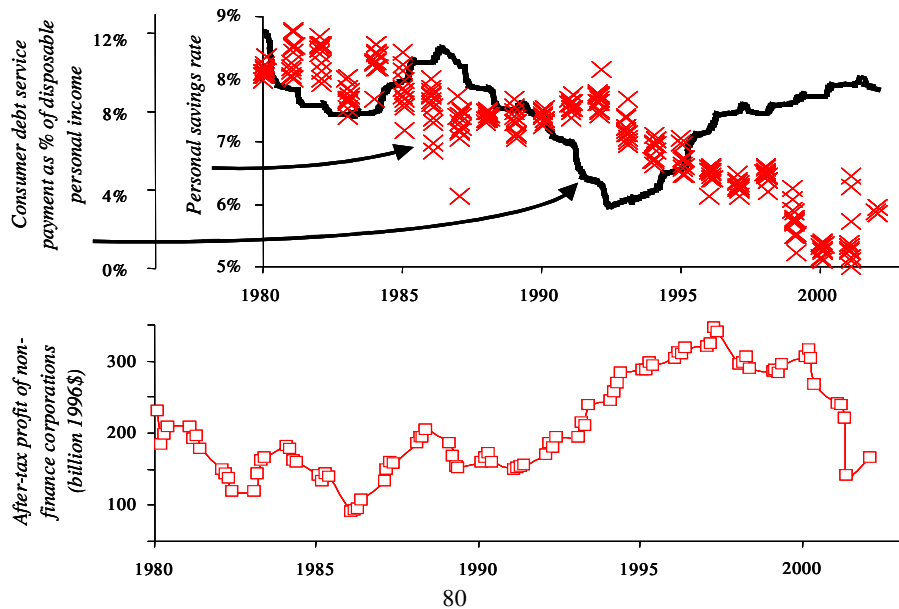


Of the macroeconomic indicators that are shown in Exhibit 3.8, yield spread (10-year treasury bonds less the federal funds) and GDP gap (i.e., potential GDP less the GDP) are of immediate relevance to the market's performance. As will be shown in the next chapter, the former is a leading indicator of the stock market and the latter a lagging indicator. Clearly, while yield spread is not the concern that it was in 2000-01, the GDP gap is. This is the reason why Exhibit 3.8 also shows unemployment and inflation rates.

Two other macroeconomic factors raise particular concerns, though. One, while personal income has been rising, consumer debt service burden has been rising faster than disposable personal income. As the 1990's growth was consumption driven, personal savings rate has steadily declined, from 8-8.5% of disposable personal income in 1990-92 to -0.4-0% at times in 2000-01, before climbing to 2.8-3.1% so far in 2002.

The top panel in Exhibit 3.9 summarizes these trends. To the extent that consumer spending has kept the economy resilient, any dampening of this debt-laden consumer's confidence can be deleterious to the economy's speedy recovery that the market now needs. Two, as shown in the bottom panel of Exhibit 3.9, after-tax corporate profitability is now back to the 1991-92 levels. On the face of it, the rise in corporate profitability during 1995-1999 correlates well enough with the rise in P/E ratios (Exhibit 3.7) to make the exuberance seem quite rational.

Exhibit 3.9: *The consumer debt service payments have risen faster than disposable personal income, personal savings rates are about the lowest they have been in decades, and the corporate profitability is down.*



Prices rise and fall faster than earnings, however, so exacerbating any volatility in the earnings. Therefore, we now confront a situation where either the profits need to double in order to justify the current prices, depressed as they are, or prices need to fall still farther. Corporate America's debt burden¹⁹ is the limiting condition here: it amounted to 60% of nonfinancial companies' net worth at the start of 2002, when financial liabilities were 91% of the financial assets. But, unlike the situation the consumers face, corporate America's ratio of net interest payments to cash flow has declined, to about 25% in 2001, from a little under 40% in 1990-91 and about 30% in 1981-82.

With almost one-half²⁰ of American households now participating in the stock market, one would ordinarily expect the market's woes to adversely affect the consumer's confidence and the economy. It is not. In a rather perverse way, part of the shock from market's fall has been cushioned by the skyrocketing housing prices. Most of this cushion has come from retirement and pension plans, however. This is because most of America's savings go to mortgage payments and retirement plans. As for the former, while the drop in interest rates has kept the payments low, the rise in housing prices has kept the perception of wealth high. On the retirement-preparation front, much of the investment is through IRAs (individual retirement accounts), 401(k) and 403(b) retirement and annuity plans, and pension plans. Only about 42 million workers in private industry and state and local governments now depend on the defined benefit plans like those of CalPERS (California Public Employees' Retirement System) and General Motors. Compared to this, the number of workers covered by the defined contribution plans has now risen to about 58 million. The bear market's toll on these plans has not been as heavy as the market's drop itself, thanks to their conservative management styles that force strict allocation ratios among stocks, bonds and real estate. But then, while their losses are insignificant compared to the 401(k) losses suffered by the Enron employees, they have hardly escaped unscathed²¹. The approximately \$150 billion CalPERS, the nation's largest public pension plan, lost about 5% in 2001, for instance, and the assets of GM's \$65 billion pension plan, the nation's largest corporate plan, dropped by about 5.7%. The pension plan assets of S&P-500 companies, net of obligations, are likely to be \$200 billion in the red in 2002, however, compared to their 1999 surplus of almost \$300 billion. Add to this the clamor to expense stock options, and we can see why the earnings picture may take a while to improve.

Bidding the house prices up has not been the only result of the market's decline, however. Despite the fact that interest rates now are the lowest they have been in decades, money has continued coming into the savings deposits. Exhibit 3.10 shows 100-week graph for NASDAQ-100 leading to its early 2000 peak and the 100-week graph of total savings

deposits in all institutions since that peak. Notice how eerily similar they seem, particularly when we look at the latter in the light of abysmal interest rates!

Exhibit 3.10: Savings deposits have been attracting money since early 2000 in much the same way as the market did until its early 2000 peak

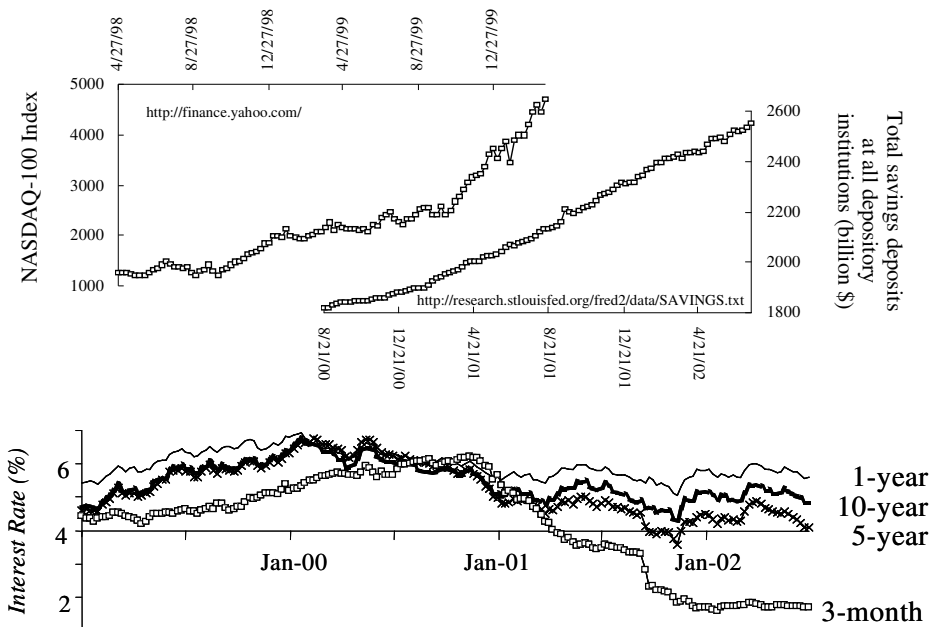
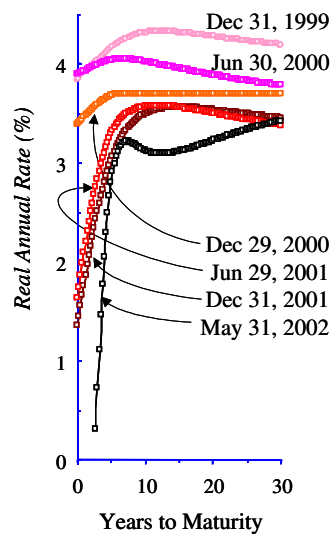


Exhibit 3.11:

The top panel shows how interest rates have generally moved since January 1999. Notice how the 1-year rates have been generally the highest throughout this period, except for a brief interlude in late 2000 when the 3-month rates were the highest. As to blaming the Fed for engineering the yield-curve inversion, these data suggest that the Fed's tightening of rates in 2000, and the aggressive cuts in 2001 may well have been reactive rather than proactive moves. The real yield curves on the right show that it was not until the second quarter of 2002 that we had a more normal looking yield curve. These data come from the following sources:

- (a) Interest rates: St. Louis Fed at the URL <http://research.stlouisfed.org/fred/data>
- (b) Yield curves: Professor J. Huston McCulloch's home-page at the URL <http://economics.sbs.ohio-state.edu/jhm/ts/ts.html>



Interest rates have played a major role in the market's history since January 2000 (Exhibit 3.11). As measured through the rates on Treasury's 2-30 year bonds and 13-week bills in the secondary market, long-term interest rates generally declined throughout the year 2000, but the short-term rates continued rising until early November. Lenders usually demand, and receive, higher rates on long-term bonds, in compensation for letting the money remain tied up over the long haul, than on short-term debt instruments such as a 13-week or 3-month treasury bill or note. Since yields received on these instruments relate inversely to interest rates²², the yield-curve usually slopes upwards, much like the May 31, 2002, yield curve in Exhibit 3.11 (bottom right panel). But notice in this Exhibit how completely this yield curve remained inverted²³ through much of 2000-2001, with greater yields on 2-5 year bonds than on those with 10-30 year maturities. This ordinarily points to darker clouds of inflation and defaults on the horizon, when spiraling interest rates increase the demand for fixed-rate instruments like bonds, so raising their prices and lowering their yields. The Fed's recurrent rate hikes in 2000 had a salutary effect on the yield curve, but a more normal looking picture would not emerge until the second quarter of 2002, after a series of aggressive rate cuts in 2001.

The historically low interest rates have exacerbated the weakening of the dollar (Exhibit 3.12) which, having had an extraordinarily long run, was ripe for correction anyway. This compounds the market's woes, though, partly by encouraging foreign investors to take their profits and run and partly because the pressure to support the dollar adds to the Fed's need to raise the interest rates in order to stem inflation. An attractive alternative for the Fed is to raise the money supply, much like what had to be done in order to be ready for the Y2K. But that is what had led to the drama of first the rise in interest rates in 2000 and then the complimentary cuts in 2001!

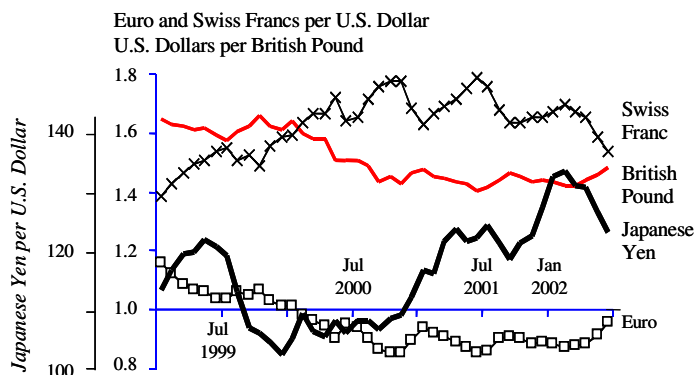


Exhibit 3.12:

Though welcome news for exports, dollar's drop can translate into the flight of foreign investor.

Why invest in the midst of such vexing uncertainties about the market, the economy and interest rates, one may well ask. But then, as logic and the past experience tell us loud and clear, the opportunities for investment abound in a depressed market, as at the present time. Besides, as we show in Chapter 5, ignoring the market instead of braving its gyrations is a costly option. This is because of three imperatives: life expectancy is rising worldwide, work-life expectancy is falling, and the expectancy-gap for receiving full retirement benefits is rising. More and more of us should thus expect to spend longer years in retirement, and retire sooner than planned, but may have less and less to live on, if what most of us have budgeted for retirement income is to be the only source of income when we retire.

This look at the market's ongoing bear run has amply emphasized the need to analyze the statistical structure of the market's performance history. Implicit in the statistics quoted here, for instance, is fact that the stocks, large and small, give negative returns one-third of the time. While this certainly offers a better than even chance of positive returns, negative returns tend to come in seemingly interminable droves, of which the present bear run itself is an example, as do the positive returns. Also, as is evident in Exhibit 3.4, holding a diversified portfolio tied to a broad market index for 20 years can still give returns that may not be any improvement over the relatively safe U.S. Treasury bills and bonds. To learn whether such risks are indeed common, and if the probability of their recurrence can be lowered, we need to look at the statistical structure of real total returns. This is the task that the last section of this Chapter will address, after we have looked at the market's 1990s bull run in the next section.

"I'd like to introduce the advisor who convinced us to invest in all those dot coms."



© 2001 Ted Goff <http://www.tedgoff.com>

3.2 The Soaring 1990s

The capitulation since March 2000 can hardly mask the impressive growth of financial markets worldwide in the past decade. This apparent “peace dividend” at the end of the Cold War generated great euphoria and an unprecedented fascination with CNBC, the Motley Fool and 13,000 like sites on the Internet. Recall the clamor²⁴, on the eve of the new millennium, for the DOW at 36,000 to 100,000 within the next 15-25 years. The market was truly a raging bull through much of the 1990s, particularly its latter half.

3.2.1 The Win-Win Game:

In hindsight, it has become fashionable to label that bull-run as hype, and some had called that exuberance *irrational* then. But it will take a long while, and a more pessimistic view of the future than investors can, before we can separate the speculative part of that growth from the fact that it was also propelled by a significant increase in economic productivity. What also remains true as yet is that, despite the incessant drops since March 2000, the cumulative gains of the past 10-15 years surpass most other similar intervals in the market’s history. These gains were basically market-wide, as can be seen in Exhibit 3.13, which compares the total returns (i.e., with reinvesting of dividends) data for selected indexes. Note that all posted significant gains through the 1990s, as the total returns in all these indexes multiplied three to four-fold between December 29, 1989, and January 2, 2000. Suppose you had invested \$1,000 in these indexes on the first trading day of 1990. As for NASDAQ-100 index, that investment would have grown almost seventeen-fold, to \$16,887, at the opening of trade on January 2, 2000, before giving up over two-thirds of it so far in the current bear run.

Exhibit 3.13: *The growth of a \$1,000 investment made on opening of trade on January 2, 1990, the first trading day of the 1990s, at the close of trading on December 31, 1999. Source data are from these URLs:*

<http://finance.yahoo.com>; <http://www.globalfindata.com> and <http://www.fool.com>

Market Index	Value of the Investment	Cumulative Total Return	Annualized Rate of Return
Dow	\$4,674	367%	16.67%
NASDAQ-100	\$16,887	1589%	32.66%
S&P-500	\$5239	433%	18.21%
Wilshire-5000	\$5453	445%	18.49%

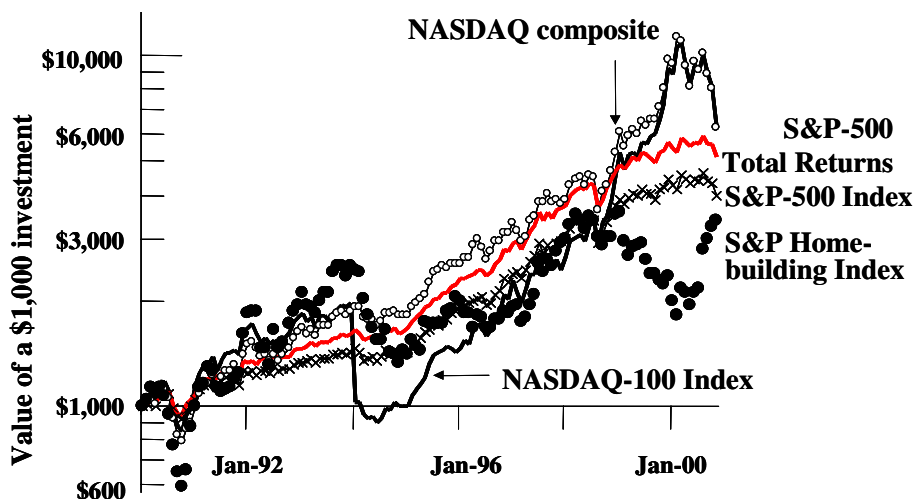
Taken together with Exhibit 3.1, these data show why the market's continuous decline since March 2000 has not caused the crisis in investor confidence that one would have ordinarily expected. Had the market registered 10.7% annual total returns in nominal dollars, as it has averaged during 1926-2001 based on the Ibbotson Associates' 2001 Yearbook, then a \$1,000 investment made in January 1990 would have only amounted to \$2,764 at the end of the decade. But the growth in the decade of the 1990s was so rapid that even the almost nonstop bleeding since March 2000 is yet to take away those gains. Also note that what we hear in the daily press is the index, not the total returns on it. Many of the S&P-500 companies periodically pay dividends that most of the NASDAQ stocks do not. The loss in S&P-500 total return index during the current bear run is considerably less, and almost inconsequential to a long-term investor, therefore. The index itself lost 10.14% in 2000 and 13.04% in 2001, for instance, whereas the total returns on it suffered losses of 9.1% in 2000 and 11.9% in 2001. The \$1000 investment of December 1989 in an S&P-500 portfolio would have thus become \$3,596 on June 28, 2002. Of course, your investment would not have dipped in the year 2,000 at all, and would have instead gained over 40% in the year, had it been committed to a broad-based real estate index like the S&P Homebuilding index (to compare with the results in Exhibit 2.13, this investment would have reached \$2,354 on January 2, 2000, and \$3,271 on October 31, 2000). These figures yield annualized growth rates of 8.94% and 11.56%, respectively, and are clearly paltry compared to the other rates here.

Investing is a matter of making choices between different stocks and their indices, and between such diverse types of assets as stocks, bonds, real estate, currencies, precious metals, and the like. This requires understanding how the markets for these different asset types perform over time, individually as also relative to one another, under diverse economic conditions. It is not that this requires a 20/20 vision of the future — those with foresight comparable to the hindsight might well be better off playing the lottery, after all! It is just that, as will be examined in the following pages, financial economics does indeed have over three centuries of history that offers a broad, and reasonably reliable, road map to make these choices.

A look at Exhibit 3.14 will clarify this point further. It graphs the monthly data on selected indexes and shows that robust growth is the main reason why one-half of the American households today are investors in the stock market. Notice how, despite the significantly higher appreciation of NASDAQ index than those of the other indices compared here, particularly since mid-1998, the gains to investors in a fund or portfolio indexed to the S&P-500 index were comparable, for most of the time, to those by the NASDAQ Composite. This is also true of the Dow, although the data on this index are not shown here, and reflects the fact that many of the S&P-500 and

Dow companies pay dividends whereas most of the NASDAQ companies do not. Looking only at this pattern of growth, it is clear that this growth is exponential — when the vertical axis is scaled logarithmically as in Exhibit 3.14, the time-paths of all these indices are broadly linear.

Exhibit 3.14: Overall, stock market has risen appreciably through the 1990s, although that of the technology heavy NASDAQ Composite has been most noted. The indices shown here are normalized at 1000 at the opening of trade on January 2, 1990.



This opens up a convenient way for computing the corresponding annual growth rates. Suppose P_0 is the initial price of any stock or asset, or the value of an index as in the present case, that rises to P_1 after 1 period. The return r on P_0 , given by $r = (P_1 - P_0)/P_0$, can be then generalized as

$$\begin{aligned}
 P_1 &= (1+r) P_0 \\
 P_2 &= (1+r) P_1 = (1+r)^2 P_0 \\
 \dots & \quad \dots \quad \dots \\
 P_T &= (1+r)^T P_0 = P_0 \exp(rT)
 \end{aligned}
 \tag{3.1}$$

after T periods, if r remains constant through the entire period. Here, \exp denotes the exponential or Euler's constant ($= 2.71828$), and r has been taken to be such a small number that r^2 and higher power can be neglected²⁵.

Equation (2.1) is the well-known compound interest formula that captures the time value of money. Simply stated, the value of money changes

with time, depending on what use we put it to²⁶. You could leave it under the pillow, for instance, or in a secured locker, and use it at a later date. The risk, then, lies in the inflation that would eat into its value by the time the money is used. You could also deposit it in a bank at a fixed rate of interest, or buy a bond, a Treasury bill, or a certificate of deposit, or buy real estate or gold, for that matter. Still another alternative would be to use the money to either finance your own business or buy a share in another business. The goal, of course, is to find and maximize the real rate of return (i.e., the nominal yield adjusted for inflation).

A well-known example of how the “time value of money” works in practice is Peter Minuit’s 1626 purchase of Manhattan Island for \$24. Taking the current value of this real estate as \$60 billion, the annual growth of such an initial investment would have to average 5.94% through these 375 years, as the computations in Box 3.2 show. This assumes a continuously compounding rate, however, whereas the rates computed in Exhibit 2.13 use the annual compounding formula $P_T = (1 + r)^T P_0$. To compute the average value of r , we note from equation (2.1) that

$$r = \ln(P_{T+1}/P_0) = \ln(P_{T+1}/P_T)$$

Thus, compounded continuously, the average rate \tilde{r} over time horizon T is

$$\tilde{r} = (1/T) \ln(P_T/P_0) \tag{2.2}$$

Box 3.2: The Time Value of Money

For Peter Minuit’s purchase of the Manhattan Island for \$24 in 1626, a real estate whose current value is \$60 billion, say, we set $P_0 = \$24$, $P_T = \$60$ billion and $T = 2000 - 1626 = 374$ years in equation (2.1).

Taking the logarithms of the two sides, we then have, for ...

annual compounding:

$$\begin{aligned} \ln(60,000,000,000 \div 24) \\ = 374 \ln(1+r) \\ \text{or } \ln(1+r) = 21.63956 \div 374 \\ = 0.05786 \end{aligned}$$

so that $r = 5.96\%$ per year.

continuous compounding:

$$\begin{aligned} \ln(60,000,000,000 \div 24) = 374 r \\ \text{so that} \\ r = 21.63956 \div 374 \\ = 0.05786 \end{aligned}$$

= 5.79% per year

As is evident in the last column in Exhibit 3.13, annualized growth rates for the investments that are compared here range from 16.67% (Dow) to 32.66% (NASDAQ-100). These rates are certainly impressive, particularly as the corresponding numbers have averaged 2.95% for inflation and 4.9% for the 3- month Treasury bills during this period. Also note that all these stock market indexes did better than the real estate-based Homebuilding index by a wide margin. It is hardly surprising, then, that the 1990s saw the emergence of stocks as the preferred investment vehicle. This is corroborated by the comparison of house prices and homebuilding index in Exhibit 3.15. Note that, during the past 15 years, house prices nationwide have barely kept pace with the CPI whereas the S&P Homebuilding index has galloped rapidly. Apparently, stocks often do better than the underlying assets themselves.

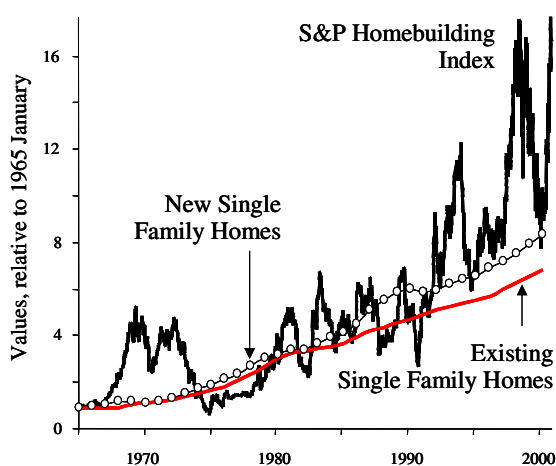


Exhibit 3.15:

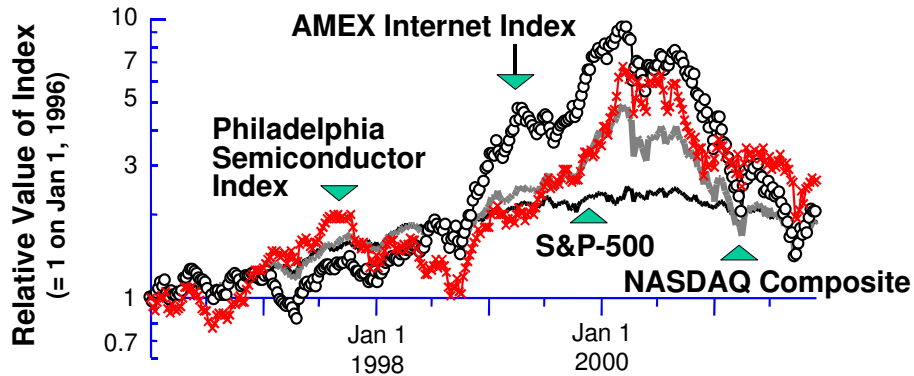
Based on the data from OFHEO (the Office of Federal Housing Enterprise Oversight), HUD and the Census Bureau, real estate prices have barely kept pace with inflation. A real estate stock index like S&P Homebuilding index has annually grown at three times this rate.
<http://www.ofheo.gov>

3.2.2: The Tech Sector’s Growth in Perspective

Perhaps the most noted feature of the market’s performance in this bull run was first the spectacular rise of technology stocks, particularly the internet sector comprising the stocks commonly labeled as the dotcoms, in the late 1990s and their rather precipitous decline in 2000. Exhibits 3.13 and 3.14, in which we saw the NASDAQ-100 index as having appreciated the most in the late 1990s, reflects this. But it is doubtful if the market’s tumble in this first year of the new millennium was indeed engineered by the fall of the dotcoms. For instance, Exhibit 3.16 compares the AMEX Internet index (IIX) and the semiconductor index (SOXX) of Philadelphia Stock Exchange with the NASDAQ Composite and S&P-500 indices. The much smaller (in terms of market capitalization) IIX and SOXX indices gained the most during market’s upturn in 1999, and gave up those gains during the market’s

2000-2002 down turn. But, despite this volatility, they were not particularly lower than the broader NASDAQ Composite and S&P-500 indices than their relative levels in January 1996.

Exhibit 3.16: The relative price performances of Internet, Semiconductor and NASDAQ indexes, all set at 1 in January 1996.



There is no disputing the fact that the market’s growth in the 1990s was spectacular by all accounts, particularly in the second half of the decade. As the total returns data in Exhibit 3.17 for 5, 10 and 20-year holdings ending in 1999 show, the annualized returns are highest for 1995-99, lower for 1990-99 and lowest for 1980-99. Even these “low” 1980-99 annualized returns are appreciably superior to the 1926-2001 annual average of 10.7% mentioned earlier, however. The market moves in cycle and the 1995-99 phase was clearly the culmination of a cycle that had already begun earlier.

Exhibit 3.17: The market’s growth accelerated in the 1990s

Period	Years	Dow		S&P-500	
		Average Annualized Return	Cumulative Total Return	Average Annualized Return	Cumulative Total Return
1995-99	5	20.12%	190.64%	24.08%	251.37%
1990-99	10	17.73%	367.39%	19.20%	432.91%
1980-99	20	17.10%	2442.73%	17.75%	2584.11%

Explaining what might have triggered this acceleration is difficult, however. The renowned Warren Buffett recently put forth a seductive idea²⁷, for instance, that buying stocks is likely to work well when the market value of publicly traded securities is within 70-80% of the GNP (Exhibit 3.18) (and

rising). This would make a good working rule to spot the danger of market's imminent collapse, and matches the patterns in P/E ratio and Tobin's Q data that we saw in Exhibit 3.7, but making the physical sense of a ratio in which the denominator is a cash flow number (GNP or GDP) and the numerator an asset (market value) is difficult. Mercifully, though, Exhibit 3.18 also tells us that the need for such an exercise does not arise every day.

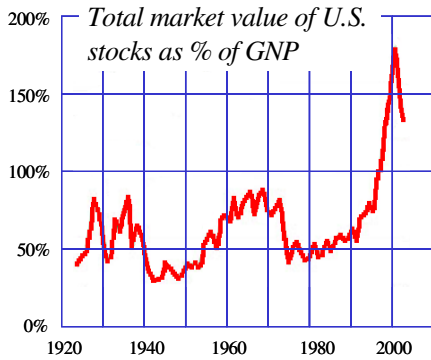


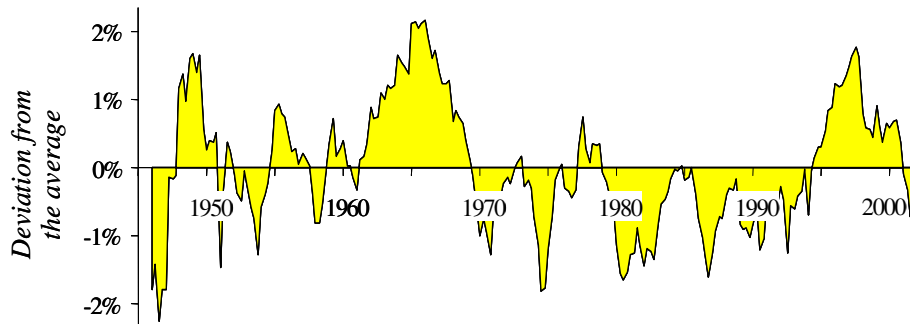
Exhibit 3.18

The market value of U.S. stocks peaked at 190% of GNP in March 2000. Despite the drop since then, the ratio was 133% in October 2001, compared to 109% at the market's peak in September 1929.

Redrawn from the *Fortune Magazine* (Dec 10, 2001) article: "Warren Buffett on the Stock Market".

The ratio of corporate profits to GDP presents a similar picture and is shown in Exhibit 3.19 where we graph after-tax corporate profits, adjusted for inventory valuation and capital consumption, as deviations from the mean ($= 5.56 \pm 0.12\%$ at 95% confidence level). Notice that the market's bull-run in the 1990s, particularly towards the end of the decade, coincided with one of the best runs in corporate profitability. The last time corporate America's profits enjoyed a similar bull-run was in the 1960s and, as will be shown in section 3.3, the 1960s were indeed comparable to the 1990s in terms of real total returns on the market, notwithstanding the seemingly unsettling social upheavals of that era.

Exhibit 3.19: *After-tax corporate profits, with adjustments for inventory valuation and capital consumption, relative to the GDP. The data presented here are deviations from the average.*



Apparently, expectations about the growth potential matter the most here. Returning briefly to the Gordon growth model of stock valuation that we introduced in the previous section, it is easy to see why expected growth (g) dominates the pricing (P) of a stock. This equation can be written as

$$\begin{aligned}
 P &= D/(r - g) = (D/r)[1 - (g/r)]^{-1} \\
 &= \underset{\substack{\uparrow \\ \text{No-growth} \\ \text{component}}}{D/r} + \underbrace{(D/r)[(g/r) + (g/r)^2 + (g/r)^3 + \dots]}_{\text{The present value of growth opportunities}} \quad (3.3)
 \end{aligned}$$

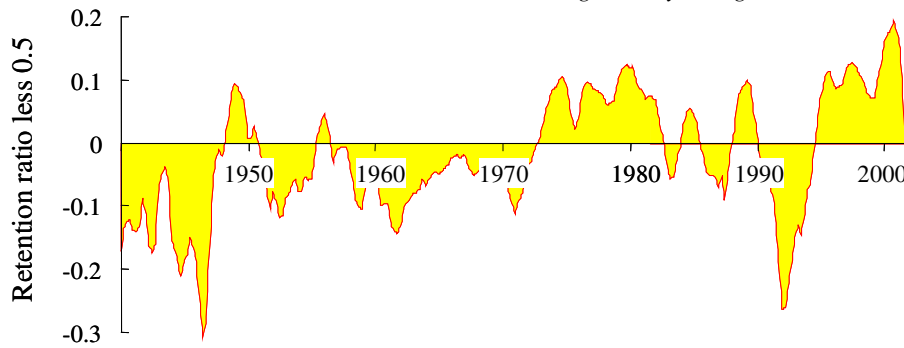
based on Binomial series expansion²⁸, because g is smaller than r, and (g/r) is positive but less than 1. Looking at the right hand side of equation (2.3), note that D/r is the equity price of a company that pays out all its earnings as dividends and therefore has no prospects of growth whereas the second factor is defined largely by the (g/r) ratio, i.e., the closer g is to r the closer (g/r) will be to 1 and the greater the number of terms that will need to be used. The multiplier [(g/r) + (g/r)² + (g/r)³ + ...] is therefore the reason why we are willing to pay higher prices for the shares of companies with better prospects of growth. It is called the present value of future growth opportunities. To understand its impact, note that if (g/r) = 0.9 then P = 10×(D/r), if (g/r) = 0.5 then P = 2×(D/r), and if (g/r) = 0.1 then P = 1.11×(D/r).

In terms of the assumptions explained earlier, (g/r) in equation (2.3) can be treated as the plowback ratio or retention rate and, as the examples of successful companies amply demonstrate, plowing part of their earnings back into the business is a strategy that businesses, particularly in dynamic sectors, commonly use in order to finance their growth. Indeed, we will seek to do no better on this issue than reproduce from Buffett's above article his following quote of John Maynard Keynes²⁹:

“Well-managed industrial companies do not, as a rule, distribute to their shareholders the whole of their earned profits. In good years, if not in all years, they retain a part of their profits and put them back in the business. Thus *there is an element of compound interest* operating in favor of a sound industrial investment.”

Interestingly, despite numerous fluctuations over time, this plowback or retention ratio has been generally increasing. Exhibit 3.20 illustrates this pattern for the average of S&P-500 companies since 1940. Notice how rapid this ratio spiraled in the mid-1990s. This rising trend in the retention rate has been the subject of several recent studies, most notably by Eugene Fama and Kenneth French³⁰ whose detailed study documents an increasing reluctance of the companies to pay dividends.

Exhibit 3.20: *The average retention rate or plowback ratio for stocks in the S&P-500 index has been generally rising.*

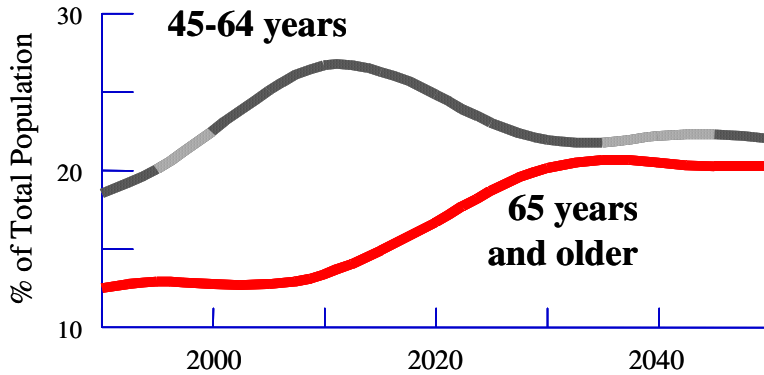


The importance of retention rate is also borne out by the fact that, as mentioned earlier, dividends accounted for less than one-third of the 10.7% average annual total return on S&P-500 stocks during the 1926-2001 period. An increase in this rate implies a concomitant decrease in dividend payment or the payout ratio, and the data in Ibbotson Associates' 2001 Yearbook also show that, over this 75 year history, the long-term decline in payout ratio has added about 2% per year to the returns on stocks. Could we therefore blame the increase in the retention rate for the market's spectacular price spiral in the 1990s? Perhaps only to some extent because the 1990s also witnessed an equally spectacular demographic shift on one hand and the dawn of the information technology based work-life and virtual market place on the other.

3.2.3 Do Demographics Matter?

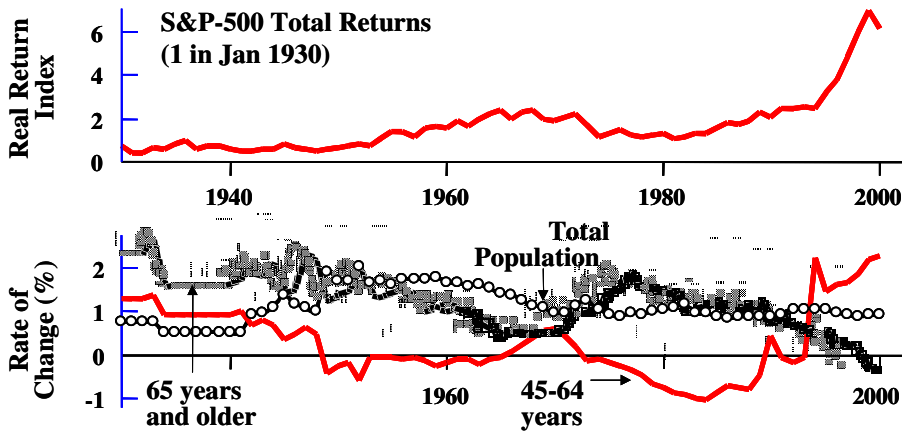
Demographics amply justify the optimism that the investors have about the U.S. stock market's enduring capacity to give excellent returns. For instance, the Census Bureau's population estimates and projections identify 45-64 year olds — the stage in life when we tend to accumulate the most of our retirement-focussed savings — as the fastest growing age-cohort of U.S. population in this decade (Exhibit 3.21). Before we get excited about this, however, we should note that Census Bureau projections also show a rapid rise of the 65-plus age-cohort in the immediately following decades, coupled with a concomitant fall in the 45-64 year cohort. Implicit in the assumption that retirement-focussed savings of *baby boomers* will propel the stock market skywards in the immediate future, therefore, is the prospect of the market's imminent crash when this generation begins its post-retirement selling or consumption. Spectacular as the market's recent growth has been, this raises the question whether the 1990s growth rates can be indeed sustained over a protracted period of time.

Exhibit 3.21: The 45-64 year olds are likely to be the fastest growing age-cohort in this decade, and 65 years old and older in the following two decades, reflecting the fact that 75 million babies were born in the U.S. between 1946 and 1964, i.e., the generation known as baby boomers (source: U.S. Census Bureau).



As can be seen in Exhibit 3.22, economic history amply attests to this assumption. The top panel in here graphs the S&P-500 total return index, set at 1 in January 1930, and the bottom panel shows changes in three demographic factors during this period: total U.S. population and its 45-64 and 65-plus segments. Note how all the three periods of stock market's accelerated growth — mid-1930s, 1960s and 1990s — coincided with accelerations in the

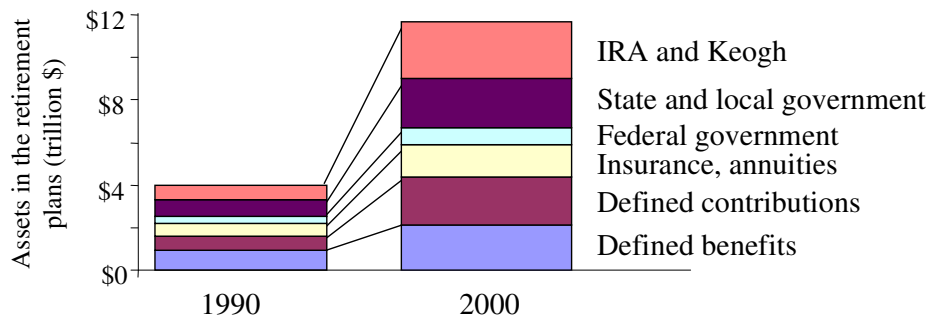
Exhibit 3.22: Demographics have clearly played an important role in shaping the history of the stock market. The top panel here shows how the S&P-500 total returns index has appreciated since Jan 1930 and the bottom panel the annual changes in total population and in its 45-64 year and 65-plus segments. Notice how closely the market's appreciation matches the relative growth of 45-64 year segment.



growth of the 45-64 cohorts. Therefore, arguing that Americans reach their peak earning and spending levels at 47, the economists like Harvard's Harry Dent³¹ even advocate investment strategies that focus completely on the demographic trends.

The direct evidence of how this aging of baby boomers fueled the demand for stocks comes in the form of retirement savings accounts. Exhibit 3.23 shows the different kinds of assets, and their worth, that American's had in their retirement savings plans. Total assets in all these accounts amounted to almost \$12 trillion in 2000, compared to a little under \$4 trillion in 1990. This itself amounts to almost 11% annual growth in the demand for different kinds of investment assets. What compounded this demand is the fact that most of it came under the individual retirement and Keogh accounts, with an annualized growth rate of over 14%, and defined contribution plans, which include 401(k)s and 403(b) and had an annualized growth rate of over 12%. Significant proportions of both these types of accounts, IRAs and the defined contribution plans, tend to be invested in stocks. Earlier we saw how the market's 2000-02 meltdown has adversely affected many of these accounts (many Enron employees have lost all their nest eggs, for instance). Here we can see the demand side of this equation! True, part of this growth was fueled by the ballooning of stock prices. But it also brought in new money into the market.

Exhibit 3.23: The ballooning of Americans' retirement assets in the 1990s



Data source: Employee Benefit Research Institute

3.2.4 The High-Flying High-Techs

The rapid growth of the stock market in the waning years of the Twentieth century has coincided not only with an equally rapid growth of the 45-64 year age-cohort but also with an equally impressive growth of the

technology sector of U.S. equities market. The result has been the rise of such wealth-builder stocks and EMC, Microsoft, Dell and the like. Exhibit 3.24 shows what an investment of \$1,000 in such technology stocks, made on the day each began trading on the exchange, would have grown to by June 30, 2000. This is only a sampling of the high-flying issues that have glamorized the stock market in general and its technology sector in particular. As is apparent from some of the statistics summarized in Exhibit 2.25, these have, until the tech sector's continuing meltdown during 2000-2001, been the outstanding millionaire-makers since market's October 1987 crash.

The market's 2000-02 correction has taken some glamour off these wealth-builders. The wisdom of listing Yahoo and Broadcom here too could perhaps be questioned, despite our disclaimer that this is not an exhaustive list. But then, even with their recent declines, it is surprising to see how well these stocks have held their own since their inception. All these companies are young, in the technology sector, and have been the market leaders in their niches. But, as Exhibit 3.25 shows, the average annually compounding growth rate tends to flatten with the company's age.

Exhibit 3.24: What an initial investment of \$1,000 in selected high-flying equities, made on the first trading day of each stock, would have grown to by June 30, 2000, in nominal dollars. Stocks are identified here with the ticker symbols given in Exhibit 3.25

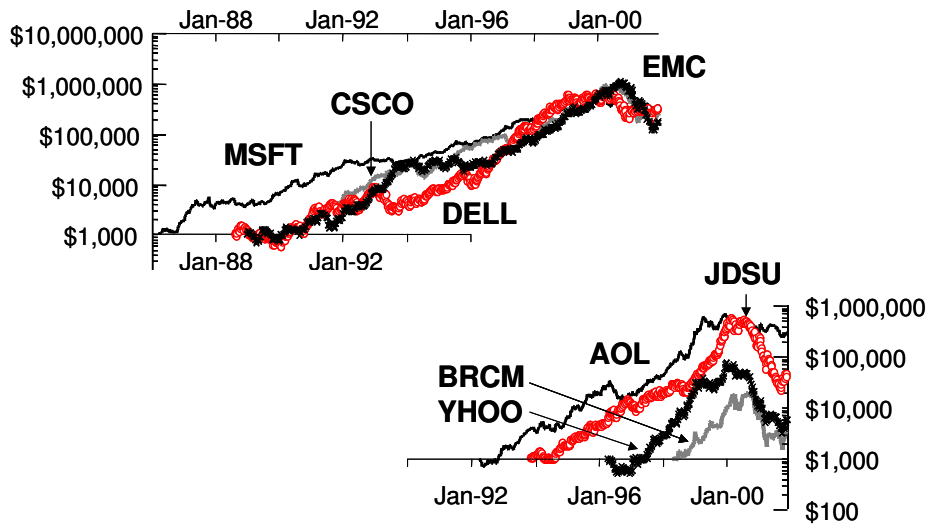


Exhibit 3.25: Statistics on the high-flying wealth-builders graphed in Exhibit 3.24

		\$1,000 invested on	... would, on Dec 31, 1999, have become	... at the annualized growth rate of	Value of the investment on June 28, 2002
Microsoft	MSFT	14-Mar-86	\$668,760	47.17%	\$308,870
Dell Computers	DELL	17-Aug-88	\$576,270	55.88%	\$295,370
EMC Corporation	EMC	16-Dec-88	\$582,360	57.67%	\$80,490
CISCO Systems	CSCO	26-Mar-90	\$656,370	66.53%	\$170,960
America Online	AOL	19-Mar-92	\$606,960	82.27%	\$117,680
JDS Uniphase	JDSU	16-Nov-93	\$312,860	93.81%	\$10,360
Yahoo	YHOO	12-Apr-96	\$78,670	117.66%	\$5,370
Broadcom	BRCM	21-Apr-98	\$10,160	138.83%	\$1,310

The Success of the equities of these companies masks the striking failures of a large numbers of other companies, however. The spectacular rise of “dotcom” stocks in the late 1990s, and their catastrophic fall in the first half of 2000, clearly illustrates this. The product life cycle (PLC) theory³² helps understand the underlying economic rationale. As Exhibit 3.26 explains, growth is most rapid, on this picture, in the second stage of the product life cycle. The technology sector in today’s market is mostly at the innovation, introduction and growth stages of this cycle when the sales are yet to build up and profits are negative. Pricing a mature business in the more established or traditional sectors of the economy is less prone to uncertainties than pricing the prospective superstars of new technology that dominate the NASDAQ indices³³.

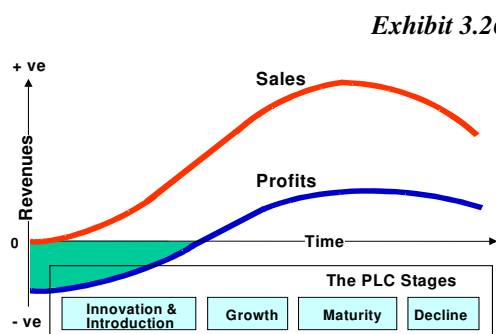


Exhibit 3.26: *The five stages in a product’s life cycle are development, introduction, growth, maturity and decline. The first two of them effectively collapse into one for investing purposes other than venture capital, because that is when the revenues from sales rise but the profits are yet to catch up. The risk here is that of the promise of prospective profits from growth not materializing in time for the firm’s survival.*

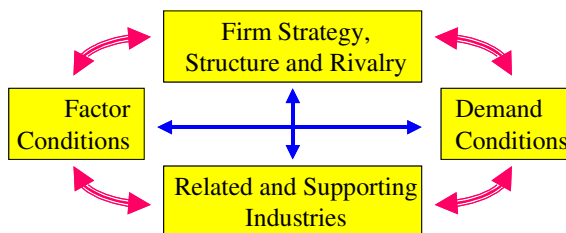
Stocks of companies and businesses in a growing sector of the economy are likely to appreciate in value faster with the overall economy, as also to decline, than those in the other sectors. But, in addition to this consequence of the PLC concept, two other criteria are equally germane to understanding why some companies and businesses succeed while others do not. One is the concept of *strategic intent*. The companies that have risen to

global leadership began, according to this concept³⁴, with ambitions that bore no proportion to their resources and capabilities, and succeeded through strategic intent, by setting the goals that greatly exceeded that grasp and marshaled the will and the resources to achieve those goals. Note, however, that in the extremely dynamic industries like the technology sector, strategic intent soon begins to either lead or lag strategic action. Divergences such as these produce *strategic dissonance*³⁵ that necessitates the reformulation of strategic intent.

The other concept is that of the *competitive advantage*. As argued by Michael Porter³⁶ in the context of nations, but also relevant to businesses in today's technology-induced and intricately globalized market place, businesses today are those that learn to meander through the determinants of competitive advantage shown in Exhibit 3.27 below.

Exhibit 3.27:

The determinants of national competitive advantage, according to Michael Porter.



These are the issues that lead to the question of valuations — a subject that we will explore in depth in the next chapter. For now, therefore, it should suffice to assert that we view the market's recent turbulence more as the opportunity for future growth than as the prospect of imminent disaster. This reinforces the message that was abundantly clear from data in Exhibit 3.5 earlier.

We now look for further confirmation using the longer data sets on stock performance.

Stocks, bonds, IRA, 401(k) ... it's all too risky and complicated! Our retirement package is a 25-year supply of arthritis cream, denture adhesive, and adult diapers."



www.glasbergen.com
© 2002 by Randy Glasbergen

3.3 The Long-Term History of U.S. Stock Markets:

3.3.1 The Early History

Let us now examine if the stock markets have generally performed as well in the past as they did in the 1990s. The problem is that, treating the stocks as reliable investment vehicles, as we now do, is a rather recent phenomenon. Common stocks have carried the stigma of speculation through much of history. This was the view held by such acknowledged stalwarts of the 1930s, for instance, as Lawrence Chamberlain³⁷ who preferred bonds over stocks and Benjamin Graham whose advocacy of careful selection over holding a broad portfolio of diversified common stocks is now known as *value investing*. The market's rather wild gyrations, and most notably the infamous crash of October 1929, undoubtedly shaped these views. Note that, even though the crash did make the common stocks inexpensive enough to become attractive for value investing, it would be another 25 years before Dow reclaimed the pre-crash peak of 381.2 that it had reached on September 3, 1929. In the book *Security Analysis*³⁸, Benjamin Graham and David Dodd were particularly harsh on Edgar Smith³⁹ for helping unleash the bull market mania of the 1920s. Smith had argued for owning a diversified portfolio of common stocks as the recipe for wealth accumulation. But Smith is not the person whom posterity would eventually blame the most for this. Instead, that credit is commonly accorded to John Raskob, albeit unjustly as will be noted elsewhere later. He had claimed, in an interview published in the Summer, 1929, issue of the *Ladies' Home Journal*, that good common stocks bought for \$15 every month for 20 years would grow into a portfolio worth \$80,000. But the markets were on such a roll in the 1920s that the great Irving Fisher, a noted authority on the strategies⁴⁰ for successful investing in a rising market, had proclaimed barely a fortnight before the crash of 1929 that the stock prices had reached *a permanently high plateau!*

This vigorous questioning of any claimed superiority of stocks over bonds as reliable instruments for long-term investment could not withstand the test of time, however. But, before comparing the historic performances of these two asset classes, let us first examine how well the stocks themselves have performed over time. Speculative gains are unlikely to be sustained over time, after all, based on the law of averages. It would be unrealistic, therefore, to expect a speculative market to have given any consistently positive returns over an adequately protracted period.

Exhibit 3.28 looks at the 200-year history of the U.S. stock market, therefore. Now, exchange traded funds or indexes, e.g., spider (SPY) for the S&P 500 index, diamonds (DIA) for the Dow, QQQ for Nasdaq-100 etc., are

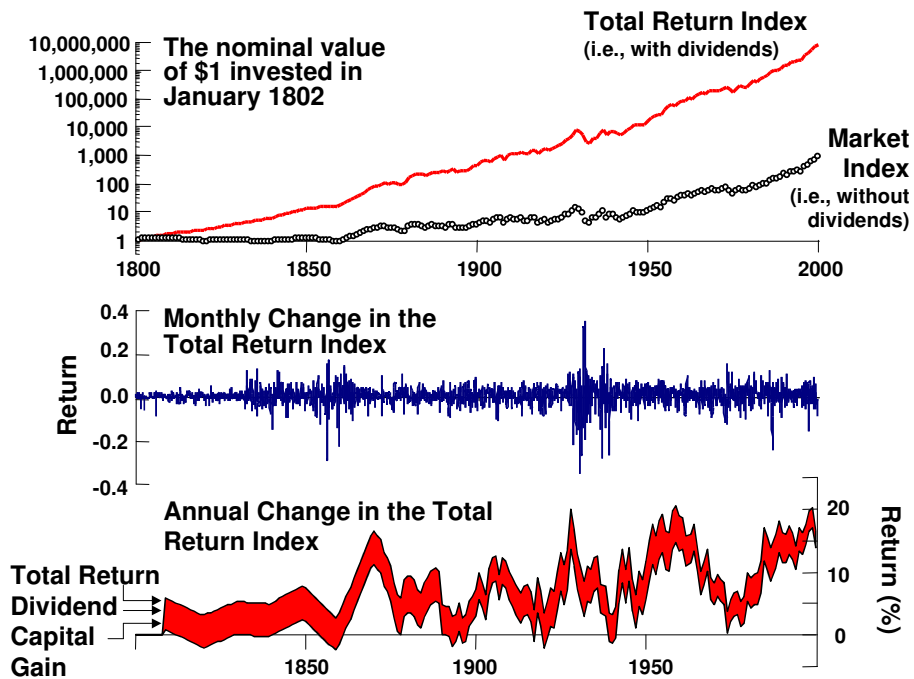


Exhibit 3.28:

Top panel shows the growth of a \$1 investment in the stock market made in January 1802, middle panel the monthly change in total return index, and bottom panel the total annual return, and its components, in annually rolling bands for 10-year averaging of the annual data. The data used here are freely available in the public domain, e.g.,

- monthly data for 1871-1968, including the Cowles Commission reconstruction of a capitalization-weighted index of NYSE stocks are available at the NBER (National Bureau of Economic Research) macrohistory site <http://www.nber.org/databases/macrobistory>
- monthly total return data for S&P 500 Composite Index since January 1970 can be retrieved from the website of Federal Reserve Board's Saint Louis branch at the URL <http://www.stls.frb.org/fred/data/business/trsp500>; while
- YAHOO's financial pages (<http://finance.yahoo.com>) and trial access at Global Financial Data website (<http://www.globalfindata.com>) also allow free access to these and related financial and economic time series data.

rather new. The oldest of them, the SPY, debuted on the AMEX (American Stock Exchange) only on January 29, 1993. Nonetheless, if a unit trust investment like SPY was available for \$1 on January 1, 1802, it would have, as shown in Exhibit 3.28, grown to about \$630 at the end of 2000, if all the dividends had been used up in personal consumption. Based on equation (2.1), this yields a paltry annual return of 3.29%! But, deferring the immediate gratification by plowing back these dividends into that investment portfolio, instead of using them up on receipt, would have raised this investment to \$6.78 million at the end of 2000. The annual returns now average to a respectable and robust rate of 8.22% over this 199-year period. Peter Minuit's successors would have certainly found even the broad equities market an equally attractive, nay, an even better, investment opportunity than Manhattan Island! Was such an opportunity indeed available then? It certainly was, as can be seen from the history of the Dutch and British stock markets that extend back farther into the past.

3.3.2 Dividends Made the Difference

These results clearly show, as was first established by Ibbotson and Sinquefeld⁴¹ for 1926-75 and in Jeremy Seigel's⁴² update of the reconstruction of the U.S. stock market index for 1802-1870 by William Schwert⁴³, that stocks offer robust returns in the long run. Dividends have contributed substantially this staggering difference between the index values and total returns. This is because capital gains from price appreciation are not the only payoffs from owning a common stock. More often than not, the total return r received from such an investment comes partly from capital gain and partly from dividend, i.e.,

$$\begin{aligned} \text{return } r &= \text{capital gain} + \text{dividend yield} \\ &= \frac{(p_{t+1} - p_t)}{p_t} + \frac{\text{Div}_{t+1}}{p_t} = \frac{(p_{t+1} - p_t) + \text{Div}_{t+1}}{p_t} \end{aligned} \quad (3.4)$$

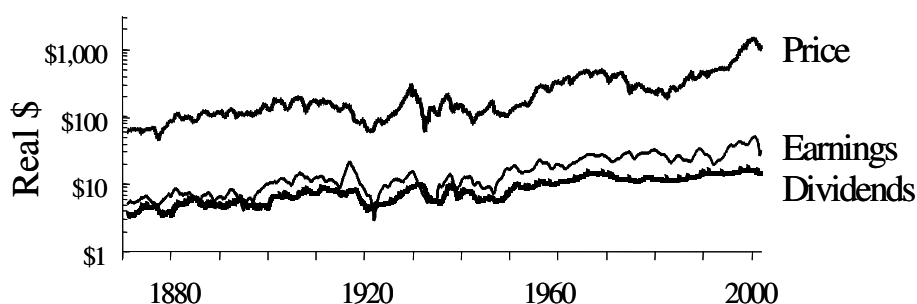
Here, p_t is the security's price at time t , p_{t+1} at time $t+1$, and Div_{t+1} is the dividend received.

Since a stock's price is almost as likely to rise as fall, a proposition that flows directly from the *efficient market hypothesis* that will be examined in chapter 5, capital gains are likely to be positive as often as negative. This particularly holds when we consider the daily returns only. Dividends are positive, however, and equal zero at worst because the firms that pay dividends to the shareholders do so by choice, not by obligation⁴⁴. Dividends

add to the capital gains, therefore, and cushion the effects of any losses that may occur.

A misperception that often crops up even in the otherwise well-informed circles is that dividends have declined in value. They have not, as can be seen in Exhibit 3.29 which traces the history of price, earnings and dividends for the S&P-500 index since January 1871. It is just that the growth in dividends has not kept pace with the growth in price, particularly in the 1990s.

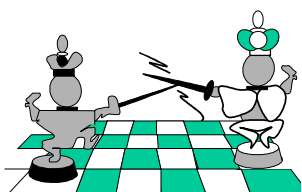
Exhibit 3.29: Price, dividends and earnings on the S&P-500 stocks normalized for their values in January 1871 (computed from Robert Shiller's data available at the URL: http://aida.econ.yale.edu/~shiller/data/ie_data6.xls)



The results in Exhibit 3.28 also display the effect of compounding — an effect that, as is apparent from the example of chessboard in Box 3.3, is indeed a powerful one. Notice how significantly this effect has amplified the cushion that an automatic reinvestment of dividends provides to an investment in the stock market. Thanks to these dividends, as can be seen in the bottom panel in this Exhibit, the total returns have never been negative when we look at the 10-year averages of these data. Monitoring the hourly, daily, weekly or monthly performance of the market, as is apparent in the middle panel in Exhibit 3.28 that graphs the monthly returns, creates a noisy picture that masks such broad trends. Hence the recourse to a 10-year averaging.

These results ignore the effects of inflation, however, as they are given in nominal dollars. But \$1 fetched far more in 1802 than now — based on the consumer price index, \$1 in Jan 1802 had the same purchasing power as \$10.32 in Dec 2000. Thus, our nominal wealth of \$6.78 million at the end of 2000, to which the \$1 investment of Jan 1802 grew, had the same purchasing power in 2000 that \$656,911 had in 1802. Therefore, a realistic comparison across these two centuries requires adjusting the dollar figures in

Exhibit 3.28 for this change in the dollar's worth with time. The top panel in Exhibit 3.30 accomplishes this by recasting the results of Exhibit 3.28 in real dollars. It also graphs how the consumer price index has changed during this period.



Box 3.3:
**The Emperor, the chess-inventor,
and the power of compounding**

So enamored was the Emperor with chess, it is said, that he called the game's inventor and asked him to name his own reward. "Only one grain of rice, Your Majesty, ..." said the inventor, "... for first square on the board, two grains for the second, and so on, doubling the quantity at each step."

All the world's rice would not have been enough. With 64 such squares on the board, the final tally comes to $(2)^{63} = 9.22 \times 10^{18}$ grains of rice which, for the 65 milligrams traditional measure of a grain, amounts to 599.5 billion metric tons of rice. Even in 1999, the world produced only 596.5 million tons of rice!

This adjustment is made in the following way. Suppose $(X_n)_{\text{nominal}}$ is what the initial amount $(X_0)_{\text{nominal}}$ has grown to in n periods at the rate of r_{nominal} per period and that, during this period, inflation has raised the corresponding initial cost $(C_0)_{\text{nominal}}$ to $(C_n)_{\text{nominal}}$ at the rate $r_{\text{inflation}}$ per period. It then follows from Equation (3.4) that,

$$(X_n)_{\text{real}} = \frac{(X_n)_{\text{nominal}}}{(C_n)_{\text{nominal}}} = \frac{(X_0)_{\text{nominal}} (1+r_{\text{nominal}})^n}{(C_0)_{\text{nominal}} (1+r_{\text{inflation}})^n} = (X_0)_{\text{real}} (1+r_{\text{real}})^n \quad (3.5a)$$

where $1+r_{\text{real}} = (1+r_{\text{nominal}})/(1+r_{\text{inflation}})$

Likewise, for the continuous time approximation $X_n = X_0 \exp(rT)$ in terms of Equation (3.1), we have

$$(X_n)_{\text{real}} = \frac{(X_0)_{\text{nominal}} \exp(r_{\text{nominal}}T)}{(C_0)_{\text{nominal}} \exp(r_{\text{inflation}}T)} \quad (3.5b)$$

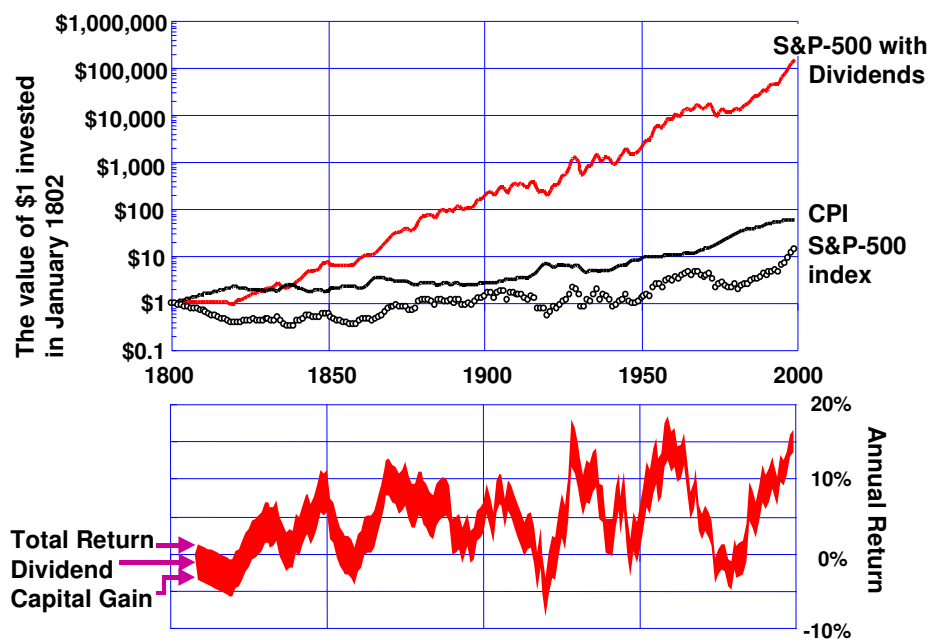
$$= (X_0)_{\text{real}} \exp[(r_{\text{nominal}} - r_{\text{inflation}})T] \quad (X_0)_{\text{real}} \exp(r_{\text{real}}T)$$

where $r_{\text{real}} = r_{\text{nominal}} - r_{\text{inflation}}$

With this correction for inflation, the logarithmically scaled market index of Exhibit 3.30 is far more strongly linear than the corresponding

unadjusted data in Exhibit 3.28. Notice how the graph for the consumer price index (CPI) in Exhibit 3.30 remained almost flat through much of the Nineteenth century but shows a faster rise through the twentieth century, particularly since the 1950s. Inflation, on the other hand, was the major scourge of the Nineteenth century, a period that witnessed an overall deflationary trend as well⁴⁵. This adjustment has thus had the effect of increasing the slope of the Nineteenth century segment of market index in Exhibit 3.28, while flattening its Twentieth century segment.

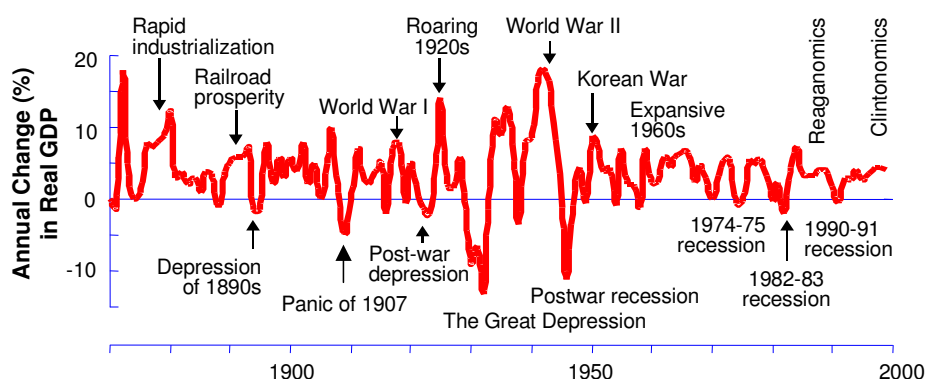
Exhibit 3.30: *The growth, in real dollars, of \$1 investment in the stock market on January 1, 1802. The graph for the consumer price index is also shown here. As in Exhibit 2.28, the returns shown in the bottom panel are computed in annually rolling bands for 10-year averaging of annual data.*



This adjustment also has a dramatic effect on our earlier inference, made from bottom panel of Exhibit 3.28, that the 10-year averaged total annual returns have never been negative. Those data also pointed to an overall rising trend towards the present. But the corresponding inflation-adjusted data in Exhibit 3.30 contradict both these inferences. Instead, they show that, within the twentieth century, the market gave conspicuously negative real returns in the 1920s and 1970s, and rather abysmal total returns

in late 1940s. This raises the scary possibility that the sluggish returns that the investors have received so far in this new millennium may well signify a repeat of the 1920s, 40s and the 70s. But then, as can be seen from Exhibit 3.31, these were economically stressful times for the nation at large. The market could have hardly remained immune to such macroeconomic constraints. Even the most pessimistic amongst us would not identify the present macroeconomic scene as anything comparable to those hard times.

Exhibit 3.31: U.S. economy in the twentieth century has experienced three periods of major stress — mid-late 1920s, late 1940s, and the 1970s (Updated from “Macroeconomics” by Baumol and Blinder⁴⁶).



3.3.2 Are The Returns Really Gaussian?

How reasonably can we extrapolate the market’s pattern of past performance into the future, so that the investor can have some idea of what returns to expect? To answer this, we need to first ascertain if there are any patterns to these returns. Interestingly, a curiosity of the market’s historic performance has been that, irrespective of whether we track the market continually during trading on the exchange floor or through its daily, weekly, monthly, quarterly or yearly closings, changes in the stock prices and index values fluctuate randomly. This is consistent with a basic observation in nature, known as Brownian motion⁴⁷, and is the domain of probability theory and statistics. Much like all the other aspects of modern life, therefore estimation and use of mean, standard deviation and the related methods and techniques of statistical analysis have become integral to modern financial analysis.

Now, a sequence of empirical observations is taken to be randomly distributed if these observations occur independently of each other, and

unpredictably so, and the statistical structure of the series remains unchanged no matter how often we the replicate experiment generating these observations. The data with these properties of independent, identical distribution (i.i.d.) often conform to the bell-shaped curve of normal⁴⁸ or Gaussian distribution. Take stock market returns r_1, r_2, \dots, r_n , with $r_n = \ln (P_n/P_{n-1})$ from Equations (3.2) and (2.4), i.e., $P_n = (p_n + \text{Div}_n)$, over n consecutive intervals. Their geometric mean \tilde{r} is computed as

$$\tilde{r} = \frac{1}{n} \sum_{i=1}^n r_i = \frac{1}{n} \sum_{i=1}^n \ln (P_i/P_{i-1}) \quad (3.6a)$$

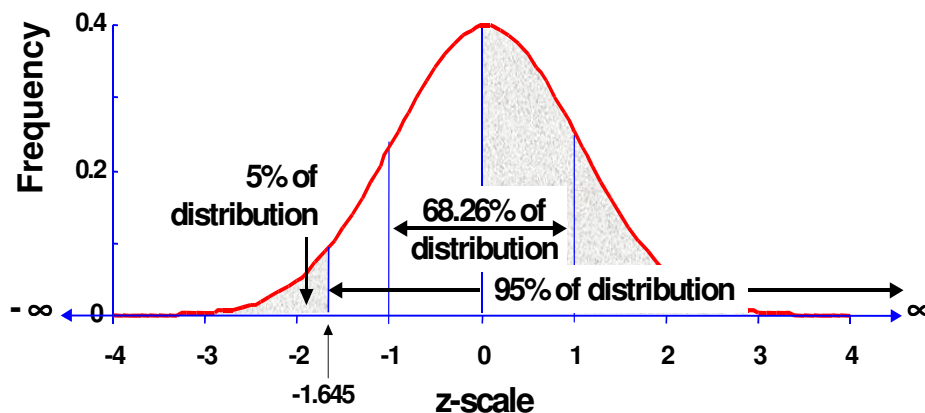
Much like the preferred path of particles in the Brownian motion, this mean value is where the individual values of returns tend to cluster, defining the central tendency⁴⁹. Standard deviation (s) is the measure of how tight or dispersed this cluster is. It is the square root of variance (s^2) where the latter is estimated as:

$$s^2 = \frac{1}{n-1} \sum_{i=1}^n (r_i - \tilde{r})^2 = \frac{1}{n-1} \sum_{i=1}^n r_i^2 - \frac{n}{n-1} \tilde{r}^2 \quad (3.6b)$$

Obviously, the tighter the cluster the smaller the values of $(r_i - \tilde{r})$ will be, and smaller, therefore, will be the variance and the standard deviation, and vice versa. As for the changes in either stock prices or indices, standard deviation (s) is a measure of volatility: the large values of standard deviation indicate large volatility⁵⁰. This is true irrespective of whether the data follow normal or any other distribution. Following Tchebysheff's theorem that, given a number $k \geq 1$ and a set of n data r_1, r_2, \dots, r_n , at least $[1-(1/k^2)]$ data are within k standard deviations from the mean, at least 75% of the data should be within two standard deviations from the mean, and almost 90% within three standard deviations. For normal distribution, 68.26% of the data lie within 1 standard deviation from the mean, 95.44% of the data lie within 2 standard deviations from the mean, and 99% of the data lie within 2.575 standard deviations from the mean. Recall our earlier discussion of normal distribution model in the context of Bollinger bands. We had then defined the band at 2.5 standard deviations from the mean. That was only for simplicity: actually, we would need to define the band within 2.326 standard deviations from the mean if we set the limit at exactly 98% and at 2.575 standard deviations, as mentioned above, in the case of 99%. Exhibit 3.32 displays a typical normal distribution curve.

Exhibit 3.32:

Normal distribution curve is symmetric about the mean, where it peaks, and tapers off to zero on either side, i.e., at $\pm\infty$. Note the standardization of returns in the horizontal axis here by conversion into z-scale, where $z = (r_t - \bar{r})/s$. As a practical application of this, note that the region to the left of $z = -1.645$ covers 5% of the normal curve's total area, and the region to the right the remaining 95%.



The use of “geometric mean” here rests on the approximation derived earlier in the context of Equation (3.1). If we compute the return (r) as the price change per period, i.e.,

$$r_n = (P_n - P_{n-1})/P_n \tag{3.7}$$

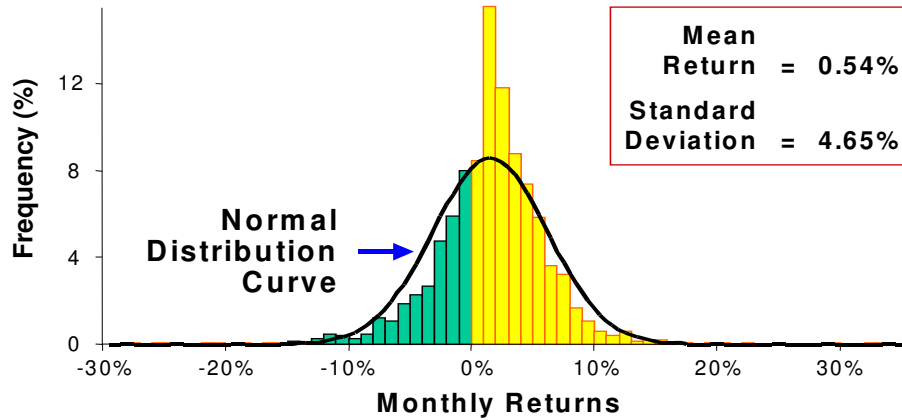
and not as $r_n = \ln (P_n/P_{n-1})$, the result would be arithmetic mean.

Practical, conceptual and analytical reasons make geometric mean the preferred measure for the financial time series analysis. Suppose that a stock, trading at \$100 on day 1, falls by 10% on day 2 and then rises by 10% on day 3. Before you imagine that these rates give the stock's price as \$100 at the end of day 3, think again: a 10% drop from \$100 means the day 2 price of \$90 which, raised by 10%, gives the day 3 price of \$99. Thus, at the end of day 3, this stock has actually lost 1% of its day 1 price. For these data, the geometric mean ($= -0.10536 + 0.09531 = -0.01005$) shows a 1.005% loss, so reflecting the reality better, than the formula for arithmetic mean ($= -0.1 + 0.1 = 0$) which gives the mean return for this period as zero. Also, as shown in Exhibit 3.32, normal distribution curve tapers off to zero at $\pm\infty$ whereas, in reality, the most that the price can drop to is 0, not $-\infty$. As to the other extreme of $+\infty$, wouldn't sane persons reject the prospects of returns rising to

$+\infty$, not a theoretical impossibility, as “wishful”? This implausibility to reach the extremes of $\pm\infty$ denies arithmetic model the conceptual basis for using the normal distribution curve. This poses no problem to the geometric model, in which $r = \ln (P_n/P_{n-1}) \rightarrow -\infty$ as $(P_n/P_{n-1}) \rightarrow 0$ and $r \rightarrow +\infty$ when the prices spiral exponentially. As discussed in the following section, this also enables the estimation of multi-period returns and risks by way of time-aggregation. A word of caution, though. Our use of the geometric mean rests on equation (3.1), it applies only to the time-series data and would produce erroneous estimates if it is used for spatial data. Strictly speaking, geometric mean of n data is the n^{th} root of their product. Suppose you had a portfolio of two stocks and both were priced at \$100 at a given point in time. The mean price then is \$100, irrespective of whether you compute arithmetic mean [= $(100+100)\div 2 = 100$] or the geometric mean [= $\sqrt{(100\times 100)} = 100$]. Suppose one of these stocks slid to \$90 at the next point in time, while the other rose to \$110, and you wish to compute the mean stock price in your portfolio now. The arithmetic mean will give you the accurate value of \$100 [= $(90+110)\div 2$] whereas the geometric mean gives this value as \$99.7 [= $\sqrt{(90\times 110)}$]!

Exhibit 3.33 shows the frequency histograms for the real monthly data for total returns on whole market index, i.e., for the 1802-2000 real or inflation adjusted total returns data presented in Exhibit 3.30. Note how these histograms display a symmetric distribution, much like the normal distribution model in Exhibit 3.23, with a pronounced peak at the mean and diminution away from it. The problem is that, compared to the normal distribution curve drawn for the mean (= 0.54%) and standard deviation (= 4.65%) values of the observed data shown in this Exhibit, these histograms have an excessively strong peak and extended tails. This raises the question whether our observed real monthly returns indeed follow the normal distribution model. The advantages of being able to describe the empirical data by a standard statistical model are obvious, however. For instance, it enables us to draw expectations of the market’s likely performance, and thus formulate suitable strategies to hedge against the market’s gyrations. The validity of normal distribution model also means that the price next minute, next hour, or next day, should be independent of its current and past levels⁵¹. This cannot happen, of course, unless we assume that the price at any given point in time essentially reflects all the information needed to determine it. Curious as it may sound, this is the crux of the *efficient market hypothesis*, i.e., a financial economist does not define the market’s efficiency in terms of how perfectly neat and tidy it is in following a pre-determined or predictable price path! Rather, the efficiency of a market is defined by how well it absorbs and reflects in price all the relevant and determinant information.

Exhibit 3.33: Histograms for total monthly returns on the US whole market index for the real 1802-2000 data of Exhibit 3.30. These returns have been computed using the geometric model here. The dark-shaded region corresponds to negative returns.



Applying the normal distribution model to market returns has been a matter of considerable critical concern in financial economics, therefore, ever since Maurice Kendall⁵² first used it to formally describe the behavior of stock and commodity price over time, arguing that that their random changes seem evenly distributed about the mean. Applying this model would certainly make it easier for the investors to draw rational expectations. The problem is that these data generally show volatility clustering and fat tails⁵³ of the kind seen in Exhibit 3.33, no matter what returns are used and how they are analyzed. The question, therefore, is whether the observed returns are indeed normally distributed.

Two statistical measures can help us answer the question as to how valid the assumption of normal distribution is for any given empirical data: skewness (S_k) and kurtosis (K_u). The first of them, S_k , measures how symmetric the observed distribution is and the other, kurtosis (K_u), measures if it is either too flat or too peaked relative to the theoretical curve. In terms of the nomenclature used in Equations (3.6a) and (3.6b), these two measures are estimated using Equations (3.8a) and (3.8b).

$$S_k = \frac{n}{(n-1)(n-2)} \sum_{i=1}^n \left(\frac{r_i - \tilde{r}}{s} \right)^3 \quad (3.8a)$$

and

$$K_u = \frac{n(n+1)}{(n-1)(n-2)(n-3)} \sum_{i=1}^n \left(\frac{r_i - \tilde{r}}{s} \right)^4 \quad (3.8b)$$

As shown in Exhibit 3.34, $S_k > 0$ or positive if the distribution is right-skewed, $S_k < 0$ or negative when the distribution is left-skewed, and $S_k = 0$ when the distribution is symmetric about the mean, as would occur for normal distribution. As for kurtosis, $K_u = 3$ for normal distribution. Therefore, $K_u > 3$ if the distribution is strongly peaked (leptokurtic) relative to normal distribution, and $K_u < 3$ if the distribution is flatter (platykurtic) than normal distribution. These statistics for our 1802-2000 total monthly returns data are summarized in Exhibit 3.35.

Exhibit 3.34:
Skewness (top) and kurtosis (bottom) of distribution

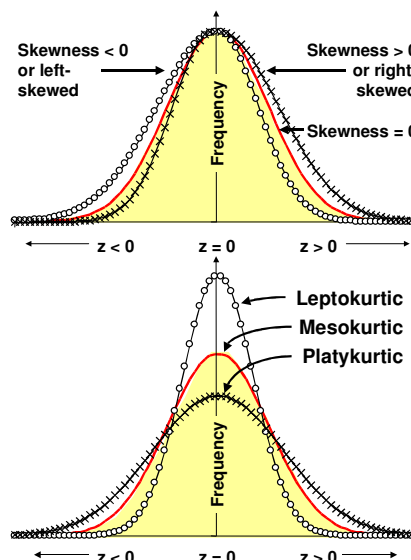


Exhibit 3.35:

The characteristics of the normal distribution model as applied to 1802-2000 real monthly total returns of Exhibit 3.33.

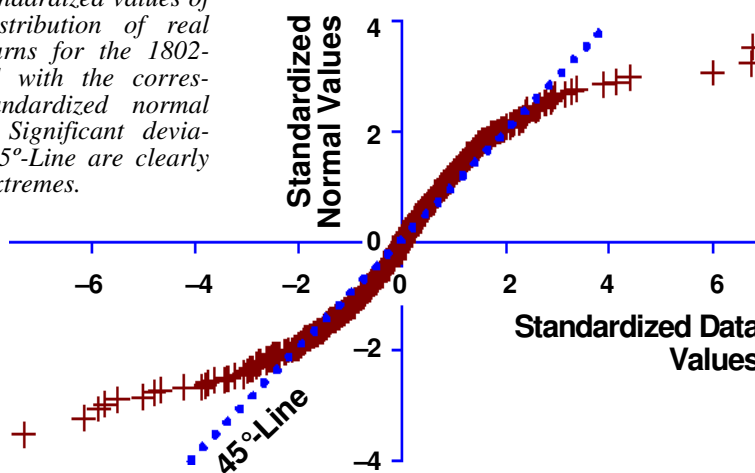
Mean	=	0.54%
Standard Deviation	=	4.65%
Skewness	=	-0.44
Kurtosis	=	6.66

Clearly, our monthly returns data of Exhibit 3.33 are leptokurtic and mildly left-skewed. Of these, the latter (i.e., skewness) value in Exhibit 3.35 is too small to be statistically significant, however. This is consistent with Peiró's⁵⁴ analyses of daily returns of several international stock markets and spot exchange rates that failed to find statistically significant asymmetries in most of the series. Skewness is hardly irrelevant, however, for it matters⁵⁵ greatly in day-to-day trading and investment decisions, and in pricing the options and evaluating their volatility, the details of which are discussed in our subsequent chapter on hedging and options. For our present focus on long-term investing, though, the results in Exhibit 3.35 make skewness an unlikely candidate for further exploration. Curiously, this applies to kurtosis as well. True, a high kurtosis ($\gg 3$) connotes as significant a deviation from the normal distribution model as a low kurtosis ($\ll 3$) does. But then, by implying a very high cluster of values within a rather narrow range, the former is also assures the long-term investor of a higher probability that the realized return will not stray too far from the expected return.

The problem in using normal distribution model for our data on real monthly returns is also brought out, graphically, in the Q-Q plot⁵⁶ in Exhibit 3.36. It compares standardized values (or z-scales) of observed cumulative distribution with the corresponding normal distribution. These two data sets diverge appreciably beyond two standard deviations from the mean (i.e., for $z > \pm 2$). Had the observed data been normally distributed, all these values would have plotted on the 45°-Line. As 95.44% of the area under the normal curve falls within two standard deviations from the mean, this suggests that we can have 95% confidence in the estimation of the mean and its dispersion but can not use normal distribution model to estimate the extreme values.

Exhibit 3.36:

The Q-Q plot graphically compares the standardized values of observed distribution of real monthly returns for the 1802-2000 period with the corresponding standardized normal distribution. Significant deviations from 45°-Line are clearly seen at the extremes.



This has led to such alternatives⁵⁷ to the normal distribution model to describe stock market returns as the discrete mixtures of normal distributions, Student's t distribution, ascribing fat tails to jump processes, and the like. A typical investor tends to be in the market for the long haul, however, and seldom enters the market on a daily, weekly or monthly basis. What if we consider the annual returns, then, instead of the monthly returns? As shown in Exhibit 3.37, the histograms of observed returns now show a better fit to the normal distribution model than was the case with the monthly returns. Notice the appreciable drop in kurtosis. The Q-Q graph for these annual data, shown in Exhibit 3.38, too suggests a better fit to normal distribution model than what the monthly data show.

Should we really sacrifice the convenience of a normal or Gaussian distribution, then, in order to estimate the expected returns and volatility?

Obviously not, judging from the results in Exhibit 3.39 in which selected features of the observed monthly and annual total returns data are compared with those expected by assuming that they fit the Gaussian model.

Exhibit 3.37: Annual returns computed for the US whole-market total return index match the normal distribution curve more closely. As in Exhibit 3.33, these returns have been computed using the geometric model and dark-shaded region corresponds to negative returns.

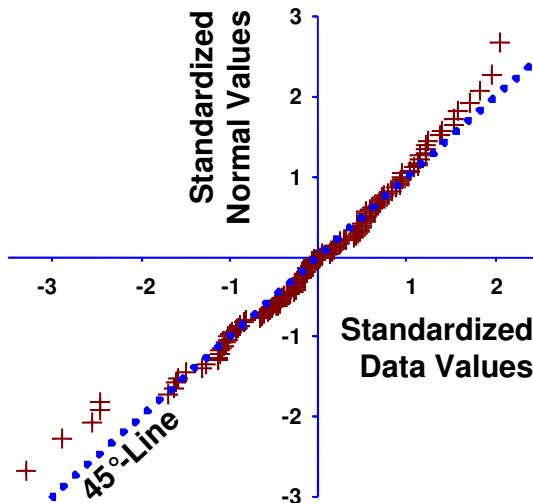
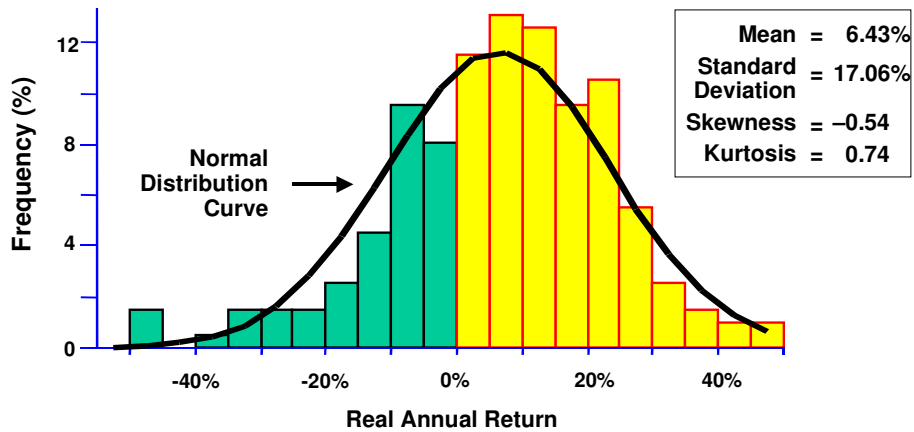


Exhibit 3.38:

This Q-Q plot graphically compares standardized values of observed distribution of real annual returns for the 1802-2000 period with the corresponding standard normal distribution. Note how greatly subdued the deviation from 45°-line is, when compared to that seen in Exhibit 3.36.

Exhibit 3.39:

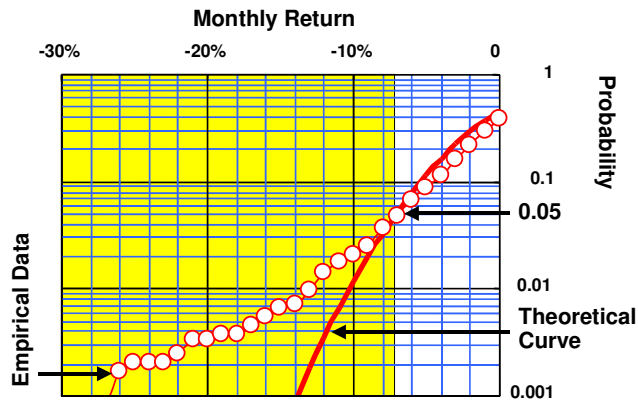
Selected statistical features of the observed monthly and annual total returns compared to what would be expected by fitting the normal distribution model.

	<i>Probability computed from the observations</i>		<i>Probability expected from the normal distribution model</i>
	<i>Annual returns</i>	<i>Monthly returns</i>	
Returns within 1 standard deviation of the mean	0.73	0.78	0.68
Returns within 2 standard deviations of the mean	0.94	0.95	0.95
Probability of a 10% or greater loss in a month	—	0.02	0.01: monthly data 0.02: annual data
Probability of a 10% or greater loss in a year	0.14	—	0.15: monthly data 0.17: annual data

This assertion of the validity of normal distribution model would be reasonable, therefore, so long as we avoid seeking statistical inferences using the extreme values. The obvious concern here is the left tail simply because complaints about greater forward jumps are unlikely. This is because of the need to assess the “Value-at-Risk” (VaR)⁵⁸, a robust and effective statistical measure for financial risk management that uses the first 1-5% of cumulative normal density function when the ‘at risk’ value of a portfolio is estimated from the historic data. Exhibit 3.40 illustrates this by comparing the left tails of empirical and theoretical cumulative density functions in Exhibit 3.33.

Exhibit 3.40:

Comparing the left tails of theoretical and empirical data of Exhibit 3.33. The vertical axis has logarithmic scaling so as to emphasize the divergence of empirical data from theoretical model. The shaded region denotes probabilities of 0.05 and less.



Consider, for instance, a portfolio worth W ($= \$100,000$, say) that is wholly invested in a broad market index like S&P-500, Russell-3000 or Wilshire-5000. The historic estimates in Exhibit 3.33 then give a 5% chance that this portfolio will suffer a loss of \$7,110 or more in a given month. The computation is as follows.

$$(\tilde{r} - 1.645s) \times W = (0.54 - 1.645 \times 4.65)\% \times \$100,000 = \$7,110$$

But then, as 96.27% of the area of our empirical distribution lies to the right of $r = -7.11\%$ ($= \tilde{r} - 1.645s$), the actual data suggest that this risk is slightly less. In other words, our above estimate of \$7,110 for the value-at-risk carries a probability of 0.0373 or a 3.73% chance, not 5%, if we use cumulative distribution of total monthly returns for the whole market in real or inflation-adjusted numbers.

“The sports car and sailboat are investments for my retirement. I’m using them to attract a younger woman who can support me in my old age.”



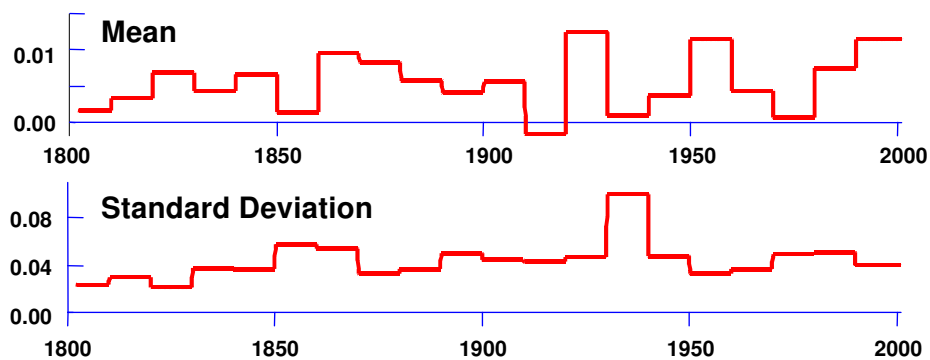
© 2000 Randy Glasbergen. www.glasbergen.com

3.4 History's Lessons

Our use of the market's entire available history, from 1802-2000, in making these deductions has advantages as well as disadvantages. The advantage lies in the fact that a long history such as this means the inclusion of all the periods of turbulence as also euphoria that resulted from forces beyond the market's control. This lends considerable confidence in projecting into the future the statistical inferences drawn from the observed data. The disadvantage is that 200 years is too unrealistically long a period for any investor's time-horizon.

Exhibit 3.41 graphs in decadal segments the statistics on real geometric returns through the market's 1802-2000 history. The top panel in this Exhibit shows the mean values, and the bottom panel the corresponding standard deviations.

Exhibit 3.41: Mean returns (top panel) and standard deviation values (bottom panel) computed in decadal segments for the total return index of Exhibit 3.30.



Three inferences follow from these graphs:

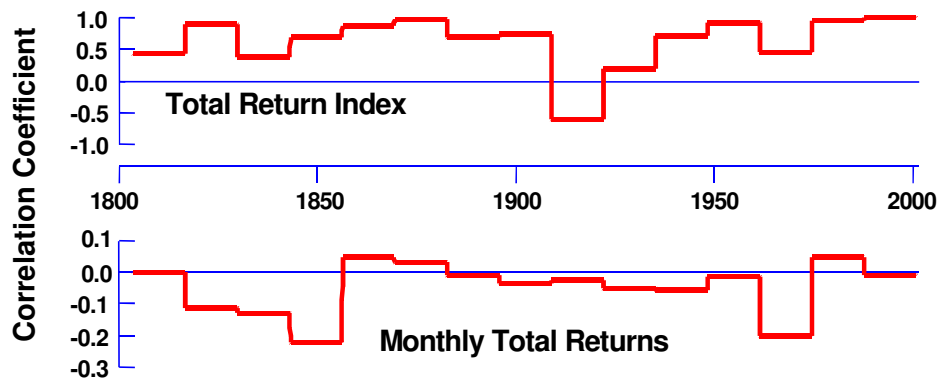
- Neither the decades of high returns have persisted, nor those of low returns. Instead, decadal returns tend to revert to the historic mean.
- The returns in 1920s and 1950s were just as good as in the 1990s, with the best returns by far in the 1920s.
- The 1930s were the times of extraordinary volatility.

Taken together, these inferences suggest that the rather high returns in the 1990s were hardly exceptional. They also suggest that the returns of the 1990s may not be sustainable in the long run, unless the earnings grow even faster.

Time alone can tell if this means that this first decade of the new millennium will turn out to be the same as the decade of the 1930s, when low returns but high volatility followed the preceding decade's high returns and moderate volatility. What history can tell us in this respect is this: compared to high to moderate volatility at such times of low returns as the 1860s, 1910s, 1930s and 1970s, such periods of high returns as the 1920s, 1950s and 1990s generally experienced moderate to low volatility. We would need to watch out for high volatility in this first decade of the 2000s, therefore, if the market's growth in the 1990s is to be compared with its growth in the 1920s. Such a caution will not be warranted, however, if we compare the 1990s with the 1950s. This is because, while decadal mean returns in the 1920s and 1950s were comparable and the following decades had depressed mean returns, volatility in the 1960s was comparable to the 1802-2000 average but that in the 1930s was the highest in the market's history.

Exhibit 3.42 explores further the question whether the market's growth in the 1990s was indeed without parallel or matched its performance at other points in its past. We do this by examining how the market's 1990s performance record correlates with the other segments of its history. The top panel shows the linear correlation coefficients (ρ)⁵⁹, computed in successive 158-month segments ending in Dec 2000, between the 1990s (Nov 1987 — Dec 2000) record and the market's 1802-2000 history. We have used Nov 1987—Dec 2000 for the 1990s, and not Jan 1990—Dec 1999, for two reasons. As for the beginning of this bull-run, Nov 1987 was when the whole-market total return index dipped to its lowest value, in real dollars, after the infamous Oct 1987 crash. As for the other end, we have used Dec 2000 for completeness. In any case, while the bull-run of the 1990s seems to have ended in March 2000, it is hardly clear, as yet, if the present bear-run is only a pause or that bull-run is really gone for good. The bottom panel in this exhibit graphs the correlation coefficients for the corresponding monthly total returns.

Exhibit 3.42: Correlating the market's 158-month long Nov 1987—Dec 2000 record with consecutive 158-month segments ending in Dec 2000. Graphed in the top panel are linear correlation coefficients for the total return index and in the bottom panel the monthly total returns.



Except for a foray into negative territory during Nov 1908—Dec 1921 ($\rho = -0.60$), correlation coefficients for total return index are positive for the rest of this 1803-2000 history. This is only to be expected, however, because the total return index in Exhibit 2.30 shows a generally rising trend. But, other than with itself, the Nov 1987—Dec 2000 record of total return index correlates 90% or better with only three of the intervals shown in Exhibit 2.29: May 1869—June 1882 ($\rho = 0.97$), May 1948—June 1961 ($\rho = 0.93$) and Sept 1974—Oct 1987 ($\rho = 0.95$). This record also includes $\rho \geq 0.90$ from Sept 1915 through Aug 1930, but that is not seen in Exhibit 2.42 because of our choice of the display parameters. As for the bottom panel in this Exhibit, not one of the intervals shows a statistically significant correlation coefficient. What makes this comforting is that this is precisely what we would expect if, as we assumed earlier in this section, the returns are indeed i.i.d.

Judging from the results in Exhibit 3.42, 1990s were not the only times when the market grew appreciably. However much this finding may dampen the proclaiming of uniqueness for real returns in the 1990s, it does not eliminate the fact that the market grew rapidly in the 1990s. Monthly returns during this period were appreciably higher ($= 1.20\%$), and volatility ($s = 4.05\%$) during this period was somewhat subdued compared to the market's historic average. But, with identical mean monthly returns of 1.20% but a significantly lower volatility, the 1950s hold a far more stellar record, however. Thus, as can be seen in Exhibit 3.43 where we compare the history of market's performance in these two periods, the market's growth in the 1990s was no more exceptional or extraordinary than that in the 1950s.

Exhibit 3.43: *A tale of two markets: the market's rise in the 1990s (top panel) was no more exceptional and extraordinary than its rise in the 1950s (bottom panel).*

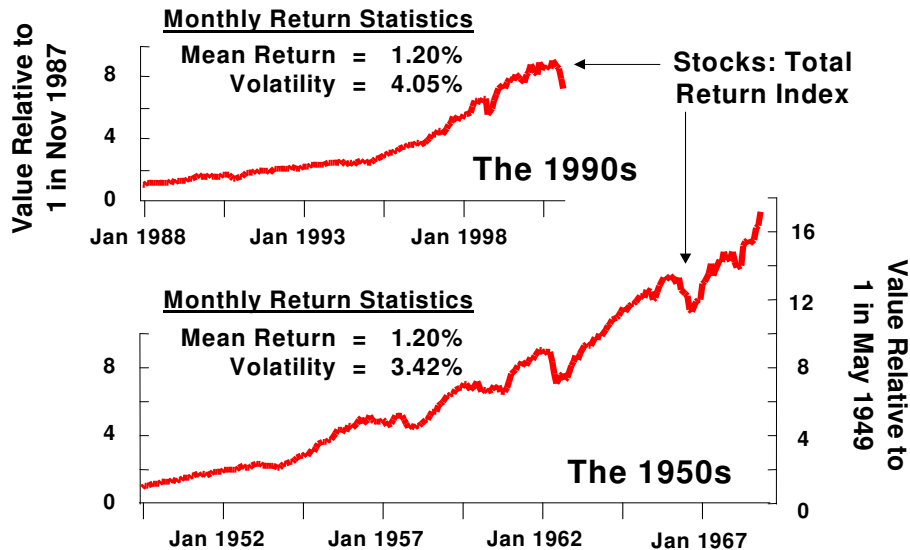


Exhibit 3.44 summarizes the monthly and annual statistics on real total returns on the market since 1802. Of the statistical measures given here, coefficient of variation is the only one that has not been explained so far. It is the ratio of standard deviation to mean and describes the variability of data by a single number, i.e.,

$$\text{Coefficient of variation}^{60} = \frac{\text{Standard deviation}}{\text{Mean}} \quad (3.9)$$

The choice of intervals here is only in order to conform to what has now become the convention in stock market research. It carries no significance in terms of the statistical structure of returns.

The following three inferences now emerge:

- the market has delivered remarkably consistent 6%-plus total returns, in real or inflation-adjusted terms, ever since 1802 when this history begins;
- the market has performed better in the twentieth century than in the nineteenth century, on a month-to-month as well as year-to-year basis, although this superiority extracted the toll of greater volatility; and

- the past 30 years have not been exceptional to the market’s history; they have given about the same returns as the rest of the twentieth century, but with a somewhat lower volatility.

Exhibit 3.44: *Statistical summary of real total returns on the US stock market since 1802. Returns are estimated here as the geometric mean, as explained in the text, and volatility is measured as standard deviation.*

Period beginning January ... ending December	1802- 2000	1802- 1899	1900- 1999	1802 1870	1871- 1925	1926- 1970	1971- 2000
---	---------------	---------------	---------------	--------------	---------------	---------------	---------------

Monthly Data (Annualized):

Mean Return	6.48%	6.36%	6.72%	6.12%	6.00%	6.96%	6.96%
Volatility	16.11%	13.82%	18.05%	13.68%	14.51%	20.75%	16.18%
Coefficient of variation	2.49	2.17	2.69	2.24	2.42	2.98	2.32
Skewness	-0.44	-0.36	-0.46	-0.45	-0.35	-0.32	-0.83
Kurtosis	6.66	5.4	6.41	7.5	0.87	6.92	3.47

Annual Data:

Mean Return	6.43%	6.40%	6.46%	6.14%	6.05%	6.95%	6.80%
Volatility	17.06%	13.98%	19.66%	14.85%	15.68%	21.32%	17.23%
Coefficient of variation	2.65	2.18	3.04	2.42	2.59	3.07	2.53
Skewness	-0.54	-0.28	-0.61	-0.33	-0.25	-0.56	-1.25
Kurtosis	0.74	1.35	0.19	1.49	0.23	0.2	1.32

Obviously, over time, the market’s growth has been truly exceptional. Two questions then arise: (a) exceptional compared to what? and (b) over how long a period of time? These are the questions that we will explore in the Chapter that follows.

“I retire on
Friday and I
haven’t saved
a dime.
Here’s your
chance
to become a
legend!”



Endnotes for Chapter 3

¹ The business cycle indicators are as follows:

Leading indicators: Interest rate spread (10-year Treasury less fed funds); M-2 money supply; average weekly hours (manufacturing); manufacturer's new orders of consumer goods and materials; **stock prices (500 common stocks, i.e., S&P-500)**; vendor performance (slower deliveries diffusion index); average weekly initial claims for unemployment insurance; index of consumer expectations; building permits for new private housing units; manufacturer's new orders for non-defense capital goods.

Coincident indicators: Employees on nonagricultural payrolls; personal income less transfer payments; industrial production; manufacturing and trade sales.

Lagging indicators: Average prime rate; consumer installment credit to personal income ratio; change in consumer price index for services; inventories to sales ratio for manufacturing and trade; commercial and industrial loans; change in labor cost per unit of output (manufacturing); average duration of unemployment.

Source: The Conference Board's Business Cycles Indicators page at the URL:

<http://www.globalindicators.org/GeneralInfo/bci4.pdf>

² Y2K stands for year 2000 and is the acronym for the much feared glitch that would have paralyzed the built-in clocks in most of the world's computers had they failed to recognize the new century because their calendars identify a year by its last two digits, e.g., 00 for 2000 is indistinguishable from 00 for 1900, 01 for 2001 is indistinguishable from 01 for 1901, and so on.

³ As discussed in Chapter 1, Dow, short for the *Dow Jones Industrial Index*, is the best known of all stock market indices and was created by Charles Dow in 1885 when he first began publishing an index of 10 railroad and 2 industrial stocks. This price-weighted average now comprises 30 stocks. The most important and best diversified benchmark of the overall U.S. stock market is the Standard & Poor's S & P 500 index. It is a capitalization or market-value weighted index of 500 of the largest U.S. corporations and is effectively the continuation of what Alfred Cowles began in 1939 when he constructed back to 1871 a value-weighted index of all stocks that then traded on the New York Stock Exchange (NYSE). In its present form, the S&P 500 index was inaugurated on March 4, 1957. The 500 corporations that then comprised this index accounted for nine-tenths of the value of all NYSE stocks. It now accounts for about three-quarters of the value of all publicly-traded stocks in the U.S. The Russell 1000 index is more representative of the large capitalization firms, with over 85% of the total value of equities, while Russell 2000 index accounts for another 10%. NASDAQ (National Association of Security Dealers Automated Quotation System) is an electronic trading system that now accounts for over 4000 securities, compared to about 2700 common stocks that trade on the NYSE and about 1000 that trade on the AMEX (American Stock Exchange). The most comprehensive, though not the most tracked index of securities traded in the U.S. is Wilshire 5000 — an index of almost 7500 stocks valued at about \$10 trillion. Russell-3000 is the next, but S&P-500 is most popular. Further details on all these averages and indices were provided in the previous chapter.

⁴ These two dates are 1,000 years and 13 days apart. Pope Gregorius XIII proclaimed the Gregorian calendar to replace the Julian calendar the day after October 4, 1582. This was to solve the problem that vernal equinox, traditionally fixed to March 21 since the first official council of the Christian Churches in 325 AD, was slipping by a day every 130 years during Julian calendar's reign from 325 AD to 1582 AD. Unlike the 365.25-day long Julian year, the shorter Gregorian calendar (= 365.2425 days per year, because it only allows a century year to be a leap year once every 400 years) reduces this slippage of vernal equinox to 1 day in 4000 years.

⁵ Morningstar is perhaps the best research and analysis firm there is for tracking the performance of mutual funds.

⁶ The market capitalization of a firm is computed by multiplying the price of a firm's share with the number of its shares outstanding.

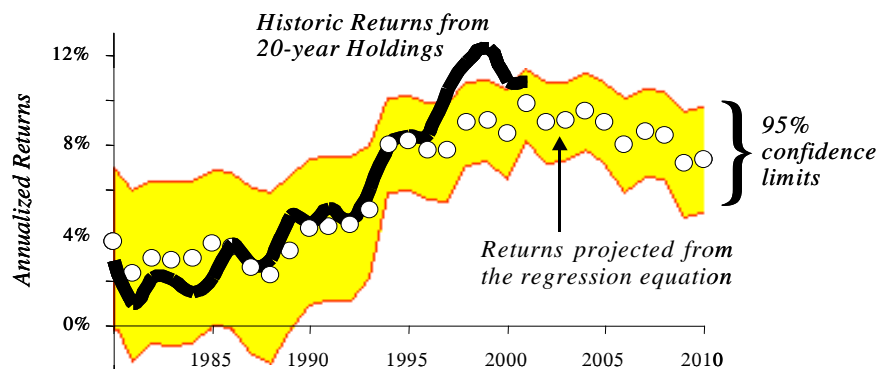
⁷ Ibbotson Associates: *Stocks, Bonds, Bills and Inflation Yearbook, 2001*. Jeremy Seigel's popular book, *"Stocks for the Long Run"* (McGraw-Hill, 2000), too presents an excellent analysis of the historic returns on U.S. stocks and their comparison with other investment alternatives.

⁸ The inflation-adjusted total annual returns for S&P-500 index (downloaded from Global Finance Data at the URL: <http://www.globalfindata.com>) for 1871-2001 have an annualized mean of 6.26% for 20-year holdings numbering 111, the corresponding standard deviation value being 2.84%. The linear regression analysis of these trailing and forward 20-year holdings gives the following equation:

$$\text{Annualized returns for forward 20-year holdings} = A - B \times \text{Annualized returns for trailing 20-year holdings}$$

where $A = 0.1055 \pm 0.0062$ and $B = 0.6965 \pm 0.0891$

Thus, if future returns could be predicted from this equation and the annual returns of 4.7-12.3% for the trailing 20-year holdings ending in 1991-2001, then the total annual returns for such holdings ending in 2002-2010 could well range from 4.9% to 11.2%.



Lacking any cause-effect relationship, such regression analyses as this carry little predictive power, however. If this or any other similar technical analysis could indeed predict the future returns then we should either have some smart chartists who would consistently beat the market over a protracted period of time, or have all the technical analysts performing poorly *en masse* because if they all are privy to the same information and are adept in the same strategies then they would all move together and at the same time. Neither of these is true, in reality, and the market has a strong element of randomness in returns. As will be discussed in Chapter 5, this is essentially what the efficient market hypothesis is all about, particularly the weak form of the hypothesis.

It is not that one can never get lucky, get out of a declining market in time and get into a winning market. This is called "beating the market" because the annual returns from the success of such a strategy would greatly exceed the average returns from the market. But, other than such legendary figures as Peter Lynch and Warren Buffet, it is hard to name an investor or a financial manager who has managed to outperform the market consistently for a decade or two. Also, even these two legends have had their odd years.

To further illustrate the limitations of this strategy, note that our analysis too underestimates the annual total returns for 20-year holdings ending in 1995-2001 at 7.78-9.87%, compared to the realized returns of 8.43-12.30%! It captures the trend rather well, though. One lesson is clear from this exercise, nonetheless: excellent performance in the past hardly guarantees excellent returns in the future.

⁹ This corroborates the analyses of price-earnings (P/E), price-dividends (P/D) and price-book value (P/B) ratios (e.g., John Cochrane: “Where is the Market Going? Uncertain Facts and Novel Theories”, *Economic Perspectives*, vol. 21, 1997; John Campbell and Robert Shiller: “Valuation Ratios and the Long-Run Stock Market Outlook”, *Journal of Portfolio Management*, vol. 24, pp. 11-26, 1998) which show that decades of high stock prices, normalized for earnings, dividends and/or book values, tend to be followed by decades of poor appreciation in stock prices, with corresponding poor returns to the investors.

¹⁰ The holding-horizon does not affect the mean return, nor it should. It only lowers volatility. This follows from the fact that, as discussed in section 2.3, when individual returns are indeed independent and identically distributed, the mean return for n -period holdings would be $n \times$ the mean return for single period holdings whereas the volatility or standard deviation for n -period holdings would be $\sqrt{n} \times$ mean return for single period holdings. The statistics summarized below on annualized total returns on S&P-500 index, computed using inflation-adjusted data for different holding horizons covering the 1871-2001 period, amply corroborate this.

Holding time (years)	1	5	10	15	20	30
Number of holdings	130	126	121	116	111	101
Annualized Mean	6.59%	6.77%	6.58%	6.40%	6.26%	6.17%
Standard deviation	18.79%	7.55%	4.80%	3.83%	2.84%	1.57%

Clearly, the longer the holding-horizon the smaller the volatility — stocks *are* for the long run!

¹¹ The problem boils down to estimating the “equity risk” premium, the extra returns on stocks that investors need to receive, over and above the safer fixed income investments like government bills and bonds, in compensation for taking the risks imposed by market’s fluctuations. This premium has fluctuated widely over time, as we show later in this Chapter. While some researchers (e.g., Robert Arnott and Ronald Ryan: “The Death of the Risk Premium: Consequences of the 1990s”, *Journal of Portfolio Management*, Spring 2001) argue that it is currently zero, the consensus estimates range from 2% to 13% (Ivo Welch: “Views of Financial Economists on the Equity Premium and Other Issues”, *The Journal of Business*, vol. 73, pp. 501-537, 2000).

¹² The Social Security Administration assumes a 7% average annual return on stocks (e.g., the 2001 *Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds* available at the Social Security Administration web site at URL: <http://www.ssa.gov>).

For a comprehensive critique of this assumption, see the paper by Peter Diamond: ‘What Stock Market Returns to Expect for the Future?’, *Social Security Bulletin*, vol. 63, pp. 38-52 (2000). This paper can be also downloaded from the URL

<http://www.ssa.gov/policy/pubs/SSB/v63n2y2000/diamond.html>

¹³ Jeremy Siegel: “*Stocks for the Long Run*” (McGraw-Hill, 2000).

¹⁴ This anticipates what will be explored further in Chapter 6. Suppose we start with the Gordon growth equation for equity price valuation, i.e.,

$$P = \frac{D}{r - g}$$

where P = price, D = dividend, r = discount rate and g = dividend growth rate.

This is the well known Gordon growth formula for equity valuation that was first reported by J.B. Williams (*The Theory of Investment Value*, Harvard University Press, 1938) and popularized, in the recent times, by M.J. Gordon and E. Shapiro (*Capital Equipment Analysis: The Required Rate of Profit*, *Management Science*, vol. 3, pp. 102-110, 1956).

The 1871-2001 history of S&P-500 index is sufficiently long to let us now make two simplifying assumptions:

- (a) $r = \text{ROE}$ (or the return on equity), an assumption that implies that market and book values are identical, i.e., the market is neither undervalued nor overvalued, and
- (b) $g = \text{ROE} \times \text{RR}$ (or the retention rate $(E - D)/E$, where $E = \text{earnings}$), i.e., g denotes the sustainable rate of growth.

In that case, $(r - g) = \text{ROE} \times (1 - \text{RE}) = \text{ROE} \times D/E$, so that

$$P = E/\text{ROE} \quad \text{or} \quad E/P = \text{ROE}$$

Thus, E/P ratio directly tells us what returns to expect on equity investments. The assumptions (a) and (b) above demand, of course, that we look for secular trends in P and E in order to secure a reasonable estimate the long-term ROE.

Turning now to the historic data, fitting exponential trend lines to the real monthly price and earnings data on S&P-500 index companies gives the following two regression equations:

$$P = 64.824 \exp(0.0156 T) \quad \text{and}$$

$$E = 5.1981 \exp(0.0144 T)$$

	P/E	ROE
1871	12.47	8.02%
1926	13.32	7.51%
2001	14.58	6.86%
2076	15.95	6.27%

where T is counted in years since 1871.

As the data tabulated alongside show, these two empirical equations enable the estimates of what P/E ratio

and ROE values should be expected in the future, if we assume that the historic trend continues. Taking the ROE estimated here as the expected return on equities, then, it is unrealistic to set either 1871-2001 or 1926-2001 estimates of real total returns on the stocks as the expected returns for the 2002-76 period.

¹⁵ The business cycle troughs here are those identified by the National Bureau of Economic Research (NBER). While these troughs are the periods of severe economy-wide contractions, the NBER looks for declines in total output, income, employment, and trade, and does not define a contraction in terms of two consecutive quarters of decline in real GDP (gross domestic product). Not all stock market troughs coincide with the business cycle trough, e.g., the largest decline in the market's recent history, the 29% decline in mid-late 1987, was not associated with any business cycle trough, for instance. The NBER has already identified the market's current drop with an economy-wide slowdown, however.

¹⁶ Robert Shiller: *'Irrational Exuberance'* (Princeton University Press, 2000); and the papers by John Cochrane (1997) and John Campbell & Robert Shiller (1997) referenced in endnote 8 earlier.

¹⁷ Named after its author, the Nobel Laureate James Tobin ("A General Equilibrium Approach to Monetary Theory", *Journal of Money, Credits and Banking*, vol. 1, pp. 15-29, 1969), Tobin's Q is the ratio of market value of assets (debt and equity) to their current replacement cost. Andrew Smithers and Stephen Wright (*Valuing Wall Street: Protecting Wealth in Turbulent Markets'*, McGraw-Hill, 2000) used this ratio, graphed in Exhibit 2.7 using the data downloaded from Smithers' web-site, to argue that the market was getting dangerously overpriced.

¹⁸ Gross domestic product is the sum of all goods and services produced within the country.

¹⁹ Business Week Magazine: May 20, 2002.

²⁰ As many as 49% of the American households owned stocks in 2000, either directly in their portfolios or by way of options, mutual funds or retirement plans, whereas only 4% of American households held stocks in 1952, when President Eisenhower was inaugurated.

²¹ David Henry, with David Welch, Michael Arndt and Amy Barrett: "The new pinch from pensions", *BusinessWeek* (August 5, 2002); James Flanigan: "Nest eggs cushioned from market's drop", *Los Angeles Times* (July 26, 2002).

²² Bonds are debt instruments and usually have a face value of \$1,000 in the US. The way they work is this. On Jan 3, 2001, the quote on a 3-year Treasury note with 11% coupon

and Nov 15, 2003 maturity was \$118.567. For the buyer, such a bond would generate a cash inflow of \$118.75 on Nov 15, 2001, \$118.75 on Nov 15, 2002, and \$1118.75 (= face value + coupon) on Nov 15, 2003, for a total of \$1,356.25 during the life of the bond. For the buyer who has paid \$1,185.67 at the time of the purchase, this cash stream amounts to an overall 4.843% rate of return. This rate of return is the bond's "yield" to maturity. When the bond was originally issued, perhaps as a 20-year bond on November 15, 1983 when the long-term interest rates were 11-12%, that original buyer must have paid \$1,000 for it and would have, had the bond been held to maturity, received a yield of 11.875%. But, as rates have fallen since then, the present buyer has to pay a premium so that the price paid reflects the current rate at which that original cash flow, promised at the time the bond was issued, is received.

²³ The price of the bond rises, and its yield declines, when interest rates fall and the opposite occurs when interest rates rise. For bonds with coupons exceeding the current rates, you thus pay a premium or a higher price, as in this case. Likewise, if the coupons were below the current rate, then the bond will sell at a discount (i.e., the buyer will pay a price below the bond's face value) to raise the yield to current rate. For example, the quote on Jan 3, 2001 on a 3-year Treasury note with 4¼% coupon and Nov 15, 2003 maturity was \$98.099. The buyer of this bond would thus pay \$980.99 to receive \$42.50 on Nov 15, 2001, \$42.50 on Nov 15, 2002 and \$1042.50 on Nov 15, 2003, for a yield of 4.983%. Evidently, a bond is a fixed income instrument, with yield that equals the coupon rate, only for a buyer who holds it to maturity. For notes, bills and bonds issued by the US Treasury, the risk of default is generally considered nonexistent. Relatively risky parties, e.g., other governments, corporations etc., have to pay higher coupons to reflect this risk that the buyer of the bond must assume. Likewise, the longer the bond's time to maturity the longer the bond's holder must weather the risk of interest rate fluctuations, risk of default etc., and the more that holder must be compensated for assuming such risks. Long-term bonds are more sensitive to interest rate changes than short-term notes, therefore, and long-term interest rates are generally higher than the short-term rates.

²⁴ James Glassman and Kevin Hassell: *Dow 36000: The New Strategy for Profiting from the Coming Rise in the Stock Market* (Times Books, 1999). See also:
David Elias: *Dow 40000: Strategies for Profiting from the Greatest Bull Market in History* (McGraw-Hill, 1999)

²⁵ This is because, taking the logarithms of two sides of the first part of equation (1), we have
$$\ln(P_T/P_0) = T \ln(1+r) \approx rT$$

when we use the Taylor series expansion of $\ln(1+r)$, i.e.,

$$\ln(1+r) = \sum_{k=1}^{\infty} (-1)^{k+1} \frac{r^k}{k} = r - \frac{1}{2}r^2 + \frac{1}{3}r^3 - \frac{1}{4}r^4 + \dots \approx r$$

because, when r is very small, the terms with r^2 and higher powers of r can be neglected altogether. This series is named after the English mathematician Brook Taylor (1685-1731).

The rule of 70 is a simplified version of this. For instance, using this equation to estimate the time T that P_0 will take to double in value (i.e., $P_T = 2P_0$), we have $\ln(2) = 0.6931 = rT$. This means that $T = 69.31$ years ≈ 70 years if $r = 0.01$ or 1% per year. Likewise, if $r = 0.02$ or 2% per year, then $T = 34.66$ or 35 years, $T \approx 23$ years if $r = 0.03$ or 3%, and so on. Some researchers prefer using the *rule of 72*, instead: 70 admittedly sounds a more round number than 72 but requires a greater degree of approximation than 72.

²⁶ The concept of "value", intuitively so easy to understand, has proven to be almost intractable to define quantitatively. St. Thomas Aquinas defined "just" value as divinely ordained, and the "just" rate of interest — our basic premise, today, for determining the cost of money — as 0. This is also the view enshrined in the world of Islam where the charging or paying of interest is essentially a sinful act. Indeed, for much of the history, the view towards the time value of money has been somewhat ambivalent. Recall the famous advice, "neither a

borrower nor a lender be”, of Polonius in Shakespeare’s Hamlet, for instance. Modern economic theory has provided a more reasoned attitude towards cost, profit and value. Such early economists as Adam Smith (1723-1790) and David Ricardo (1772-1823) distinguished between price as “value in exchange” from value as “value in use”. But this led to the “water-diamond” paradox — water has much value in use but little value in exchange, for instance, whereas the converse is true of diamond — until Alfred Marshall (1842-1924) showed “price” as the point at which supply and demand are in equilibrium. Profit is the difference, then, between this price of a commodity, or service, and the cost of producing it. But this still left the concept of “value” undefined, except identifying it as the benefit perceived by the buyer in the supply-demand transaction. Since cost of production already includes the costs of labor and materials, it is this profit that then amounts to the returns received on the capital invested. Of course, if this capital came from sources other than the entrepreneur, then the cost of capital, or the time value of money, would be the part of this profit that needs to be apportioned to the investor.

²⁷ Interview with Carol Loomis: “Warren Buffett on the Stock Market”, *Fortune Magazine*, December 10, 2001. This article is accessible at the URL:

http://www.fortune.com/indexw.jhtml?channel=article.jhtml&doc_id=205324

²⁸ Returning to endnote 13, note that the factor $1/(r - g)$ in the Gordon growth equation can be expanded using the Binomial series

$$(a + x)^n = a^n + n a^{n-1} x + \{n(n-1)/2!\} a^{n-2} x^2 + \{n(n-1)(n-2)/3!\} a^{n-3} x^3 + \dots$$

Thus, setting $a = r$, $x = -g$ and $n = -1$, and noting that, as $g < r$, $0 < (g/r) < 1$, we have

$$\begin{aligned} P &= D/(r - g) \\ &= D \times [(1/r) + (g/r^2) + (g^2/r^3) + (g^3/r^4) + \dots] \\ &= (D/r) \times [1 + (g/r) + (g/r)^2 + (g/r)^3 + \dots] \\ &= D/r + (D/r) [(g/r) + (g/r)^2 + (g/r)^3 + \dots] \end{aligned}$$

²⁹ This passage comes from the review by Keynes of the book “*Common Stocks as Long Term Investments*” by Edgar Lawrence Smith (Macmillan, New York, 1925).

³⁰ E.F. Fama and K.R. French: “Disappearing Dividends: Changing Firm Characteristics or Lower Propensity to Pay”, *Journal of Financial Economics*, vol. 60, pp. 3-43 (2001).

³¹ In his bestseller, “*The Great Boom Ahead*” (Hyperion Press, 1994), Dent shows how well U.S. economic growth and stock market have matched the birth rates by 47-year lag. See also Michael Weiss: “The Demographic Investor” (*American Demographics*, December 2000).

³² R. Vernon: “International Investments and International Trade in the Product Life Cycle”, *Quarterly Journal of Economics* (May 1966, pp. 190-207); George D. Day: “The Product Life Cycle: Analysis and Applications Issues”, *Journal of Marketing* (Fall 1981, pp. 60-67).

³³ That strategic overkill can turn investing in “growth” sector into a financial nightmare is demonstrated by the disappointing results from BCG’s (Boston Consultancy Group) “stars” of the 1970s and 1980s. This idea, based on the PLC theory, advocated using excess revenues from the mature segment of a business (the “cash cow”) to feed the growing segment (the “star”). But the star may then end up attracting investment so beyond its capacity as to make the initial projection of growth into profitability completely moot.

³⁴ Gary Hamel and C.K. Prahalad: “Strategic Intent”, *Harvard Business Review* (May/June, 1989) and “*Competing for the Future*” (Harvard Business School Press, 1994).

³⁵ Robert Burgelman and Andrew Grove: “Strategic Dissonance”, *California Management Review* (Winter, 1996).

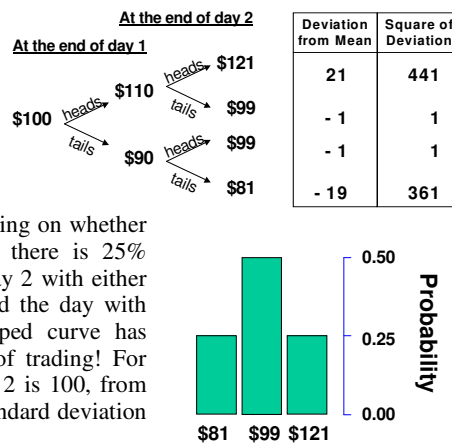
³⁶ Michael E. Porter: “The Competitive Advantage of Nations”, *Harvard Business Review* (March/April, 1990).

³⁷ Lawrence Chamberlain & William Hay: *Investment and Speculations* (Henry Holt, New York, 1931)

³⁸ Benjamin Graham & David Dodd: *Security Analysis* (McGraw-Hill, New York, 1940)

- ³⁹ Edgar Smith: *Common Stocks as Long-Term Investments* (Macmillan, New York, 1925)
- ⁴⁰ Irving Fisher: *How to Invest When Prices are Rising* (G. Lynn Sumner & Co., Scranton, PA, 1912)
- ⁴¹ Roger Ibbotson & Rex Sinquefeld: 'Stocks, Bonds, Bills, and Inflation: Year-by-Year Historical Returns', *Journal of Business*, vol. 49, pp. 11-43 (1976)
- ⁴² Jeremy Siegel: 'The Equity Premium Stock: Stock and Bond Returns Since 1802', *Financial Analysts Journal*, Jan/Feb 1992; also Jeremy Siegel: *STOCKS FOR THE LONG RUN* (McGraw Hill, 2000)
- ⁴³ G. William Schwert: 'Indexes of the United States Stock Prices from 1802 to 1987', *Journal of Business*, vol. 63, pp. 399-426 (1990)
- ⁴⁴ This only applies to the common stocks, however, and not to the preferred stocks.
- ⁴⁵ The reason why the CPI graph fails to reflect the fluctuations is that CPI presents an integrated picture of inflation. Suppose inflation averaged 5% one year and -5% the next year. Starting with the value of 1 at the beginning of this period, then, CPI will be 1.05 at the end of the first year and 0.9975 at the end of the second year. Note how subdued these fluctuations are than our +5% and -5% swings in the inflation rate.
- ⁴⁶ William Baumol and Alan Blinder⁴⁶: *Macroeconomics: Principles and Policy* (Dryden, 2000).
- ⁴⁷ In 1827, the English botanist Robert Brown (1773-1858) first found microscopic pollen grains jiggling constantly along a preferred path when they were suspended in water, as if they had come back to life even after they had been stored for a long time. We now know that this erratic motion occurs in a colloidal suspension of tiny particles through incessant bombardment by molecules of the dispersion medium, i.e., gravity takes over, and the particles settle down, when this motion and the suspension are broken. In 1905, Albert Einstein developed and integrated the mathematics of this explanation into kinetic theory to win the Nobel Prize in Physics. The preferred path of Brown's microscopic pollen grains leads to a basic observation in modern probability theory and statistics: that samples from a large number of independent observations from the same distribution tend to form the bell shaped curve of normal distribution, a tendency that improves with the number of observations.
- ⁴⁸ Normal distribution is also called Gaussian, after Karl F. Gauss (1777-1855) who observed this pattern while studying celestial mechanics. It was Sir Francis Galton (1822-1911) who first called it "normal" and used it extensively in his work in eugenics, mainly to show that many of our intellectual and physical traits are passed from one generation to another. The following example shows normal distribution applies to our context.

Suppose that you start with a \$100 investment in the stock market and that the extent of your gain or loss is determined by the flip of a coin at the end of the day: heads you gain 10%, tails you lose 10%. We will assume, of course, that the coin is a fair one so that each outcome is equally likely. At the end of end of day 1, you will thus end up with either \$110 or \$90, depending on whether the coin flipped heads or tails. Likewise, there is 25% chance or a 0.25 probability that you end day 2 with either \$81 or \$121 and 50% chance that you end the day with \$99. Thus, as shown alongside, a bell-shaped curve has started forming already in merely 2 days of trading! For these data, the mean (\bar{r}) at the end of day 2 is 100, from Equation (2.5a), while the corresponding standard deviation (s) value is $\sqrt{(804/3)} = \sqrt{(268)} = 16.37$.



-
- ⁴⁹ Median (defined as the value such that it is less than one-half of the values and greater than the other half) and mode (the value that occurs most frequently) are the other two measures of central tendency. Because of its symmetry, a normal distribution has the same mean, median and mode.
- ⁵⁰ To be specific, mean (\bar{r}), variance (s^2) and standard deviation (s) defined here are sample estimators of the corresponding population characteristics — $\bar{\mu}$, σ^2 and σ , respectively.
- ⁵¹ Hence the iid (independent, identically distributed) assumption made earlier in this section.
- ⁵² Maurice G. Kendall: “The Analysis of Economic Time-Series, Part I. Prices”, *Journal of the Royal Statistical Society*, vol. 96, pp. 11-25 (1953).
- ⁵³ Donncheol Kim & Stanley Kon: “Alternative models for the conditional heteroscedasticity of stock returns”, *Journal of Business*, vol. 67, pp. 563-598 (1994). See also Stanley Kon: “Models of stock returns - a comparison”, *Journal of Finance*, vol. 39, pp. 147-165 (1984).
- ⁵⁴ Amado Peiró: “Skewness in financial returns”, *Journal of Banking and Finance*, vol. 23, pp. 847-862 (1999).
- ⁵⁵ C.R. Harvey & A. Siddique: “Autoregressive conditional skewness”, *Journal of Financial and Quantitative Analysis*, vol. 34, pp. 465-488 (1999). See also F.D. Arditti & H. Levy: ‘Portfolio efficiency analysis in three moments: the multi-period case’ *Journal of Finance*, vol. 30, pp. 797-809 (1975); M. Brennan: “The pricing of contingent claims in discrete time models”, *Journal of Finance*, vol. 34, pp. 53-68
- ⁵⁶ Richard Devor, Tsong-How Chang & John Sutherland: *Statistical Quality Design and Control: Contemporary Concepts and Methods* (Prentice Hall, 1992).
- ⁵⁷ Nassim Taleb: *Dynamic Hedging – Managing Vanilla and Exotic Options* (John Wiley, 1997). See also David Hsieh: ‘Nonlinear dynamics in financial markets – evidence and implications’, *Financial Analysts Journal*, vol. 51, pp. 55-62 (1995); James Hamilton: ‘A quasi-Bayesian approach to estimating parameters for mixtures of normal distributions’, *Journal of Business and Economic Statistics*, vol. 9, pp. 27-39 (1991); C.A. Ball & W.N. Torous: ‘A simplified jump process for common stock returns’, *Journal of Financial and Quantitative Analysis*, vol. 18, pp. 53-61 (1983); R.C. Blattberg & N.J. Gonedes: ‘A comparison of the stable and Student distribution as statistical models for stock prices’, *Journal of Business*, vol. 47, pp. 247-280 (1974); P. Boothe & D. Glassman: ‘The statistical distribution of exchange rates’, *Journal of International Economics*, vol. 22, pp. 297-319 (1987).
- ⁵⁸ Phillippe Jorion: “Value at Risk: The New Benchmark for Controlling Market Risk” (Irwin, Chicago: 1997).
Phillippe Jorion and Sarkis Khoury: “Financial Risk Management: Domestic and International Dimensions (Blackwell, Cambridge, MA: 1996).
- ⁵⁹ Suppose we have n number of observations of any two variables, X and Y, and wish to quantitatively ascertain how closely they vary with one another. We would then compute their linear coefficient of correlation (ρ) statistic as follows:

$$\rho = \frac{[n\sum XY - \sum X \cdot \sum Y]}{[\{n\sum X^2 - (\sum X)^2\}\{n\sum Y^2 - (\sum Y)^2\}]^{1/2}}$$

Here, Σ denotes summation of the entire data. Also known as Pearson’s correlation coefficient, and computed assuming that this relationship is linear, this statistic (ρ) varies from a minimum of -1 , denoting an inverse relationship, to a maximum of $+1$, denoting a direct relationship, while $\rho = 0$ denotes a lack of any relationship. Note that this is a purely statistical measure that connotes no causal relationship whatever.

- ⁶⁰ As will be shown in the following Chapter, the customary practice in finance literature is to use the reciprocal of this, called the Sharpe Ratio, after adjusting mean return for the risk by deducting from it the ‘risk-free’ rate (usually the rate on 3-month Treasury Bills).