

## How to Build Expected Return Forecasting Models

by

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## ABSTRACT

Investors are enamored with various investment houses and personalities who claim insight into the prospects for long-term expected market returns. Some classic examples include Nouriel Roubini, John Hussman, David Rosenberg, or Jeremy Grantham. All really smart people.

But have you ever asked "How" these folks came to their conclusions?

In most cases, the answer is probably "**No**" and the reason is because there is a lack of transparency from the author(s) and/or a lack of knowledge/understanding on behalf of the reader. We also want to highlight that one can develop incredibly complex return forecasting models -- super sexy, super interesting, super compelling, etc. -- but that still doesn't mean they are any good at forecasting much of anything.

The point of this learning module is to educate the reader so they can make informed decisions about long-term expected return forecasting models.<sup>1</sup>

## 1. Summary

We generate projected long-term expected return forecasts for the S&P 500 using a variety of models ranging from simple (Bob Shiller Method) to medium complexity (Hussman Method) to relatively complex (Alpha Architect Method).

Core model inputs are as follows:



- Current P/E: 18.10 (As of 7/7/2014)
- Current Profit Margin: 13.35% (As of 7/7/2014)
- Current Cyclically Adjusted Price/Earnings (CAPE or Shiller P/E): 25.82 (As of 6/30/2014)

## Shiller Method (Simple)

- Regression approach
- The current predicted 10-year Nominal Total Return: 6.06%.

## Hussman Method (mid range complexity)

- Total return approach with assumptions on exit valuations.
- The current predicted 10-year nominal total return ranges between: -4.16% and 5.52%.

## Alpha Architect Method (high complexity)

- Simulation approach with dynamic revenue, profit margins, and valuations.
- The current predicted 10-year nominal total return ranges between: 3.42% and 5.49%.
  - $_{\circ}$  The top line is with average/good input assumptions.
  - The bottom line is with below average/poor input assumptions.

Simulation Statistics	Mean	Min	five_percent	twentyfive_percent	fifty_percent	seventyfive_percer	ntninetyfive_percent	maximum
10-Year Total Return Projection	5.49%	2.64%	4.03%	4.91%	5.50%	6.09%	6.96%	8.36%
Simulation Statistics	Mean	Min	five_percent	twentyfive_percent	fifty_percent	seventyfive_percer	ntninetyfive_percent	maximum
10-Vear Tetal Peturn Projection	2 4 2 0/-	-0 67%	1 2004	2 6204	2 260/-	4 2204	E 4 E 94	6 97%

The results are hypothetical results and are NOT an indicator of future results and do NOT represent returns that any investor actually attained. Indexes are unmanaged, do not reflect management or trading



fees, and one cannot invest directly in an index. Additional information regarding the construction of these results is available upon request.

## 2. Generating Expected Real Return Forecasts

## Shiller Method (simple)

We identify two variables:

- 1. The cyclically adjusted PE yield (1/CAPE) for any given point in time.
- 2. The subsequent 10 year average total returns (nominal) from that date.

Next, we run a regression on these two variables, using input from 1/31/1881 through 9/30/2001 and solve for an intercept, A, and a slope, B, in the regression equation Y = A + BX + error. Then we get the following estimated regression equation:

- 10-year Nominal Total Return=0.9198495\*(1/CAPE)+0.024967
- A detailed explanation can refer to an earlier post here: The Shiller P/E Ratio.

The figure below highlights the relationship between actual 10-year realized return observations and predicted 10-year returns using the simple Shiller prediction model.





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This model is estimated "in-sample" meaning that the usefulness of the regression estimates are only useful to the extent that one believes the historical linear relationship between 1/CAPE and future returns remains constant "out of sample."

- The current predicted 10-year Nominal Total Return: 6.06% (As of 6/30/2014, CAPE=25.82, plug it into the equation above)
- Below we plot the 10-year predicted total return using the Shiller Method and the realized 10-year total return.





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The figure above plots the relationship between actual 10-year realized return observations and predicted 10-year returns using the simple Shiller prediction model.

The Shiller model does a decent job predicting the general movement of future returns, but realized returns are much more volatile than those predicted by the Shiller model. Plus, this model is really simple.



## Hussman Method (mid-level complexity)

Background article on the Hussman Method: Long-term Market Return Projections

<u>Philosophical Economics</u> has some additional thoughts on the validity of this approach (and the <u>Hussman rebuttal</u>), but we aren't here to highlight which model is good or bad, rather, we are simply showing the reader how they are created.

In the short piece Hussman suggests that the projected annual total return on the S&P 500 over *T* years can be represented with the following equation:

 Long term total return = (1+g)(future CAPE / current CAPE)^(1/T) - 1 + dividend yield(current CAPE / future CAPE + 1) / 2



Source: <u>Hussman</u>

We make the following assumptions and plug them into the equation above:

- Peak to Peak earnings growth, g=6%
- T=10 years



- Dividend yield = 2.24%
- Current CAPE = 25.82 (as of 6/30/2014)
- future CAPE (E=Peak Earnings over cycle) range between 20 (major bull) and 5 (major bear)

The current predicted 10-year nominal total return ranges between: -4.16% and 5.52%.





The figure above highlights 10-year predict total return ranges under different ending valuations regimes. The "worst-case" regime is a CAPE = 5 (black line) and the "best-case" regime is a CAPE = 20 (blue line). We also plot realized 10-year total returns to assess how well the upper and lower ranges have captured historical realized return measures.

This model is effective at pinpointing the potential ranges for future returns, at least historically. There are a few notable exceptions, such as the Great Depression and the Internet Bubble. Outside of these rare events, one can reasonably expect future 10-year returns to fall within the bounds predicted by this model.

## Alpha Architect Method (way too complex)

Both the Shiller and the Hussman method for predicting long-term returns suffer from an inability to effectively model parameters that matter to future returns. For example, the Hussman model makes an assumption of 6% peak to peak earnings growth. But is this a reasonable assumption if profit margins are at all-time highs and known to mean-revert?

A more sophisticated model might be needed.

Our approach to this problem begins with a 40,000 foot view of the drivers of long-term returns:

- Revenue growth
- Margins
- Valuations

Any long-term return projection models needs to account for the empirically-observed dynamics of these variables.



- Revenue growth
  - In particular, revenue growth (as approximated by GDP) follows a fairly stable growth pattern, but with bumps along the road. We model this "bump" aspect by simulating growth paths at a static growth rate, but add a random volatility component around this static growth rate.
- Margins
  - For profit margins, the dynamic is a bit different. Margins tend to meanrevert, in other words, currently high margins systematically drift back to the long-term average and currently low margins drift up to the long-term average. This **mean-reversion** reflects the competitive dynamics in the economy.
- Valuations
  - Finally, valuations are modeled in a similar fashion to margins—meanreverting. Higher valuations are typically not followed with even higher valuations in the future (unless we are reliving the Internet Bubble).

Here is the breakdown of the process:

- Estimate Nominal Revenue Growth as a growing, but volatile time series.
- Estimate Margins as a mean-reverting, but volatile time series.
  - Revenues + Margins -->Generate Earnings
- Estimate Valuations as a mean-reverting, but volatile time series.
- Estimate Payout Ratios—we just use the historical average and assume this stays in place in the future.
  - Earnings + Payout Ratio + Valuation --> Generate total expected return forecasts



## First, an Introduction to some Basic Modeling Techniques

Let's first introduce some basic modeling techniques:

- Random walks
- Mean reverting processes.

## Random Walk:

We model GDP, or revenue growth, such that GDP tomorrow is equal to GDP today, plus an element of normally distributed randomness surrounding a mean expected growth rate.

# GDP(t) = GDP(t-1) + (1+Z(t))

GDP(t-1) is GDP in the previous period. Z(t) is a normally distributed GDP growth shock, with a mean and standard deviation equal to user input (typically historical values or projected estimates).

Example: GDP was \$10 this year. Average GDP growth is 3% and the standard deviation of GDP growth is 4%.

- Generate Random Normal Variable~(3%,4%); say, 4.26% (good year)
- GDP next year will be \$10\*(1+.0426)=\$10.426
- Generate Random Normal Variable~(3%,4%); say, -1.0% (bad year)
- GDP twos years from now will be \$10.426\*(1-.01)=\$10.32174

## Mean Reversion Process:

We model **profit margins** and **valuations** as mean-reverting processes. We use the Ornstein-Uhlenbeck Process.



# $dx = \eta \ (\overline{x} - x) \ dt + \sigma \ dz$

This means that there is a reversion force over the variable x pulling towards an equilibrium level (e.g., long-term average)

The velocity of the reversion process is a parameter in this model

- Velocity of reversion measures, "How fast it gets back to the long-term average?"
- We use a value of .2 in our models gives a half-life of 3.47 years, in other words, a
  observation above the long-term mean can expect to be half-way back to the mean
  within 3.47 years, on average.

## Next, the Step by Step Process

First, let's outline the long-term expected return estimation framework in the graphic below:



The endstate of this process is to build the income statement for the economy:

Alpha Architect | 19 E. Eagle Rd. | Havertown, PA 19083 | T: 215.882.9983 | F: 216.245.3686 https://AlphaArchitect.com/



Income Statement	2013	2014	2015	2016	2017	2018	2019	2020
Revenues	\$ 10.00	\$ 10.27	\$ 11.27	\$ 12.06	\$ 12.58	\$ 13.31	\$ 13.76	\$ 14.40
Revenue Growth (Random Walk Model)		2.66%	9.79%	6.96%	4.36%	5.82%	3.38%	4.62%
Profit Margin % (Mean Reversion Model)	13.35%	12.94%	12.69%	12.21%	12.09%	11.73%	11.90%	11.79%
Net Earnings	\$ 1.34	\$ 1.33	\$ 1.43	\$ 1.47	\$ 1.52	\$ 1.56	\$ 1.64	\$ 1.70
P/E Ratio	18.1x	17.44x	16.79x	16.77x	16.26x	16.35x	15.58x	15.41x
Stock Price	\$ 24.16	\$ 23.17	\$ 24.00	\$ 24.68	\$ 24.74	\$ 25.54	\$ 25.51	\$ 26.15
+Dividends + Net Repurchases (Payout)		\$ 0.56	\$ 0.60	\$ 0.62	\$ 0.64	\$ 0.66	\$ 0.69	\$ 0.72
Stock Price Return		-4.11%	3.61%	2.82%	0.25%	3.22%	-0.10%	2.49%
Total Return (Stock Appreciation + payout)		-1.79%	6.15%	5.29%	2.68%	5.64%	2.30%	4.93%
Total Cumulative Value	\$ 24.16	\$ 23.73	\$ 25.19	\$ 26.52	\$ 27.23	\$ 28.77	\$ 29.43	\$ 30.88
Total Return CAGR	4.84%							

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these results is available upon request.

The income statement above is meant for illustrative purposes only. The starting values for revenues, margins, P/E, and stock price are simply initial values. The future revenue growth, profit margins, and P/E ratios are estimates from a single simulation run of the economy. To generate robust estimates for potential total returns in the future, we could run 1,000 economic simulations.

Let's walk through the process:

## Step 1: Real Revenue Growth:

## Estimating Real Revenue Growth:

- S&P 500 Revenue Growth
  - Approximated by real GDP growth over the long haul
  - Follows a random walk with drift
  - Requires initial value
  - Requires initial GDP Growth Rate





## • Requires estimation of GDP volatility

- The figure above represents a single simulation of future GDP growth (blue line) and a stable GDP growth with no volatility (red line).
- The figure below shows the data that went into this chart.



Nominal GDP Growth																
Parameters	5															
Std Dev (GDP)	2.87%															
Initial Value	10.000															
Exp. Growth Rate	3.00%															
t (years) =	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
v		0.043128 (	0.0371470	.0493760	.0405820	.0205860	036745	0.0316840	0.0173650.	023042	0.005631	0.0266310	0.0104540	0.050709	0.042077	0.009747
5	10.00	10.431281	0.818771	1.352961	1.813691	2.0568812	2.49991	12.89596	13.119913	.42221	13.49779	13.857251	14.00212	14.71214	15.33118	15.48062
E[s]	10.00	10.3	10.6091	0.927271	1.255091	1.592741	1.94052	12.29874	12.667713	04773	13.43916	13.842341	14.25761	14.68534	15.1259	15.57967

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## But how do we figure out which parameters to use in the figures above?

Legions of economists will all have a different answer to this question, but we highlight some empirical observations and thoughts that might help one identify the "correct" parameters to plug into the model.

What has GDP looked like historically?

• The figure below plots historical GDP growth rates for different GDP time series from 1947 to 2012.





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• The figure below plots cumulative nominal GDP growth and real GDP growth from 1947 to 2012.





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One framework for projecting future GDP

- GMO presents a basic tool to estimate potential GDP growth in the future depending on one's assumptions for different parameters.
- We are somewhat agnostic on GDP growth over the next 30 years, but believe GMO underestimates the benefits of cheap energy and technological progress.
  - GMO's Forecast = Thomas Malthus' Forecast = Wrong.



• Regardless, the framework below might be helpful for those pontificating the future.

REAL GDP CALCULATION MODULE												
Real GDP	%	GMO Estimate	Past 30 years	Estimated to 2030	Estimated 2030 to 2050							
Demographic Effects	0.4	Demographic Effects	+1.2	+0.4	0.1 to 0.5							
Hours Worked per Person	-0.2	Hours Worked per Person	-0.2	-0.2	-0.2							
Est.Productivity per Hour - Traditional Accounting	1	Est.Productivity per Hour - Traditional Accounting	+1.3	+1.1	+1.1							
Adjustment for R.Gordon's Four Factors (education/income inequality/globalization/debtoverhang	0.2	Adjustment for R.Gordon's Four Factors (education/income inequality/globalization/debtoverhang	/	+0.2	+0.2							
Adjustment for Reduced Capital Spending	-0.2	Adjustment for Reduced Capital Spending	/	-0.2	/							
Stimulus from Cheap Fracking Gas (and Oil)	0.2	Stimulus from Cheap Fracking Gas (and Oil)	/	+0.2	/							
Adjustment for Rising Resource Costs	0	Adjustment for Rising Resource Costs	+0.1	-0.7 to -0.3	-0.9 to -0.3							
Adjustment for Environmental Damage	-0.1	Adjustment for Environmental Damage	/	-0.1	-0.6 to -0.2							
Total	1.30%	Total	+2.4	0.7 to 1.1	-0.3							
User Defined GDP	3.00%	Source: On the Road to Zero Growth, GMO Nove	mber 2012, Jer	emy Grantham								

Source: ZeroHedge

How about inflation? Also a critical input for estimating nominal GDP, or revenue growth, in the future.

• The figure below plots CPI growth from 1947 to 2012.





- The figure below plots realized and predicted CPI growth from 1947 to 2012.
- Our CPI forecasting method is based on a simple autoregressive framework described <u>here</u>.
  - The chart below suggests that it is fairly accurate at predicting inflation.





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The inputs for revenue growth standard deviation and growth rate into the random walk simulation model mentioned at the beginning of this section, can be difficult, but perhaps the empirical figures above help guide a forecaster in the right direction.



## Step 2: Profit Margins

Once we've identified the economy's top line growth and revenue projections, we need to figure out how much of the revenue the "shareholders" will get to keep. In other words, the margins.

We simulate S&P 500 Profit Margins using the following framework:

- Follows a mean reversion model
- Requires initial value
- Requires profit margin volatility
- Requires mean reversion speed parameter
- Requires long-term profit margin average
- The mean reversion model simulates future profit margins that mean revert to the long-term average, albeit in a random fashion.





- The figure above represents a single simulation of future profit margins (blue line) and average profit margins (red line). Notice that because margins are above trend, they trended down to the average in this simulation, but the ride down was bumpy and unpredictable.
- The figure below shows the data that went into this chart.



Profit Margin Simulation																
Initial Value	13.35%															
Std Dev (PM)	1.74%															
Reversion Speed <b>n</b> (per annum)	0.2000															
H (half-life of x(t), years)	3.47	Half-life is	the time th	iat is expe	cted time	for PM to re	each the h	alfofthe	way toward	the LT Av	rage					
PM Long-Term Average (PMavg)	11.25%															
	0.40400															
Ln(PMavg) =	-2.18480															
Ln(PMavg) =	-2.18480 RAND	0.316817	0.835513	0.236438	0.614651	0.848988	0.824276	0.084159	0.80402	0.747153	0.615727	0.829533	0.066031	0.568673	0.846294	0.517315
Ln(PMavg) = t (years) =	-2.18480 RAND 0	0.316817	0.835513 2	0.236438 3	0.614651 4	10.848988 5	0.824276 6	0.084159 7	0.80402	0.747153 9	0.615727 10	0.829533	0.066031	0.568673	0.846294 14	0.517315 15
Ln(PMavg) = t (years) = N(0, 1) =	-2.18480 RAND 0	0.316817 1 0	0.835513 2 0.30684 (	0.236438 3 0.144543	0.614651 4 -0.7415	0.333384(	0.824276 6 0.279718	0.084159 7 1.92101	0.80402 8 0.219907	0.747153 9 0.01366	0.615727 10 -0.73576	0.829533 11 0.292961	0.066031 12 2.133578	0.568673 13 -0.96511	0.846294 14 0.32861	0.517315 15 -1.14134
Ln(PMavg) = t (years) = N(0, 1) = x(t) =	-2.18480 RAND 0 - -2.013653801	0.316817 1 0 -2.04468	0.835513 2 0.30684 -2.06523	0.236438 3 0.144543 -2.08462	0.614651 4 -0.7415 -2.11449	0.333384 -2.12197	0.824276 6 0.279718 -2.12894	0.084159 7 1.92101 -2.10872	0.80402 8 0.219907 -2.11904	0.747153 9 0.01366 -2.13118	0.615727 10 -0.73576 -2.15252	0.829533 11 0.292961 -2.15374	0.066031 12 2.133578 -2.12587	0.568673 13 -0.96511 -2.15163	0.846294 14 0.32861 -2.15246	0.517315 15 -1.14134 -2.17635
t (years) t (years) N(0, 1) x(t) P(t) =	-2.18480 RAND 0 -2.013653801 13.35%	0.316817 1 0 -2.04468 12.94%	0.835513 2 0.30684 -2.06523 12.68%	0.236438 3 0.144543 -2.08462 12.43%	0.614651 4 -0.7415 -2.11449 12.07%	0.333384 0.333384 -2.12197 11.98%	0.824276 6 0.279718 -2.12894 11.89%	0.084159 7 1.92101 -2.10872 12.13%	0.80402 8 0.219907 -2.11904 12.01%	0.747153 9 0.01366 -2.13118 11.87%	0.815727 10 -0.73576 -2.15252 11.61%	0.829533 11 0.292961 -2.15374 11.60%	0.066031 12 2.133578 -2.12567 11.93%	0.568673 13 -0.96511 -2.15163 11.63%	0.846294 14 0.32861 -2.15246 11.62%	0.517315 15 -1.14134 -2.17635 11.34%

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### But how do we figure out which parameters to use in the figures above?

Everyone has an opinion on profit margins, where they are, and where they are going. Below we present some empirical evidence to give context so one can input the right values into the profit margin simulation exercise highlighted above.

- The figure below plots realized profit margins from 2/28/1990 to 10/31/2012.
- Margins generally follow a random mean-reverting process.





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## Step 3: Earnings

Once we identify revenue and profit margins, calculating the earnings for the economy is straight forward:



<u>S&P 500 Simulated Earnings = Simulated Revenue \* Simulated Profit Margin</u>

- Simulated Revenue = Nominal GDP generated via Random Walk
- Simulated Profit Margin = Profit Margin generated via mean reversion model





• The figure above represents a single simulation of future profit margins (blue line), future revenue growth (red line), and forecasted earnings (derived from simulation of margins and revenue growth using the techniques discussed previously).

## What do earnings look like historically?

Below we present some empirical evidence on historical earnings growth for the market.

- The figure below plots realized EPS growth from 1955 to 2013.



## Step 4: Valuation

With a projected earnings path we can identify how stock prices might move, however, we need one more piece for the puzzle: valuations.

We model valuations using the following framework:

S&P 500 Valuations (E/P)

- Follows a mean reversion model
- Requires initial value
- Requires valuation volatility
- Requires mean reversion speed parameter
- Requires long-term valuation average
- The mean reversion model simulates future valuations that mean revert to the long-term average, albeit in a random fashion.





- The figure above represents a single simulation of future valuations (blue line) and average valuations (red line).
- The figure below shows the inputs for the figure above.



E/P																
Initial Value	5.52%															
Std Dev (E/P)	2.37%															
Reversion Speed <b>n</b> (per annum)	0.2000															
H (half-life of x(t), years)	3.47	Half-life is	the time th	nat is expe	cted time f	or PM to r	each the h	halfofthev	vay toward	the LT A	/erage					
E/P Long-Term Average (E/Pavg)	6.79%															
Ln(E/Pavg) =	-2.68972															
	_		_			_	-	_	_	-						
t (years) =	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
N(0, 1) =	-	0	-0.69026	0.365047	-1.16769	-1.04564	1.039154	-0.99381	0.302602 -	0.97234	0.79155	0.3370511	1.881382	0.77421	-0.51004	2.01664
×(t) =	-2.895911938	-2.85854	-2.84279	-2.80719	-2.81102	-2.81153	-2.76709	-2.77445	-2.75258	-2.7621	-2.76601	-2.74493	-2.69444	-2.71025	-2.7175	-2.66907
P(t) =	5.52%	5.73%	5.82%	6.03%	6.01%	6.01%	6.28%	6.23%	6.37%	6.31%	6.29%	6.42%	6.75%	6.65%	6.60%	6.93%
E/P Long-Term Average																
(E/Pavg)	6.79%	6.79%	6.79%	6.79%	6.79%	6.79%	6.79%	6.79%	6.79%	6.79%	6.79%	6.79%	6.79%	6.79%	6.79%	6.79%

Click to enlarge. The results are hypothetical results and are NOT an indicator of future results and do NOT represent returns that any investor actually attained. Indexes are unmanaged, do not reflect management or trading fees, and one cannot invest directly in an index. Additional information regarding the construction of these results is available upon request.

#### But how do we figure out which parameters to use in the figures above?

Everyone has an opinion on valuations, but what do the data say on the matter?

What have valuations looked like historically?

• The figure below plots realized TTM E/P from 1955 to 2013.





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## Step 5: Long-Term Total Returns

After creating the economy wide balance sheet, calculating the long-term returns for the stock market is a fairly easy exercise.

A recap of the process works:



- Generate simulated earnings path
- Generate simulated valuation path
  - Generate simulated price path
- Estimate payout yield (dividends plus net repurchases)
- Estimate long-term returns
  - (FV/PV)^(1/T)-1
- The figure above represents a single simulation of future total returns (blue line) and price-only returns (red line).





 Processin
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 0.642
 \$
 0.624
 \$
 0.508
 \$
 0.523
 \$
 0.533
 \$
 0.547
 \$
 0.586
 \$
 0.629
 \$
 0.642
 \$
 0.624
 \$
 0.508
 \$
 0.508
 \$
 0.503
 \$
 0.547
 \$
 0.586
 \$
 0.631
 \$
 0.6

The results are hypothetical results and are NOT an indicator of future results and do NOT represent returns that any investor actually attained. Indexes are unmanaged, do not reflect management or trading fees, and one cannot invest directly in an index. Additional information regarding the construction of these results is available upon request.

One element we've introduced above is the payout yield, which is an important component to total returns on the stock market.

- The figure below plots dividend and net repurchases from 1972 to 2012 for S&P 500 firms (excluding financials).
- Div Payout is dividends / net income, Total Payout is dividends + net repurchases
   / net income, Div yield is dividends / market capitalization, and shareholder yield
   is dividends + net repurchases / market capitalization.
- Median Dividend Payout % is 42.26% (total dividends relative to total net income)





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What does the historical total return and price-only return look like historically?

• The figure below plots total returns and price-only returns from 1926 to 2012.





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## 3. Putting it all together

The end state for any long-term return forecaster is to model out the income statement for entire economy.



To do so we need to model revenues, profit margins, and valuations. We also need to make assumptions about the dividend payout ratio and the initial values and parameters for the models we use to simulate future revenues, margins, and valuations.

Income Statement	2013	2014	2015	2016	2017	2018	2019	2020
Revenues	\$ 10.00	\$ 10.27	\$ 11.27	\$ 12.06	\$ 12.58	\$ 13.31	\$ 13.76	\$ 14.40
Revenue Growth (Random Walk Model)		2.66%	9.79%	6.96%	4.36%	5.82%	3.38%	4.62%
Profit Margin % (Mean Reversion Model)	13.35%	12.94%	12.69%	12.21%	12.09%	11.73%	11.90%	11.79%
Net Earnings	\$ 1.34	\$ 1.33	\$ 1.43	\$ 1.47	\$ 1.52	\$ 1.56	\$ 1.64	\$ 1.70
P/E Ratio	18.1x	17.44x	16.79x	16.77x	16.26x	16.35x	15.58x	15.41x
Stock Price	\$ 24.16	\$ 23.17	\$ 24.00	\$ 24.68	\$ 24.74	\$ 25.54	\$ 25.51	\$ 26.15
+Dividends + Net Repurchases (Payout)		\$ 0.56	\$ 0.60	\$ 0.62	\$ 0.64	\$ 0.66	\$ 0.69	\$ 0.72
Stock Price Return		-4.11%	3.61%	2.82%	0.25%	3.22%	-0.10%	2.49%
Total Return (Stock Appreciation + payout)		-1.79%	6.15%	5.29%	2.68%	5.64%	2.30%	4.93%
Total Cumulative Value	\$ 24.16	\$ 23.73	\$ 25.19	\$ 26.52	\$ 27.23	\$ 28.77	\$ 29.43	\$ 30.88
Total Return CAGR	4.84%							

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What are the assumptions we use to plug into this uber fancy model?

We consider two scenarios: Good and Bad.

- "Good" is characterized by inputs that represent historical averages. Mean reversion occurs, but is not very aggressive.
- "Bad" is characterized by inputs that reflect lower growth, lower valuations and margins, and higher volatility. The mean reversion effect is more aggressive. (bad = good +-1%)



Good		Bad	
DESCRIPTION	INPUTS	DESCRIPTION	INPUTS
GDP Inputs		GDP Inputs	
Real GDP Growth	3.24%	Real GDP Growth	2.00%
GDP Std. Dev.	2.87%	GDP Std. Dev.	3.87%
Profit Margin Inputs		Profit Margin Inputs	
Std Dev	1.74%	Std Dev	2.74%
Long-Term Average	11.25%	Long-Term Average	10.25%
Mean-Reversion Half-life	3.47 years	Mean-Reversion Half-life	3.47 years
Valuation Inputs (E/P)		Valuation Inputs (E/P)	
Std Dev	2.37%	Std Dev	3.37%
Long-Term Average	6.79%	Long-Term Average	7.79%
Mean-Reversion Half-life**	3.47 years	Mean-Reversion Half-life**	2.31 years

## Fixed Inputs

DESCRIPTION	INPUTS
Payout Percentage	42.26%
Inflation Growth	3.30%
Current Profit Margin	13.35%
Current PE	18.10
Expected Dividend Yield	2.24%

In the table below we have the summary statistics for the various inputs to give context as to the sanity of our model inputs.

DESCRIPTION					BENCHMARKS						From	То
Real GDP Growth	Average	3.24%	Minimum	-2.80%	5% Percentile	-0.56%	95% Percentile	7.08%	Maximum	8.71%	12/31/1947	12/31/2012
Inflation Growth	Average	3.30%	Minimum	-0.16%	5% Percentile	1.09%	95% Percentile	8.87%	Maximum	9.34%	12/31/1947	12/31/2012
Nominal GDP Growth	Average	6.64%	Minimum	-0.90%	5% Percentile	2.67%	95% Percentile	11.47%	Maximum	15.10%	12/31/1947	12/31/2012
Profit Margin	Average	11.10%	Minimum	6.03%	5% Percentile	6.29%	95% Percentile	13.73%	Maximum	14.59%	12/31/1991	12/31/2013
PE	Average	16.39	Minimum	7.33	5% Percentile	8.24	95% Percentile	26.42	Maximum	29.30	12/31/1954	7/7/2014
Expected Dividend Yield	Average	2.99%	Minimum	1.11%	5% Percentile	1.31%	95% Percentile	5.25%	Maximum	5.41%	12/31/1970	7/7/2014

Click to enlarge. The results are hypothetical results and are NOT an indicator of future results and do

NOT represent returns that any investor actually attained. Indexes are unmanaged, do not reflect management or trading fees, and one cannot invest directly in an index. Additional information regarding the construction of these results is available upon request.



## What Does the Expected Returns Model Spit out?

To generate these figures and the associated statistics below, we run 1,000 simulations of revenue growth, profit margins, and valuations and generate 1,000 possible 10-year total return estimates. We then plot them in the histogram below to show what is possible, given the model inputs outlined above.





The figure above highlights the histogram of possible 10-Year total returns under the "good" and "bad" regimes discussed on the previous slide.

Under "good" conditions one can expect to earn **5.49%** nominal CAGR over the next 10 years. With "bad" conditions, the expected CAGR drops to **3.42%** and the distribution of CAGRs increases.

Simulation Statistics	Mean	Min	five_percent	twentyfive_percent	fifty_percent	seventyfive_perc	entninetyfive_percent	maximum
10-Year Total Return Projection	5.49%	2.64%	4.03%	4.91%	5.50%	6.09%	6.96%	8.36%
Simulation Statistics	Mean	Min	five_percent	twentyfive_percent	fifty_percent	seventyfive_perc	entninetyfive_percent	maximum
10-Year Total Return Projection	3.42%	-0.67%	1.39%	2.63%	3.36%	4.23%	5.45%	6.87%

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## What's the Bottomline?

The summary conclusion from all the models--from the simple to the complex--is roughly the same. The complicated model we've described represents the "black box" sophisticated financial services firms and banks might peddle to the clients to justify ridiculous fees, but the reality is the silly simply Shiller Method will put you in the same ballpark. And the even more humbling reality is all of these models will almost certainly be wrong and generate nearly zero additional prediction ability over the long haul.

Moreover, even though we can build really cool models that "predict" the future, we don't use them at all in our investment process. Why? Same reason we don't deploy highly complex optimization models in our asset allocation systems: the estimation error of these models is INSANE, and the signal/noise ratio is to high. So why bother adding complexity if it doesn't add any value?



How's that for inspiring news on the stock market expected returns prediction front?

Notes:

 Disclaimer: We recommend a realistic perspective on the viability of trying to predict market returns with quantitative models (we've written off the ability of "gut instinct" to forecast the future). The same holds for the complex model we outline below: 99% chance it doesn't work any better than predicting the future based on astrology.