This note gives you a very brief idea about how to think about trade-off between risk and return. We broadly understand what return means. Suppose you are in period $t$. Then for coupon bonds the rate of return between period $t$ and $t+1$ it is given by

$$R_t^e = \frac{C + P_{t+1}^e - P_t}{P_t}$$

where $C$ is the coupon payment that you will receive before you sell the bond at $t+1$. Since at $t$ you do not know what the price will be in $t+1$, all you can do is to smartly (rationally) expect its price which we denote as $P_{t+1}^e$. Therefore, the rate of return is also at this point only expected and not realized. For a stock, the same holds true, and we can rewrite the above equation as

$$R_t^e = \frac{D_{t+1}^e + P_{t+1}^e - P_t}{P_t}$$

where $D_{t+1}^e$ is now the expected dividend payment next period. Note the difference. In case of bonds you know exactly what the coupon payment is. However, for stocks you can only expect.

Now the question is: if two securities say two bonds issued by different companies (or two stocks of different companies) offer the same expected rate of return, how should one choose between the two? The financial economists will differentiate between the two securities by their risks. The one which has a lower risk will be preferred.

But how does one formally measure risk? For our purposes we will look at the standard deviation of returns. We can think of returns as generated by a chance mechanism. Given past data on returns, one will be able to calculate both the expected return and standard deviation by using some simple statistics (101?). Let me illustrate this point through an example. Consider two stocks: Boeing and WalMart. Suppose by looking at the past data you have come to the following conclusion

<table>
<thead>
<tr>
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<th>Return (%)</th>
<th>Probability</th>
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<tbody>
<tr>
<td>WalMart</td>
<td>10 6 4 2</td>
<td>0.25 0.25 0.2 0.3</td>
</tr>
<tr>
<td>Boeing</td>
<td>12 4 1</td>
<td>0.25 0.55 0.2</td>
</tr>
</tbody>
</table>

The above table simply states that 25% of the time WalMart stock’s past returns has been 10%, 25% of the time 6%, 20% of the time 4%, and 30% of the time 2%. The same interpretation holds for Boeing’s stock (only three possibilities though). Now first step is to calculate their respective expected returns. The expected value is simply the sum of returns multiplied by their corresponding probabilities. Thus for WalMart

$$R_{tWM}^e = 10 \times 0.25 + 6 \times 0.25 + 4 \times 0.2 + 2 \times 0.3 = 5.4$$

Similarly, the expected return on Boeing’s stock can be calculated as

$$R_{tB}^e = 12 \times 0.25 + 4 \times 0.55 + 1 \times 0.2 = 5.4$$
Thus, both stocks have same expected return of 5.4%. Of course, the example has been constructed such that both returns turn out to be equal. How about risk? We need to calculate standard deviations of these returns. Let’s first calculate the variance, which is square of the standard deviation. The variance is calculated by taking the difference of each possible return from the expected return, then squaring the difference, then multiplying by their probability, and finally summing all of them together. Thus, for WalMart

\[
Variance\left(R_{WM}\right) = 0.25 \times (10 - 5.4)^2 + 0.25 \times (6 - 5.4)^2 + 0.2 \times (4 - 5.4)^2 + 0.3 \times (2 - 5.4)^2 = 9.24
\]

Then simply take the square root to obtain standard deviation

\[
Std.Dev\left(R_{WM}\right) = \sqrt{9.24} = 3.04
\]

Similarly for Boeing

\[
Variance\left(R_{WM}\right) = 0.25 \times (12 - 5.4)^2 + 0.55 \times (4 - 5.4)^2 + 0.2 \times (1 - 5.4)^2 = 15.84
\]

Its standard deviation is

\[
Std.Dev\left(R_{B}\right) = \sqrt{15.84} = 3.98
\]

Conclusion: Both stocks have the same expected rate of return but Boeing has more risk because it has a higher standard deviation. I will prefer WalMart.