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THE SCIENCE BEHIND THE NUMBERS: PART 4 – DIVERSIFICATION & THE RANDOMNESS OF RETURNS

At the Hummel Financial Group it is our responsibility to provide clients with the greatest probability of long term investment success. In this article we look at the research supporting why financial diversification helps individual investors and how diversification works. We will simplify the mathematical theory that proves why diversification is so important to the health of your overall investment portfolio.

Sir John Templeton – *"Diversify. In stocks and bonds, as in much else, there is safety in numbers."*

What is Financial Diversification:

Diversification is the process of putting your money into a range of different types of investments in order to reduce risk. While this is intuitive to most investors, it is easy to be tempted by the latest trends and overlook the discipline required to stay diversified.

How our Model Works to Maintain Proper Diversification:

We focus on constructing strong investment portfolios that promote diversification by asset type, geographical location, and size. We maintain this diversified asset allocation within our portfolios via regular rebalancing.

Maintaining a properly diversified portfolio can be very difficult. It is emotionally challenging to sell your winning companies/asset classes to buy into recently underperforming companies or asset classes. Additionally it can be uncomfortable to invest in asset classes or countries that you are unfamiliar with. Unfortunately, failing to trust the principles of diversification can leave an investor's portfolio overly exposed to losses. If a portfolio's undiversified positions happen to be in stocks that drop in value (Nortel, General Electric, Bre-X Minerals, to name a few), the effects on the portfolio are magnified.

Thus by constructing our portfolios with strict limits on individual position size, our portfolios mitigate asset concentration risk. This meaningfully limits our portfolios against the effects of a sudden drop in value of a particular asset within the portfolio.

Proper diversification is known as the one "free lunch" in investing, and can significantly enhance the probability of perpetual investment gains. We use diversification in our portfolios to mitigate volatility while maintaining heightened expected returns, giving our clients' portfolios the greatest probability of long term investment success.

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FUNCTION 1: RANDOMNESS OF RETURNS

Stocks and bonds can be sliced into numerous different categorizations; geographically, asset type, sector based, etc. No matter how you categorize the data, there is a repeated randomness in returns which are impossible to forecast.

In Exhibit 1 you will see the equity returns of developed markets for the past twenty years. As you can see there is a general randomness in where each country ranks year over year. There is no persistence of any one country to outperform or underperform its peers. Therefore by only investing in a few countries, you are exposing your investment portfolio to a broader range of return outcomes.

Exhibit 1: Equity Returns of Developed Markets – Annual Return (%)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Highest Return	Finland 137.9	Finland 138.7	Switz. 9.5	NZ 15.2	NZ 23.0	Sweden 34.6	Austria 59.0	Canada 25.1	Spain 48.8	Finland 26.1	Japan -11.5	Norway 58.9	Sweden 26.8	Ireland 16.5	Belgium 36.5	Finland 55.8	US 22.8	Denmark 48.0	Canada 20.3	Austria 47.9
	Belgium 80.1	Singapore 88.4	Canada 9.0	Australia 8.1	Austria 15.3	Germany 34.0	Norway 42.1	Japan 22.4	Portugal 46.8	HK 19.8	Switz. -13.1	Australia 49.8	Denmark 23.9	NZ 8.2	Denmark 28.4	Ireland 50.6	NZ 17.0	Ireland 39.7	NZ 14.3	HK 27.2
	Italy 63.7	Sweden 69.8	Denmark 7.1	Ireland 3.3	Australia -2.4	Spain 29.6	Belgium 33.1	Austria 21.5	Ireland 46.3	Germany 14.7	US -21.9	Singapore 47.7	HK 16.8	US 3.9	Singapore 28.1	US 40.6	Denmark 15.7	Belgium 34.4	Norway 9.4	Singapore 26.7
	Spain 60.9	Japan 52.6	Norway 2.6	Austria 0.3	Norway -8.2	Austria 28.4	Ireland 32.7	Denmark 21.4	Singapore 46.1	Norway 11.5	Spain -25.7	Sweden 39.4	Singapore 15.8	UK -0.1	Germany 28.0	Germany 40.2	HK 14.5	Japan 31.4	Australia 7.6	Denmark 25.8
	France 51.9	HK 50.7	Italy 2.1	Belgium -5.3	Italy -8.3	NZ 27.1	Sweden 26.4	Norway 21.1	Norway 44.6	Canada 9.9	France -29.0	HK 36.0	Canada 14.2	Switz. -4.5	NZ 26.4	Spain 40.1	Belgium 13.5	Austria 24.1	Austria 7.4	Nether. 23.5
	Ireland 45.3	Canada 45.3	Nether. -0.7	Spain -5.8	Japan -11.2	Canada 26.5	NZ 25.3	Finland 13.8	Sweden 42.8	Singapore 8.9	Canada -31.8	Belgium 33.7	Japan 9.4	Norway -7.8	HK 25.4	Nether. 40.1	Singapore 12.3	Italy 22.7	US 7.1	France 20.3
	US 39.7	Norway 24.4	France -1.0	Norway -6.7	Switz. -11.2	Australia 22.3	Italy 22.8	Switz. 13.4	Denmark 38.2	Australia 8.8	Germany -32.3	Canada 32.6	US 8.8	Belgium -8.4	Austria 23.1	Belgium 36.2	Ireland 11.5	Finland 22.3	France 1.3	Italy 20.0
	Germany 38.9	France 22.1	Australia -6.8	US -6.9	Singapore -12.0	Denmark 22.1	Denmark 21.3	Australia 13.1	Belgium 36.1	Denmark 6.5	Singapore -34.1	NZ 27.7	Australia 8.5	Australia -8.8	Australia 19.4	Japan 35.7	Canada 10.7	Nether. 21.5	Nether. 1.2	Norway 19.8
	Portugal 36.8	US 15.2	Portugal -7.2	UK -8.7	Canada -14.1	Norway 21.2	Australia 20.8	Singapore 11.5	Austria 36.0	Portugal 5.2	Denmark -34.4	Spain 21.8	Switz. 6.0	Nether. -9.9	Sweden 19.3	Switz. 35.1	Switz. 8.9	Portugal 21.0	Portugal 0.0	Germany 19.3
	Switz. 32.6	Germany 13.4	UK -8.4	Denmark -9.5	Portugal -14.7	Ireland 17.7	Spain 19.5	Nether. 11.0	Germany 35.5	Spain 5.1	Nether. -35.2	UK 21.7	Norway 5.2	Spain -10.1	France 18.6	France 34.8	Finland 8.2	US 20.8	Germany -0.8	Spain 18.7
	Nether. 32.3	Australia 11.1	Austria -8.9	HK -13.5	Belgium -15.8	Portugal 17.0	HK 15.9	Sweden 7.5	France 34.0	Nether. 2.3	UK -35.4	Austria 21.6	Finland 4.5	Canada -10.6	Nether. 17.9	Denmark 33.7	Australia 5.3	Switz. 20.5	Japan -1.2	Japan 15.8
	UK 26.4	NZ 6.7	Ireland -9.7	Canada -15.4	UK -16.1	France 14.7	Portugal 15.6	Germany 7.2	Italy 32.0	France -4.0	Sweden -37.3	Nether. 20.8	Austria 4.1	Japan -12.2	Switz. 17.7	Sweden 32.9	Nether. 5.2	France 19.8	HK -1.3	Portugal 15.7
	Sweden 22.3	UK 6.2	US -9.8	Switz. -16.4	Spain -16.2	HK 13.0	Singapore 13.4	France 7.1	Nether. 30.9	NZ -7.6	Italy -37.4	Portugal 19.2	UK 3.1	Sweden -13.9	Norway 16.0	UK 28.8	Japan 4.6	HK 19.3	Singapore -2.1	Switz. 14.5
	Denmark 17.0	Denmark 5.9	Finland -11.2	Portugal -17.1	Denmark -16.9	Italy 12.7	Canada 13.3	Belgium 6.3	Australia 30.4	UK -8.1	Australia -38.3	Denmark 16.0	Germany 2.8	Denmark -13.9	US 12.8	Italy 28.5	Spain 3.9	Germany 17.7	Sweden -2.9	Finland 14.4
	Australia 13.8	Nether. 1.0	HK -11.8	Nether. -17.2	HK -18.6	Singapore 12.6	UK 10.9	HK 5.7	UK 30.1	Italy -10.1	HK -39.0	France 12.0	NZ 2.7	HK -13.9	UK 12.7	Austria 21.0	UK 3.1	Sweden 13.9	UK -3.6	UK 14.3
	Japan 12.8	Spain -0.9	Germany -12.6	France -17.5	Nether. -21.6	Japan 11.2	France 9.9	UK 4.7	HK 29.9	US -10.6	Portugal -40.2	Italy 7.5	Nether. -3.6	France -14.8	Finland 12.0	NZ 18.7	Sweden 0.8	NZ 12.4	Spain -4.4	US 13.2
	Austria 7.7	Italy -5.8	Spain -12.9	Germany -17.5	France -22.0	Belgium 10.7	Germany 7.7	US 2.5	Finland 29.4	Switz. -10.7	NZ -42.2	US 7.2	Belgium -5.6	Singapore -15.9	Italy 10.0	HK 18.5	Italy -1.4	UK 10.9	Finland -8.0	Sweden 12.7
	HK 4.2	Switz. -12.1	Belgium -13.9	Singapore -18.6	US -23.9	Switz. 9.7	Japan 7.4	Spain 1.8	Switz. 26.9	Austria -13.3	Finland -43.9	Switz. 6.4	France -9.1	Germany -16.1	Canada 6.7	Portugal 18.4	France -1.8	Australia 8.0	Switz. -8.2	Australia 12.1
	Canada 0.7	Portugal -13.9	Sweden -18.5	Italy -22.0	Ireland -27.0	UK 8.0	Switz. 6.6	Italy -0.7	Canada 17.4	Sweden -14.7	Norway -55.3	Germany 6.3	Portugal -15.9	Portugal -21.1	Japan 5.8	Norway 16.7	Germany -2.3	Norway 2.0	Ireland -10.3	Belgium 10.8
	Singapore -6.5	Austria -14.1	Singapore -25.2	Sweden -22.6	Finland -31.0	US 5.0	Nether. 4.1	NZ -0.8	NZ 16.1	Belgium -17.5	Belgium -58.1	Ireland -4.7	Italy -19.4	Italy -21.3	Ireland 3.4	Canada 12.7	Norway -15.0	Spain 1.2	Belgium -10.8	Ireland 10.4
	NZ -16.9	Ireland -17.5	Japan -25.7	Japan -25.0	Sweden -31.2	Nether. 4.8	US 2.1	Portugal -4.3	US 14.2	Japan -18.8	Austria -60.5	Finland -5.6	Ireland -22.4	Finland -30.2	Portugal 1.2	Australia 11.2	Austria -23.4	Singapore -1.3	Italy -13.6	Canada 8.4
Lowest Return	Norway -24.9	Belgium -19.0	NZ -31.2	Finland -34.3	Germany -33.9	Finland -2.3	Finland -1.6	Ireland -4.7	Japan 5.8	Ireland -32.2	Ireland -64.9	Japan -9.8	Spain -26.0	Austria -34.9	Spain 0.7	Singapore 8.5	Portugal -32.7	Canada -9.0	Denmark -18.7	NZ 4.4

Source 2: Dimensional fund Advisors LP. (2018). Matrix Book 2018 – Historical Returns Data Canadian Dollars

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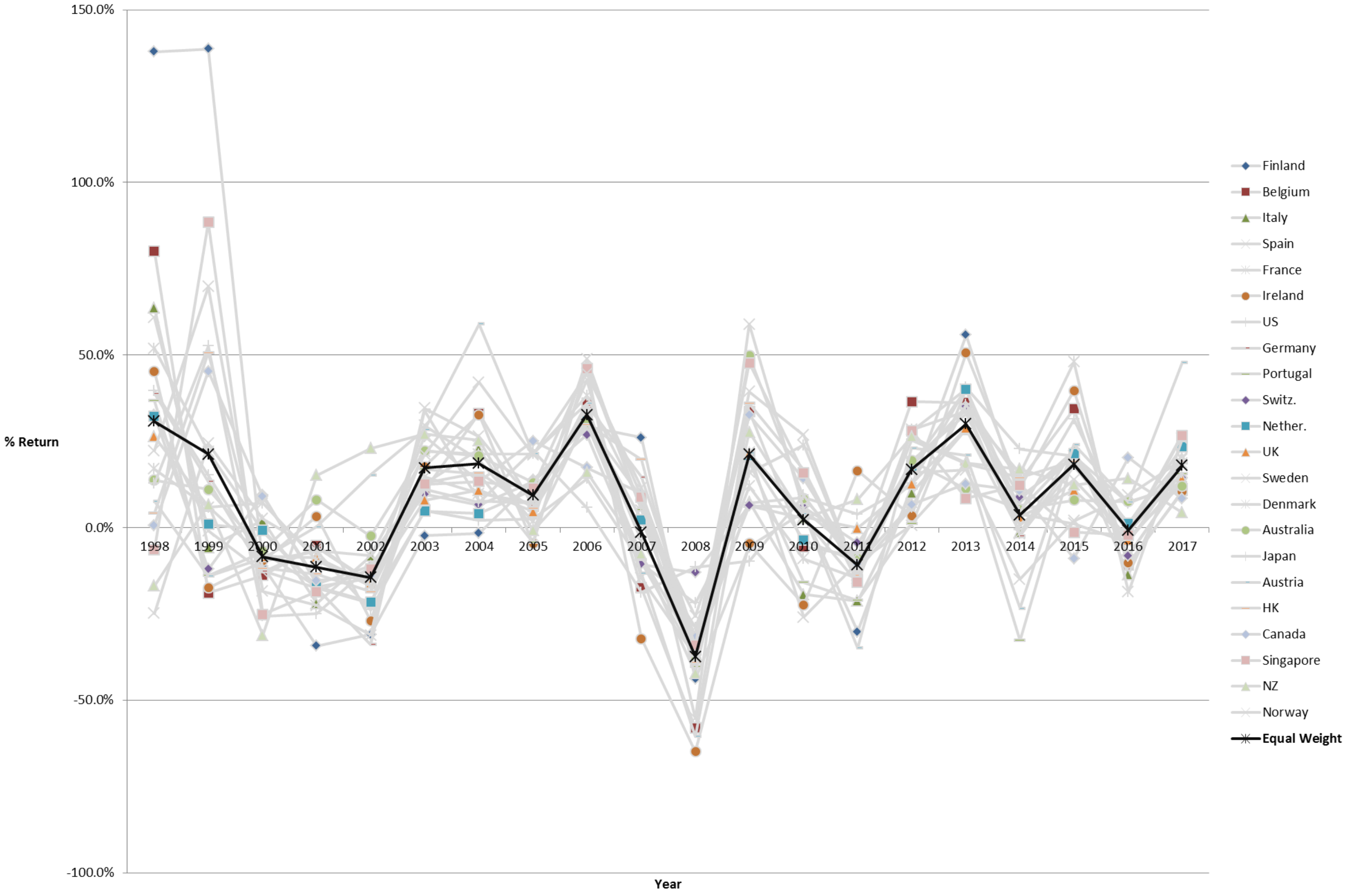
FUNCTION 1: RANDOMNESS OF RETURNS - CONTINUED

This wider range of return outcomes, compared to the diversified portfolio, can be seen below in Exhibit 2. The grey lines represent the annual returns of each individual country, and the black line is the annual returns of the equal-weighted diversified portfolio. As you can see, the diversified portfolio's range of annual returns operates within a much narrower band. In mathematical terms this means the diversified portfolio's standard deviation is lower, which is a measure of the riskiness of the investment. The narrower the range, the smoother the investment experience.

Exhibit 2: Equity Returns of Developed Markets – Annual Return (%)



Dimensional fund Advisors LP. (2018). Matrix Book 2018 – Historical Returns Data Canadian Dollars

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FUNCTION 2: RISK MINIMIZATION

Thanks to Nobel Laureate Harry Markowitz's ground breaking paper "Portfolio Selection," published in 1952, we can now mathematically prove the usefulness of diversification. His research revealed that by constructing a portfolio of investments that are not perfectly positively correlated (i.e. they behave differently from one another), an investor can decrease their portfolio's variability without forfeiting any expected return. In other words, a properly diversified investor can receive the benefit of more consistent year over year returns without losing overall performance.

Exhibit 3: 20-Year Return, Standard Deviation, and Sharpe Ratio of Developed Countries

Rank:	Country:	Return:	Standard Deviation:	Sharpe Ratio:
1	Denmark	9.8%	21.2%	0.46
2	Australia	8.3%	17.1%	0.48
3	HK	7.8%	21.3%	0.36
4	Canada	7.1%	18.2%	0.39
5	Singapore	7.0%	28.3%	0.25
6	Finland	6.9%	48.6%	0.14
7	Sweden	6.9%	27.8%	0.25
8	Equal Weight	6.2%	18.1%	0.34
9	US	5.8%	17.0%	0.34
10	Norway	5.5%	25.6%	0.22
11	Switz.	5.5%	15.5%	0.36
12	France	5.5%	20.6%	0.26
13	NZ	5.3%	19.2%	0.28
14	Spain	5.2%	23.6%	0.22
15	Germany	5.2%	22.2%	0.23
16	Nether.	4.7%	19.0%	0.25
17	Belgium	4.5%	30.3%	0.15
18	UK	3.8%	16.0%	0.23
19	Austria	3.7%	28.4%	0.13
20	Japan	3.1%	20.5%	0.15
21	Italy	1.7%	23.4%	0.07
22	Ireland	-0.7%	29.8%	(0.02)
23	Portugal	-1.0%	22.5%	(0.04)

Dimensional fund Advisors LP. (2018). Matrix Book 2018 - Historical Returns Data Canadian Dollars

In Exhibit 3 we see the 20 year Return, Standard Deviation, and Sharpe ratio of these 22 developed countries and the equal weight diversified portfolio.

(The Sharpe ratio formula equals the return of the portfolio divided by the standard deviation of the portfolio. The Sharpe ratio is a measure of an investment's overall risk and return characteristics. The higher the Sharpe ratio, the higher return you are earning per unit of risk you take. Thus, the higher the Sharpe ratio the better.)

- 32% (*7 out of 22*) of countries have returns above that of the diversified portfolio. 68% are below.
- 18% (*4 out of 22*) of countries have standard deviations below that of the diversified portfolio. 82% are above.
- 23% (*5 of the 22*) countries have a Sharpe ratio higher than the diversified portfolio; Denmark, Australia, Hong Kong, Canada, and Switzerland.

<u>Conclusions:</u>

When investing for the future, because you do not know which investments will outperform, a diversified portfolio gives you the greatest odds of earning a high investment return while significantly decreasing the risk of the portfolio.

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FUNCTION 2: RISK MINIMIZATION

When assets are broken up by type instead of geographically, the same principles of diversification theory prevail. You do not know which market segments will outperform from year to year, but by holding a globally diversified portfolio of numerous asset types, investors will be positioned to seek returns wherever they occur. A diversified portfolio minimizes the randomness of any one asset class and keeps annual returns in a narrower performance band. This is seen below in Exhibit 4. The orange boxes that represent the diversified portfolio stay near the middle of the performance band.

Exhibit 4: U.S. Asset Type Returns – Annual Return (%)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Best	Lg cap growth 38.7%	Lg cap growth 33.2%	Fixed income 11.6%	Fixed income 8.4%	Fixed income 10.3%	Sm cap 47.3%	Int'l 20.3%	Int'l 13.5%	Int'l 26.3%	Lg cap growth 11.8%
	Lg cap core 28.6%	Int'l 27.0%	Lg cap value 7.0%	Cash 4.4%	Cash 1.8%	Int'l 38.6%	Sm cap 18.3%	Lg cap value 7.1%	Lg cap value 22.3%	Int'l 11.2%
	Int'l 20.0%	Sm cap 21.3%	Cash 6.2%	Sm cap 2.5%	Div portfolio -9.8%	Lg cap value 30.0%	Lg cap value 16.5%	Div portfolio 5.4%	Sm cap 18.4%	Fixed income 7.0%
	Div portfolio 17.0%	Lg cap core 21.0%	Div portfolio -1.1%	Div portfolio -4.8%	Lg cap value -15.5%	Lg cap growth 29.8%	Lg cap core 10.9%	Lg cap growth 5.3%	Lg cap core 15.8%	Div portfolio 6.0%
	Lg cap value 15.6%	Div portfolio 13.6%	Sm cap -3.0%	Lg cap value -5.6%	Int'l -15.9%	Lg cap core 28.7%	Div portfolio 10.5%	Lg cap core 4.9%	Div portfolio 13.0%	Lg cap core 5.5%
	Fixed income 8.7%	Lg cap value 7.4%	Lg cap core -9.1%	Lg cap core -11.9%	Sm cap -20.5%	Div portfolio 23.5%	Lg cap growth 6.3%	Sm cap 4.6%	Lg cap growth 9.1%	Cash 5.0%
	Cash 5.2%	Cash 4.9%	Int'l -14.2%	Lg cap growth -20.4%	Lg cap core -22.1%	Fixed income 4.1%	Fixed income 4.3%	Cash 3.1%	Cash 4.9%	Lg cap value -0.2%
Worst	Sm cap -2.6%	Fixed income -0.8%	Lg cap growth -22.4%	Int'l -21.4%	Lg cap growth -27.9%	Cash 1.2%	Cash 1.3%	Fixed income 2.4%	Fixed income 4.3%	Sm cap -1.6%

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Best	Fixed income 5.2%	Lg cap growth 37.2%	Sm cap 26.9%	Fixed income 7.8%	Lg cap value 17.5%	Sm cap 38.8%	Lg cap core 13.7%	Lg cap growth 5.7%	Sm cap 21.3%	Lg cap growth 30.2%
	Cash 2.1%	Int'l 31.8%	Lg cap growth 16.7%	Lg cap growth 2.6%	Int'l 17.3%	Lg cap growth 33.5%	Lg cap value 13.5%	Lg cap core 1.4%	Lg cap value 17.3%	Int'l 25.0%
	Div portfolio -22.8%	Sm cap 27.2%	Lg cap value 15.5%	Lg cap core 2.1%	Sm cap 16.4%	Lg cap value 32.5%	Lg cap growth 13.1%	Fixed income 0.6%	Lg cap core 12.0%	Lg cap core 21.8%
	Sm cap -33.8%	Lg cap core 26.5%	Lg cap core 15.1%	Div portfolio 1.8%	Lg cap core 16.0%	Lg cap core 32.4%	Div portfolio 8.1%	Div portfolio 0.1%	Div portfolio 8.7%	Div portfolio 15.1%
	Lg cap value -36.9%	Div portfolio 20.8%	Div portfolio 13.0%	Lg cap value 0.4%	Lg cap growth 15.3%	Int'l 22.8%	Fixed income 6.0%	Cash 0.0%	Lg cap growth 7.1%	Sm cap 14.7%
	Lg cap core -37.0%	Lg cap value 19.7%	Int'l 7.8%	Cash 0.1%	Div portfolio 12.2%	Div portfolio 20.3%	Sm cap 4.9%	Int'l -0.8%	Fixed income 2.7%	Lg cap value 13.7%
	Lg cap growth -38.4%	Fixed income 5.9%	Fixed income 6.5%	Sm cap -4.2%	Fixed income 4.2%	Cash 0.1%	Cash 0.0%	Lg cap value -3.8%	Int'l 1.0%	Fixed income 3.5%
Worst	Int'l -43.4%	Cash 0.2%	Cash 0.1%	Int'l -12.1%	Cash 0.1%	Fixed income -2.0%	Int'l -4.9%	Sm cap -4.4%	Cash 0.3%	Cash 0.9%

Source: Informa Investment Solutions. Past performance is no guarantee of future results. The information provided is for illustrative purposes and is not meant to represent the performance of any particular investment. Assumes reinvestment of all distributions. It is not possible to directly invest in an index. Diversification does not guarantee a profit or protect against loss.

- **Cash** is represented by the ICE BofA ML 3-month Treasury Bill Index, an unmanaged index based on the value of a 3-month Treasury Bill assumed to be purchased at the beginning of the month and rolled into another single issue at the end of the month. U.S. Treasury securities are direct obligations of the U.S. government and are backed by the "full faith and credit" of the U.S. government if held to maturity.
- **Diversified portfolio** is composed of 35% of the BBG Barclays U.S. Aggregate Bond Index, 10% of the MSCI EAFE Index, 10% of the Russell 2000 Index, 22.5% of the Russell 1000 Growth Index and 22.5% of the Russell 1000 Value Index.
- **Fixed income** is represented by the BBG Barclays U.S. Aggregate Bond Index, an unmanaged market-weighted index that consists of investment grade corporate bonds (rated BBB or better), mortgages and U.S. Treasury and government agency issues with at least one year to maturity.
- **International** is represented by the Morgan Stanley Capital International (MSCI) EAFE Index, an unmanaged index that measures the total returns of developed foreign stock markets in Europe, Asia and the Far East.
- **Large cap core** is represented by the S&P 500 Index, an unmanaged index that consists of the common stocks of 500 large capitalization companies, within various industrial sectors, most of which are listed on the New York Stock Exchange.
- **Large cap growth** is represented by the Russell 1000 Growth Index, which consists of those Russell 1000 Index securities with higher price-to-book ratios and higher forecasted growth rates.
- **Large cap value** is represented by the Russell 1000 Value Index, which consists of those Russell 1000 Index securities with lower price-to-book ratios and lower forecasted growth rates.
- **Small cap** is represented by the Russell 2000 Index, which is a market-weighted small capitalization index composed of the smaller 2,000 stocks, ranked by market capitalization, of the Russell 3000 Index.

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FUNCTION 2: RISK MINIMIZATION

As time passes some assets will do better than others, but because one does not know in advance which assets will perform better, this fact cannot be exploited. Therefore we must use expected returns when building an investment strategy. These expected returns are shaped by the market, and are based on the asset's future cash flows and risks related to that asset. For example, a stock is expected to earn a higher return on investment than a bond, but the stock's return is more risky (less certain) than the bond's.

In summary, diversification has three core benefits:

- Diversification narrows the range of possible return outcomes.
- It increases the likelihood of generating strong annual positive returns. It does this because investments don't always perform as expected, and by diversifying you do not rely on a single source for investment return.
- Diversification minimizes the risk of an investment portfolio, thus protecting your savings.

What the Numbers Tell Us, and our Resulting Strategy…

We base our investment strategy on empirical market research and the data tells us this:

- Diversification decreases risk within the portfolio while maintaining overall return performance.
- Diversification promotes long term thinking via continual maintenance of an asset allocation that is properly diversified by asset type, geographical location, and size. Remaining focused on proper diversification aligns expected return and risk characteristics with the investment strategy, instead of focusing on short term trendy asset classes.

At the Hummel Financial Group we manage our portfolio's by staying intensely focused on our clients' long term investment goals. We build strong investment portfolios in the construction phase that promote diversification by asset type, geographical location, and size, and then we stick to this asset allocation via regular rebalancing. This ensures we do not fall into a trap of short term, emotionally driven decision making, thus giving our clients the greatest odds of long term investment success.

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3) Blackrock. (2018). Retrieved from Blackrock Investor Education. (https://www.blackrock.com/investing/literature/investor-education/asset-class-returns-one-pager-va-us.pdf)

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- Brad Hummel is an Investment Advisor with CIBC Wood Gundy in Edmonton. The views of Brad Hummel do not necessarily reflect those of CIBC World Markets Inc.

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