



Rethinking Asset Allocation

Why Innovation Deserves A Strategic
Allocation In Investor Portfolios

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Introduction

In the current yield-starved environment, ARK believes it is important for investors and allocators to find new pockets of opportunity for their customized portfolios. Growth-oriented investors with long-term time horizons often find it difficult to balance between growth and volatility. When faced with economic, geopolitical, and technological uncertainty, however, they often adopt creative strategies after transitioning through periods of skepticism, research, and acceptance. Emerging market allocations serve as an important example of such a transition. While “out of the box” or “non-traditional” investment strategies may seem to demand “high conviction” at first blush, they can evolve into viable and important sources of return.

In this paper, ARK identifies problems associated with traditional “style boxes” in both asset allocation and portfolio management. Similar to that for emerging markets, we then detail why innovation deserves a strategic allocation in global equity portfolios.



You might also like our White Paper

Disruptive Innovation: Why Now?

ARK identifies five transformative innovation platforms that approach tipping points as costs drop, potentially unleashing demand across sectors.

The Risks of Under-Allocation

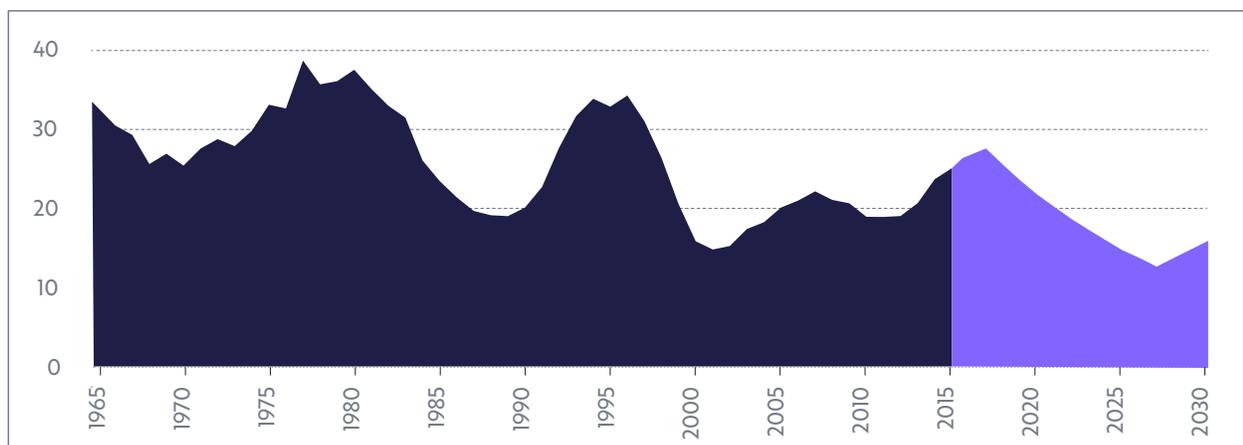
ARK believes that asset allocators do not have enough exposure to innovation in the public equity markets. We estimate that disruptive innovation will add \$50 trillion to global equity market capitalizations by 2032.¹ Today, these technologies account for less than \$6 trillion, suggesting that they will deliver a 21% compound annual rate of return during the next 12 years. As technologies emerge and transform entire industries, investors in traditional benchmarks may face more risk than historically has been the case. In the 52 years from 1964 to 2016, the average lifespan of a stock in the S&P 500 dropped roughly 25%, from 33 years to 24, according to Innosight. By 2027, as shown in Figure 1, it is likely to drop another 50% to 12 years² as transformational technologies disrupt broad-based equity indices, impairing the “old guard”. In other words, we believe in little more than a decade the S&P 500 is unlikely to be even a shadow of itself today.

¹ Winton, Brett. “Disruptive Innovation: Why Now?” White Paper by ARK Invest, ARK Invest, research.ark-invest.com/innovation-why-now.

² “Corporate Longevity Forecast: Creative Destruction Is Accelerating.” Innosight, www.innosight.com/insight/creative-destruction/.



Figure 1: Average Company Lifespan Of S&P 500 Index
(Years, Rolling 7-year average)



*Forecasts are inherently limited and cannot be relied upon.
Source: Innosight, 2018; "2018 Corporate Longvity Forecast: Creative Destruction is Accelerating"*

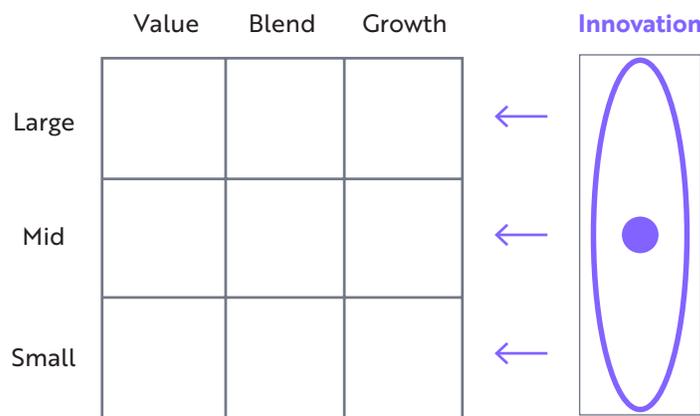
In our view, the turnover of stocks in the S&P 500 is accelerating because innovation is disrupting or disintermediating the traditional world order at an accelerated rate, creating value traps – stocks that are “cheap” for a reason. Stocks in industries particularly at risk - big pharma, banks and other financial services, fossil fuel-based energy, auto and auto-related manufacturers, telecommunications, transportation, retail - dominate broad-based indices today. In fact, their market capitalization weighted index structure may be exacerbating the risk, reflecting success stories from the past, not the future. We believe technological disruption will cause both value destruction and value creation during the next decade, making it imperative that investors seek to position portfolios on the right side of change.

At the portfolio level, disruptive innovation should be particularly frustrating, if not unnerving, for investors committed to style boxes. Rapid change can create winners and losers, perhaps slower than expected at first, and then blazingly fast. As new technologies enter parabolic trajectories, large cap companies can lose market share at alarming rates, suggesting that traditional style-box and benchmark-sensitive strategies should find hedges against such disruption. For example, fintech companies seem to have evolved much faster than expected and already are competing successfully against large financial institutions. Relative to bricks and mortar banks saddled with infrastructure, “digital wallet” providers can acquire customers at a fraction of the cost thanks to the convergence between and among three technologies: cloud computing, mobile devices, and artificial intelligence. As a result, they have more digital users in the US today than the largest banks. Yet rarely, if at all, are digital wallet providers weighted more heavily than banks in value or growth portfolios today. ARK believes that well-structured core portfolios should include not only hedges against disruptive innovation but also exposure to the record-breaking number of exponential growth opportunities that we believe it is creating. Therefore innovation should



deserve a more strategic allocation in global equity portfolios. Given market capitalization biases, multi-quarter profitability requirements, and one-year stock listing minimums, traditional index methodologies can sometimes disqualify the stocks of innovative companies that are sacrificing short-term earnings and investing aggressively to capitalize on exponential growth opportunities. In our view, investors should evolve their traditional “style box” investment strategies to capture innovation and capitalize on the multi-trillion dollar opportunity it creates. Because technology is permeating every sector of the global economy, innovation cannot be boxed into sectors, geographies, or market caps. Traditional market capitalization and style-focused equity strategies are centered around benchmarks and indices which are backward-looking and do not adjust rapidly to change. As a result, equity strategies built on past success may miss the growth that innovation is brewing for the future.

Figure 2: Innovation: A “New” Style Box



Source: ARK Investment Management LLC, 2020

Strategic Allocation To Innovation: A Comparison to Emerging Markets

We believe a strategic allocation to innovation probably will evolve into a sub-asset class, as did the “niche” strategy of the 1980s—emerging markets. In the late 1980s and early 1990s, investors had little, if any, exposure to what has evolved into 13% of the global equity market capitalization³ and 60% of global gross domestic product (GDP) on a purchasing power parity basis.⁴ In 1981, while proposing a global public equity fund for developing countries, Antoine van Agtmael of the International Finance Corporation (IFC) coined the term “emerging markets”. The IFC began tracking total return data for ten developing markets and discovered “attractive results...making a good case for increased investment.”⁵

3 Chen, James. “What Is the MSCI Emerging Markets Index?” Investopedia, Investopedia, 25 Mar. 2020, www.investopedia.com/terms/e/emergingmarketsindex.asp.

4 International Monetary Fund, 2019; “World Economic Outlook (October 2019)”, <https://www.imf.org/external/datamapper/PPPSH@WEO/OEMDC/ADVEC/WEOWORLD>.

5 International Finance Corporation, 2019; “IFC: The First Six Decades”, https://www.ifc.org/wps/wcm/connect/corp_ext_content/ifc_external_corporate_site/about+ifc_new/ifc+history/establishing-emerging-markets.

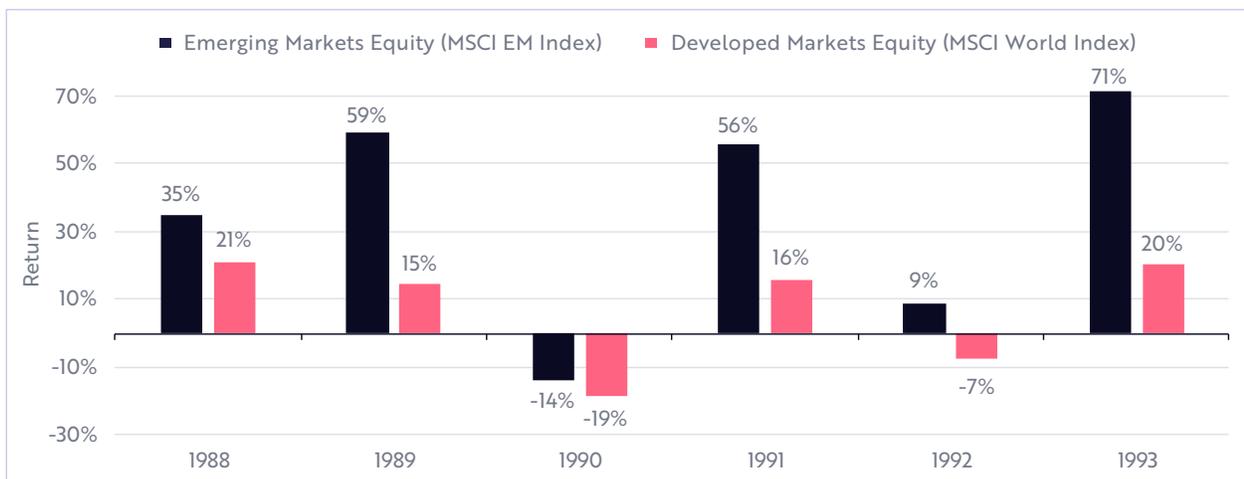


Initially, many investors resisted exposure to developing markets based on the volatility associated with geopolitical uncertainties, corporate governance, and liquidity. With time, however, they observed low correlations between and among the stock returns of the various developing nations, as well as growth rates that far surpassed those in the developed world. Investors concluded that broad-based exposure to developing markets offered enough diversification to minimize idiosyncratic risks and lower volatility, resulting in higher risk-adjusted return.

Launched in 1988, the MSCI Emerging Markets Index marked the beginning of a new investable sub-asset class for public equity portfolios. The index included only ten developing nations but enabled allocators to track the local equity markets of rapidly growing emerging nations.⁶

During the late eighties and early nineties, allocators that made a strategic decision to reallocate some of their global equity portfolio from developed markets to emerging markets enjoyed the benefits of increased relative returns. As shown in Figure 3 below, emerging markets stocks, represented by the MSCI Emerging Markets Index outperformed developed markets stocks, represented by MSCI World Index:

Figure 3: Annual Performance of Emerging Markets vs. Developed Markets (1988-1993)



Source: ARK Investment Management LLC, 2020 | Data Source: Bloomberg

We believe innovation will evolve in a similar fashion. ARK has identified five major innovation platforms and 14 transformative technologies that are likely to provide significant growth and diversification benefits.⁷ As costs continue to decline, these technologies are approaching tipping points that based on our white paper *'Disruptive Innovation: Why Now?'* should unleash waves of

6 Chen, James. "What Is the MSCI Emerging Markets Index?" Investopedia, Investopedia, 25 Mar. 2020, www.investopedia.com/terms/e/emergingmarketsindex.asp.

7 Winton, Brett. "Disruptive Innovation: Why Now?" White Paper by ARK Invest, ARK Invest, research.ark-invest.com/innovation-why-now.



demand across sectors and geographies and, in turn, spawn more innovation. While many investors perceive innovative technologies and their associated stocks as volatile and risky, each of them tends to be idiosyncratic, such that collectively we think they can provide enough diversification to minimize risks and lower volatility. ‘Pure play’ stocks associated with technologies like DNA sequencing, for example, have a fairly low correlation to those associated with collaborative robots or blockchain technology. In fact, based on Figures 4 and 5, the correlations between and among disruptive technologies can be lower than those between and among S&P 500 sectors.⁸ In Figure 4, the S&P sectors are represented by ETFs selected by ARK that are intended to represent each of the 11 S&P sectors. In Figure 5, the disruptive technologies are represented by individual stocks selected by ARK to represent each of the 14 transformative technologies. The average correlation between S&P sectors is 0.55, more than double the 0.22 associated with the 14 disruptive technologies. As with emerging markets, a diversified basket of innovative stocks has the potential to enhance risk-adjusted returns in global equity portfolios.

Figure 4: Five-Year Weekly Correlation Of The S&P Sectors Represented By SPDR ETFs⁹

Sector	Ticker	XLC	XLY	XLP	XLE	XLF	XLV	XLI	XLB	XLRE	XLK	XLU
Communications Services	XLC	1.00	0.82	0.53	0.69	0.64	0.68	0.67	0.60	0.43	0.81	0.24
Consumer Discretionary	XLY	0.82	1.00	0.62	0.61	0.73	0.71	0.78	0.70	0.47	0.84	0.21
Consumer Staples	XLP	0.53	0.62	1.00	0.39	0.49	0.57	0.58	0.51	0.62	0.64	0.53
Energy	XLE	0.69	0.61	0.39	1.00	0.63	0.49	0.69	0.68	0.22	0.57	0.05
Financials	XLF	0.64	0.73	0.49	0.63	1.00	0.63	0.84	0.75	0.28	0.67	0.08
Health Care	XLV	0.68	0.71	0.57	0.49	0.63	1.00	0.67	0.59	0.46	0.69	0.29
Industrials	XLI	0.67	0.78	0.58	0.69	0.84	0.67	1.00	0.85	0.35	0.76	0.19
Materials	XLB	0.60	0.70	0.51	0.68	0.75	0.59	0.85	1.00	0.36	0.69	0.14
Real Estate	XLRE	0.43	0.47	0.62	0.22	0.28	0.46	0.35	0.36	1.00	0.46	0.67
Technology	XLK	0.81	0.84	0.64	0.57	0.67	0.69	0.76	0.69	0.46	1.00	0.26
Utilities	XLU	0.24	0.21	0.53	0.05	0.08	0.29	0.19	0.14	0.67	0.26	1.00
S&P 500 Index		0.84	0.91	0.71	0.71	0.84	0.82	0.89	0.80	0.52	0.92	0.30

Source: ARK Investment Management LLC, 2020 | Data Source: Bloomberg. Five-year weekly fund price correlation data as of December 31, 2019
For informational purposes only and should not be considered investment advice, or a recommendation to buy, sell or hold any particular security. The representative securities identified were selected based on ARK’s methodology. The reader should not assume that an investment identified was or will be profitable. Data is unreconciled and from a third party system.

8 The S&P 500 Index is a widely recognized capitalization-weighted index that measures the performance of the large-capitalization sector of the U.S. stock market.

9 ARK Investment Management LLC, 2020 | Datasource: Bloomberg. ARK constructed a correlation matrix including the following ETFs to represent each of the 11 S&P Sectors: Communication Services Select Sector SPDR ETF (XLC), Consumer Discretionary Select Sector SPDR ETF (XLY), Consumer Staples Select Sector SPDR ETF (XLP), Energy Select Sector SPDR ETF (XLE), Financial Select Sector SPDR ETF (XLF), Health Care Select Sector SPDR ETF (XLV), Industrial Select Sector SPDR ETF (XLI), Materials Select Sector SPDR ETF (XLB), Real Estate Select Sector SPDR ETF (XLRE), Technology Select Sector SPDR ETF (XLK), Utilities Select Sector SPDR ETF (XLU) | Note: The correlations of each fund was calculated using Bloomberg’s following methodology: Correlation coefficient between each fund’s returns of defined granularity over the time frame. The Correlation coefficient ranges between -1.0 and 1.0. The time frame selected was 5 years using the initial start date of 12/31/14. The correlation coefficient between each fund is calculated using weekly returns over the stated time frame (5 Years).



In periods of market distress and volatility, investors often recoil from stocks associated with innovation, especially those not in benchmarks, perceiving them to have high betas and asymmetric downside risks. As a result, while investors are flocking back to their benchmarks to lower tracking error in the early stages of a correction, innovation-based strategies tend to underperform broad-based equity indices.

Figure 5: Five-Year Weekly Correlation Of 14 Technologies Represented By ARK’s Pure Play Stocks¹⁰

Platform	Technology	Company Name	Ticker	GBTC	SQ	APTIV	TSLA	ILMN	NTLA	CLLS	TER	SSYS	SPCE	NVDA	TWTR	NTNX	XLNX
Blockchain	Blockchain	Grayscale Bitcoin Trust	GBTC	1.00	0.00	0.03	0.03	0.03	-0.04	0.12	0.03	0.08	0.04	0.07	0.02	0.11	-0.04
	Frictionless Value Transfer	Square	SQ	0.00	1.00	0.38	0.14	0.25	0.29	0.22	0.36	0.40	-0.06	0.40	0.31	0.34	0.33
Energy Storage	Autonomous Mobility	Aptiv	APTIV	0.03	0.38	1.00	0.35	0.33	0.27	0.33	0.49	0.38	0.00	0.38	0.33	0.26	0.44
	Advanced Battery Systems	Tesla	TSLA	0.03	0.14	0.35	1.00	0.27	-0.01	0.30	0.19	0.28	0.29	0.23	0.09	0.12	0.24
DNA Sequencing	Gene Sequencing	Illumina	ILMN	0.03	0.25	0.33	0.27	1.00	0.36	0.36	0.29	0.29	-0.11	0.28	0.22	0.26	0.27
	Gene Editing	Intellia Therapeutics	NTLA	-0.04	0.29	0.27	-0.01	0.36	1.00	0.44	0.17	0.27	-0.21	0.24	0.24	0.18	0.21
	Immunotherapy	Collectus	CLLS	0.12	0.22	0.33	0.30	0.36	0.44	1.00	0.35	0.38	0.12	0.39	0.23	0.19	0.28
Robotics	Adaptive Robotics	Teradyne	TER	0.03	0.36	0.49	0.19	0.29	0.17	0.35	1.00	0.28	0.18	0.46	0.25	0.25	0.53
	3D Printing	Stratasys	SSYS	0.08	0.40	0.38	0.28	0.29	0.27	0.38	0.28	1.00	0.06	0.37	0.32	0.32	0.29
	Reusable Rockets	Virgin Galactica	SPCE	0.04	-0.06	0.00	0.29	-0.11	-0.21	0.12	0.18	0.06	1.00	0.11	-0.06	-0.04	0.12
Artificial Intelligence	Neural Networks	Nvidia	NVDA	0.07	0.40	0.38	0.23	0.28	0.24	0.39	0.46	0.37	0.11	1.00	0.23	0.40	0.48
	Mobile Connected Devices	Twitter	TWTR	0.02	0.31	0.33	0.09	0.22	0.24	0.23	0.25	0.32	-0.06	0.23	1.00	0.28	0.16
	Cloud Computing	Nutanix	NTNX	0.11	0.34	0.26	0.12	0.26	0.18	0.19	0.25	0.32	-0.04	0.40	0.28	1.00	0.21
	Internet of Things	Xilinx	XLNX	-0.04	0.33	0.44	0.24	0.27	0.21	0.28	0.53	0.29	0.12	0.48	0.16	0.21	1.00
		S&P 500 Index		0.06	0.48	0.64	0.33	0.45	0.35	0.48	0.55	0.45	0.04	0.58	0.32	0.40	0.52
		MSCI World Index		0.06	0.49	0.67	0.34	0.43	0.30	0.46	0.54	0.48	0.06	0.55	0.31	0.39	0.52

Source: ARK Investment Management LLC, 2020 Data Source: Bloomberg. Five-year weekly stock price correlation data as of December 31, 2019. For informational purposes only and should not be considered investment advice, or a recommendation to buy, sell or hold any particular security. There is no assurance that ARK will make any investments with the same or similar characteristics as any investment presented. The investments identified and described do not represent all of the investments purchased or sold for client accounts. The representative securities identified were selected based on ARK’s view of the correlation to the noted platforms and technologies. The reader should not assume that an investment identified was or will be profitable. There is no assurance that any securities identified, will comprise ARK client accounts at the time you receive this document. Data presented is unreconciled and from a third party system.

Ironically, during periods of fear, uncertainty, and doubt, businesses and consumers can sometimes be more willing to change their behavior and try innovative products and services that are more productive, cheaper, and faster. Innovation takes root and typically gains significant market share during tumultuous times, explaining the adage that new leadership emerges toward the end of a bear market. As a result, we believe stocks associated with innovation typically recover much faster than many of the value traps that increasingly populate the traditional indices. Indeed, during these days of explosive innovation, the greater risk during tumultuous times in the market could be in increasing exposure to the incumbents that dominate broad-based indices. The incumbents stand

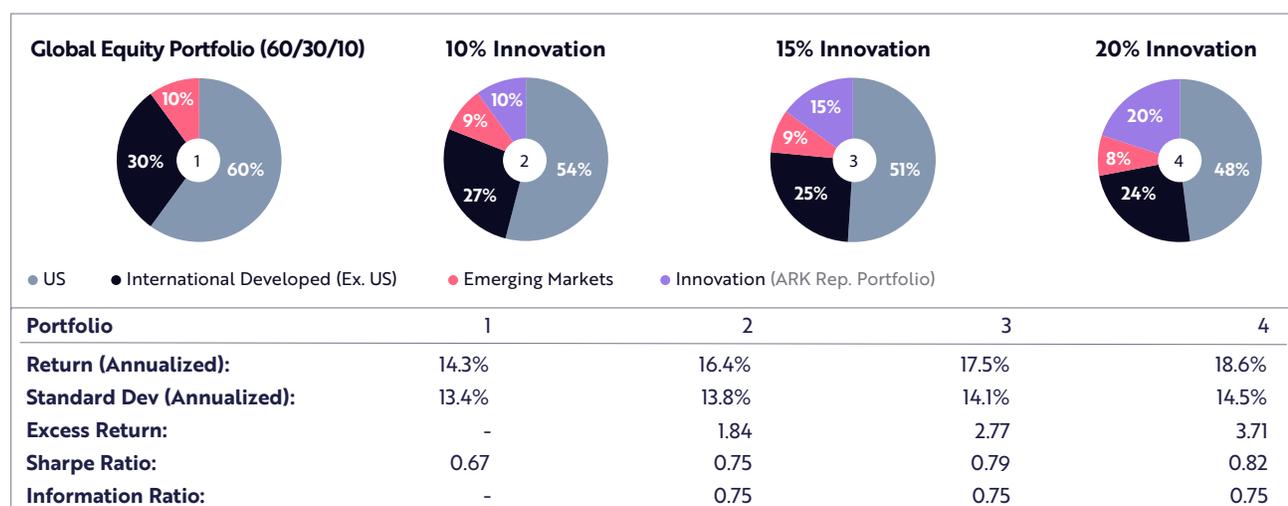
¹⁰ ARK Investment Management LLC, 2020 | Datasource: Bloomberg. ARK constructed a correlation matrix including the following individual stocks to represent each of the 14 transformative technologies ARK has identified: Blockchain = Grayscale Bitcoin Trust (GBTC); Frictionless Value Transfer = Square (SQ); Autonomous Mobility = Aptiv (APTIV); Advanced Battery Systems = Tesla (TSLA); Gene Sequencing = Illumina (ILMN); Gene Editing = Intellia Therapeutics (NTLA); Immunotherapy = Collectus (CLLS); Adaptive Robotics = Teradyne (TER); 3D Printing = Stratasys (SSYS); Reusable Rockets = Virgin Galactica (SPCE); Neural Networks = Nvidia (NVDA); Mobile Connected Devices = Twitter (TWTR); Cloud Computing = Nutanix (NTNX); Internet of Things = Xilinx (XLNX) | ARK selected a sample stock from each of the 14 transformative technologies that we believed had the highest exposure and thus was considered a pure play stock. Stock evaluation was based on ARK’s research and assumption. | The correlations of each stock was calculated using Bloomberg’s following methodology: Correlation coefficient between each fund’s returns of defined granularity over the time frame. The Correlation coefficient ranges between -1.0 and 1.0. The time frame selected was 5 years using the initial start date of 12/31/14. The correlation coefficient between each fund is calculated using weekly returns over the stated time frame (5 Years).



to be disrupted. As mature companies cut costs and R&D to salvage profitability, they may become even less competitive and, in a vicious cycle, lose even more market share.

As was the case with emerging markets, ARK believes investors are likely to evolve asset allocation and portfolio construction strategies, increasingly incorporating disruptive innovation and identifying stocks poised to benefit from trends misperceived, misunderstood, and mispriced in the market. An allocation to innovation has the potential to increase risk-adjusted returns in global equity portfolios in the long term. To test our hypothesis and demonstrate the impact of innovation to an investor’s portfolio, we created and analyzed four hypothetical global equity portfolios as shown in Figure 6.¹¹

Figure 6: Hypothetical Global Equity Portfolios With And Without Innovation (5 Years Ending 12/31/2019)



Source: ARK Investment Management LLC, 2020 | Data Source: Bloomberg. Note following market representations: US Market: iShares Core S&P Total US Stock Market ETF (ITOT); International Developed Market (Ex US) : iShares MSCI EAFE ETF (EFA); Emerging Markets: iShares MSCI Emerging Markets ETF (EEM); Innovation: ARK Disruptive Innovation Strategy (Representative Portfolio. Inception Oct. 30, 2014). Please note that the ARK Representative Portfolio was primarily selected based on applicable strategy and length of track record.

For informational purposes only and should not be considered investment advice, or a recommendation to buy, sell or hold any particular security. Past performance does not guarantee future results. Data presented is unreconciled and from a third party system. The hypothetical back-tested performance returns presented: 1) are not actual performance data or actual portfolios, 2) are being provided for illustrative purposes only, 3) do not represent the results of actual trading, 4) were achieved by means of the retroactive application of the model (see Footnote #11) designed with the benefit of hindsight and are back-tested performance results, 5) back-testing involves the use of theoretical performance developed by applying an analytical model (See Footnote #11) to historical financial data, 6) should not be used as the basis for making an investment decision, 7) are NOT intended to illustrate investment results that were actually achieved or could have been achieved by any of our clients, 8) are comprised of what we believe are the most appropriate securities making up the hypothetical portfolios, 9) do not account for typical fees and expenses incurred by our clients, 10) assumes investment in the hypothetical portfolios net of management fees, and 11) do not reflect the impact that material economic and market factors may have had on investment decisions that would have been in actual portfolios being managed at the time and do not involve market risk.

¹¹ ARK Investment Management LLC, 2020 | Datasource: Bloomberg. The four hypothetical portfolios were constructed using an inception date of 12/31/14. The initial portfolio weights and securities for each portfolio are as follows: **Portfolio 1:** iShares US Total Stock ETF (ITOT) = 60%, iShares MSCI EAFE ETF (EFA) = 30%, iShares MSCI Emerging Markets ETF (EEM) = 10% | **Portfolio 2:** iShares US Total Stock ETF (ITOT) = 54%, iShares MSCI EAFE ETF (EFA) = 27%, iShares MSCI Emerging Markets ETF (EEM) = 9%, ARK Disruptive Innovation Strategy = 10% | **Portfolio 3:** iShares US Total Stock ETF (ITOT) = 51%, iShares MSCI EAFE ETF (EFA) = 25.5%, iShares MSCI Emerging Markets ETF (EEM) = 8.5%, ARK Disruptive Innovation Strategy = 15% | **Portfolio 4:** iShares US Total Stock ETF (ITOT) = 48%, iShares MSCI EAFE ETF (EFA) = 24%, iShares MSCI Emerging Markets ETF (EEM) = 8%, ARK Disruptive Innovation Strategy = 20%. Each of the four hypothetical portfolios were set to rebalance to their initial weightings noted above on a monthly frequency. The hypothetical portfolio weights were set to drift intra-month before rebalancing at the end of each month. The risk/return statistics and ratios (Return, Standard Deviation, Alpha, Sharpe Ratio, and Information Ratio) were calculated using Bloomberg’s PORT function under the ‘Portfolio Statistics’ tab for each portfolio. See additional disclosure on page 10 for Bloomberg’s calculation methodology for each statistic/ratio.



Portfolio 1 includes no exposure to innovation and weights US stocks, Developed International stocks, and Emerging Markets stocks 60%, 30%, and 10%, respectively. The remaining three portfolios include an additional allocation to innovation in 5% increments starting at 10%, while maintaining the 60/30/10 weights in the balance of the portfolios.

As illustrated above and according to our analysis, an equity allocation to innovation may produce positive absolute and risk-adjusted returns. From an absolute return perspective, over the five years ended December 31, 2019, innovation allocations of 10%, 15%, and 20%, respectively, delivered higher annualized returns relative to the traditional global equity portfolio. Not only did they generate 2.1%, 3.2%, and 4.3% of alpha, respectively, but the allocations to innovation increased volatility only modestly as measured by standard deviation, and from a risk-adjusted return perspective, also produced higher Sharpe and Information Ratios.

Conclusion

ARK believes as technologies launch into accelerated growth trends, disrupting the traditional world order, innovation strategies should position investors to capitalize on them. When added to traditional global equity portfolios, thematic allocations focused on technological transformation have the potential to outperform broad market indices on an absolute and risk-adjusted basis over the long-term.

Based on our analysis presented in this paper, we believe innovation should be considered as a strategic allocation, if not a sub-asset class, in global public equity portfolios, much as emerging markets have evolved during the last 40 years. In our ever-changing world, as industries are disintermediated or displaced, and lifespans of companies shorten, investors should capitalize on alternative sources of growth by rethinking traditional asset allocation. Specifically, we think investors should ask themselves whether they sufficiently have incorporated disruptive innovation into their portfolio construction.

About the Author



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Renato "Ren" joined ARK in October 2018. As ARK's Client Portfolio Manager, Ren works directly with ARK's investment team to communicate in-depth knowledge of investment-level detail to internal and external clients. Prior to ARK, Ren was Vice President and Director of Investment Research & Due Diligence at Capital One's Wealth & Asset Management division. He was responsible for leading the expansion of investment research, third-party investment manager platform, strategic asset allocation framework, and portfolio construction. He also worked as a client-facing portfolio manager, developing and maintaining institutional and high-net-worth client relationships. Prior to Capital One, Ren held various portfolio management, investment due diligence and analyst roles at Morgan Stanley Private Bank, Nomura Holdings, and Legg Mason, Inc. Ren is a CFA® and CAIA® charterholder, and earned his Bachelor of Business Administration in Accounting and Master of Science in Finance from Loyola University Maryland.



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Index Descriptions: MSCI World Index - The MSCI World Index captures large and mid cap representation across 23 Developed Markets (DM) countries. With 1,640 constituents as of Dec. 31, 2019, the index covers approximately 85% of the free float-adjusted market capitalization in each country. DM countries include: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, the UK and the US. The MSCI World Index was launched on Mar 31, 1986. **S&P 500 Index** - The index measures the performance of the large-cap segment of the market. Considered to be a proxy of the U.S. equity market, the index is composed of 500 constituent companies. The S&P 500 Index was launched Mar 4, 1957.

Bloomberg's calculation methodology for each statistic/ratio: Return: The 5 year annualized return on the security including appreciation and dividends, assuming the dividends are reinvested back into the security. Gross dividend is used. | Standard Dev: This is a measurement of the degree to which an individual probability value varies from the distribution mean. The higher the variation, the greater the risk. This amount is calculated on each portfolio's monthly returns over a 5-year period, and then annualized. | Excess Return (Alpha): The weighted average percentage performance of a portfolio with respect to the benchmark (Portfolio 1) over the time frame. The return combines price appreciation (or depreciation) and corporate actions. The time frame selected was 5 years using the initial start date of 12/31/14. The Excess Return formula is: $Excess\ Return = (SUM(Relative\ Returns\ on\ granularity\ defined) / N\ of\ periods\ in\ the\ time\ frame) * 100$ annualized. | Sharpe Ratio: Portfolio Sharpe Ratio as computed in Bloomberg's Portfolio & Risk Analytics function as the excess return over the risk free rate (3-month yield linked to the USD currency), per unit of volatility. Performance is measured as mean return. The higher the Sharpe ratio, the better the historical risk-adjusted performance. The time frame selected was 5 years using the initial start date of 12/31/14. The ratio is calculated using daily returns over the stated time frame (5 Years). The Sharpe ratio formula is: $Sharpe\ Ratio = [(Annualized\ Mean\ Return - Risk\ Free\ Rate) / Annualized\ Standard\ Deviation\ of\ Returns]$. | Information Ratio: Ex-post Information Ratio is computed in the Portfolio & Risk Analytics function. It is a risk-adjusted measure that calculates the excess return over the benchmark, per unit of tracking error volatility. The average performance of each portfolio (Portfolios 2, 3, and 4) relative to the benchmark (Portfolio 1) per unit of volatility in benchmark tracking over the time frame. The time frame selected was 5 years using the initial start date of 12/31/14. The ratio is calculated using daily returns over the stated time frame (5 Years). The information ratio formula is: $Information\ Ratio = [Annualized\ Mean\ Excess\ Return / Annualized\ Tracking\ Error]$.

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