*International Diversification Effect: The modern impact of the internet on international diversification*.

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Abstract

***In the investing world we live in today, with contestant technological changes and improvements to the methods we utilize we are continuously forced to update and change the strategies we use to invest. International portfolio diversification strategies have been around for a long time and are not exempt from this rule. The birth of the Internet has dramatically changed how investors trade their money and also how different markets around the world interact with each other. With that being said, this paper is designed to study the true effects of portfolio diversification through the years of January 1980 - December 2017. With such a large time frame we will get to see how those effects change. Our findings suggest that correlation is increasing over time with narrower margin each period. While international diversification continues to yield an outstanding return, it is not a feasible option when comes to risk coverage. Due to the high correlation during bear markets and small correlation during bull, managers are better off using cross-listed and international companies as a medium for diversification. Which in turn allows the manager to have better insights about the organization compared to an entire nation.***

1. Intro

International diversification began as a skeptical and foreign concept but became a widely accepted portfolio management strategy in the 1990’s by investors throughout the entire world (Michaud, Bergstrom, Frashure & Wolahan, 1996). According to their study “*Twenty years of international equity investing*”, international diversification provides the benefit of diversification due to the low correlation with developed markets like the U.S. and Europe. Therefore, to minimize the systematic risk exposure the investor is better-off with international diversification. Similar to what they have done, we wish to imitate their study but with using current data and reassess the impact of modernization and how the current technology (Internet) changed the way we invest in the twenty-first century.

Today, the financial market has seen huge changes compared to 1996. Companies are able to scale-up worldwide without the extreme overhead costs associated with foreign investments. Similarly, consumers have the ability to reach suppliers and manufacturers from any part of the world thanks to the new and innovative technologies that have been implemented. Lastly, investors are able to access information and data like never before; where an investor can look up information about a company on the other side of the world instantly.

Our motive for this paper is quite simple, we first got the idea for our study after reading the article “Twenty Years of International Equity Investing” where it outlines the benefits of a well diversified portfolio. Due to the past explosion of new technologies in the market and the constant innovation, we began to wonder if international diversification is still as effective of a strategy as it used to be

II. Literature Review

The most difficult part about doing any research paper is finding material that is specifically on the subject that you wish to study. In this case we would be finding specific research studies on portfolio diversification talking about the effects of the Internet. The main objective of a international portfolio is the diversification of risk and it hinges critically upon the lack of currency risk. With a portfolio management strategy that has been around as long as international diversification has, you are bound to come across various opinions surrounding the true effectiveness. The first article we found was called “Financial Crises and Dynamic Linkages Across International Stock and Currency Markets” which was written in 2016 by the authors Dua and Tuteja. The purpose of this paper was to investigate the contagion that has spread across stock and currency markets of China, Eurozone, India, Japan and US during global financial crisis and Eurozone crisis. In order to select the appropriate criss periods the authors decided to utilize Markov-switching models for US and Eurozone markets. Following the utilization of the DCC-GARCH model to estimate the time-varying conditional correlation coefficients among the asset market returns they test for the existence of interdependence vs contagion/flight effects. These results are crucial for portfolio managers and hedgers, governments and central banks because it shows that in times of financial stress the benefits of portfolio diversification that investors rely on actually may be non-existent. The following 2016 paperwritten by Zhang, Zheng and Zeng looks to examine the dynamic interdependence of international markets, in which they examine 27 international stock markets from 24 countries. They open by explaining it is very possible for one financial markets turbulence to cause disturbance in another with the impacts of these disturbances becoming more evident in turmoil market conditions and especially in stock markets. There main findings were able to show that one, American indices have a very strong influence on other indices around the world meaning when they struggle, others are bound to struggle as well which calls into question the benefits of international diversification. Second, the results that they have found will be able to aid investors and policy makers related to portfolio rebalancing and the construction of optimal portfolio diversification at the country level. These first two articles we seem to have put a more negative connotation towards portfolio diversification which is something that not many papers on the subject seem to do. The next study we looked at was a 2011 paper written by Khurshid M.Kiani who looked to explore the effects of both local and international portfolio diversification and how it affected the investors value at risk. The risk on an investment is that the outcome is different than one was expecting shown by Grundy and Malkiel (1996) and one of the best ways to mitigate these risks is to diversify your portfolio suggested by Jorion (1985) and thereafter by Xu (2003). This paper sets out to discover the true effects of diversification by using correlation analysis employing Pearson R statistic. The overall results of this paper are able to show that portfolio diversification across markets, industry and country reduces an investors exposure to risk[[1]](#footnote-1). They then proceed to discuss how additional measures need to be taken in times of financial crisis after the repeated episodes of global financial turmoil. The main measure to be undertaken in financial crisis is to reap the benefits of diversification in emerging markets which is backed by the research done by Saleem and Vaihekoski (2008). Following this study, we looked at a 2010 paper titled “International Portfolio Diversification is Better Than You Think” written by Nicolas Coeurdacier and Stephane Guibaud. The authors utilize aggregate data on bilateral cross-border equity holdings in order to investigate whether investors correctly hedge their over-exposure to domestic risk. It has been shown by Solnik (1974) that foreign securities provide great diversification opportunities but despite this fact investors still tend to keep a disproportionate amount of domestic securities in their portfolios. Their study revolves around the rational portfolio theory to describe investors asset allocation decisions. Studies done by Huberman (2001) and Keloharju (2001) both suggest that familiarity with the market is the most important determinant when selecting a portfolio. Both those studies report that in their findings, familiarity is in fact that crucial factor when investors select an portfolio and those that are willing to diversify internationally, do so properly and are able to see the benefits. Finally, we looked at a 2017 paper that looked to examine the Multi-dimensional portfolio risk and its diversification. They propose that the risk in a portfolio is made from three components; variance, skewness and kurtosis which leads into a fundamental concept in finance theory dating back to Markowitz’s (1952) who was the first to talk about the tradeoff between reward and risk. What they are able to find when taking into account the three main components of risk is that when a portfolio is skewed and flat tailed then not only its variance but also its skewness kurtosis are are simultaneously reduced as the number of risky assets are increased. Overall they are able to show that diversification is able to reduces risk but only when a portfolio is well-diversified which means that only investors that are well educated in the field are able to successfully obtain the benefits from diversification.

III. Macro Analysis

**Market Interdependence**

Since the rise of technology, labour specialization has become one of the most discussed topics in international business. Countries are able to gain a competitive advantage in certain sectors which forces other countries around the world to depend on the resources produced by this nation. Simultaneously, the same nation is dependent on these customers, this notion creates the basic ideology behind market interdependency. When a country reaches a developed state, its interdependency raises to meet the local demand for goods and services. Therefore, globalization is strongly present in developed nations. This phenomena allows emerging and developing economies to grow along with their developed counterparts.

One of the major impacts is a higher growth rate for the Gross Domestic Product (GDP). Whether you subscribe to the expenditure, income, or production methodology of computing GDP; the GDP plays a significant role in assessing the current condition of the market. Furthermore, it allows countries and governmental bodies to measure the productivity of its nation. By accounting for the net exports/trade surplus of the countries, one of the major factors that affects the GDP is the fluctuation of exchange rates. As the country's currency gets stronger, its net exports weaken and the country will prefer to utilize foreign goods and services. This effect is obvious when looking at the North American market.

**Trade Blocs and Economic Unions**

With the rise of trade blocs in the early in the 1990s, many countries have seen stronger economic growth, more importantly, the capital market was the biggest winner from this change. Along with labour improvements and the movement of goods and services, companies for the first time were not limited to certain geographical market. They now had the opportunity to expand further with cheaper access to resources. The creation of jobs and the access to new customers, as well as cheaper resources are the primary factors as to why countries are interdependent. Looking at the equity market, according to Bekaert, Harvey, Lundblad & Siegel (2013) after measuring the EU’s effect on the capital market integration, the computed earning yields differ between 60 and 330 basis points lower if both parties are EU members. While this finding is harnessing the positive impact of economic unions, the creation of competition and small businesses are one of the most crucial factors for capitalism to survive. In addition, the adaptation of the Euro has no significant impact according to Bekaert, et al (2013). Therefore, ruling out the impact of the Euro on the European Union is clear indication of how trade blocs are a powerful source of economic growth.

**Internet**

The rise of the Internet and the integration of this technology in every market allows markets and consumers around the world to have access to goods and services that previously would have been out of reach. Today, with the IT sector dominating all markets, the consumption rate of each nation has increased exponentially. According to Joseph Romm (2002), the Internet is a new source of energy that countries did not have before. More importantly, the reduction of energy intensity is caused by the rise of the information technology (IT) sector. Where this sector is less intensive than traditional manufacturing plants and the efficiency impact of the Internet on all sectors is a powerful tool has replaced traditional methods. The efficiency is coming from the reduction of overhead and inventory costs, where the Department of Commerce reported a drop of 16.3% in inventory ratio caused by the rise of the Internet in 1998[[2]](#footnote-2). This impact is valued at 115 billion USD, it is a significant amount is allocated to the GDP. Therefore, if this notion continued, current GDP growth is expected to double because the inventory savings has doubled simultaneously according to EY estimates.

IV. Hypothesis

Most historical articles surrounding the topic of international diversification are fairly unanimous when talking about the benefits that can be acquired through international diversification. Our group then stumbled upon the work done by Dua and Tuteja (2016) which talks about the downfalls of diversification through financial crises. We then also read the work of Zhang, Zheng and Zeng (2016) who again discussed how financial turbulence in one market often affects other markets. We then began to think, with the rise of international and global organization, which increases the interconnectivity of the world market, is international equity diversification affected? With that being said, we believe that international equity diversification has become less significant due to the rise of market connectivity and the increase of dual-listing**.** As such our hypothesis is:

* Ho: The benefits of international diversification will be significantly less than previously reported.
* Ha: International diversification serves its goals as optimizing the portfolio.

V. Data & Methodology

**Data**

In order to investigate the impact of world interconnectivity on the equity market, it is crucial to measure the risk and return of capital securities across both regions and countries to assess the correlation and behavioral dependency among these securities. Therefore, we will be measuring the yearly risk and return factor between January of 1980 to December 2017. Our data was gathered from reliable sources, Yahoo! Finance, CRSP database, and Mergent Online to name a few. To avoid abnormalities, the study computed daily factors and with daily changes. Unfortunately, many countries lack a major index thus we included these countries using regional indices, using daily closing adjusted for dividend gains. Additionally, the chosen securities are listed using foreign currencies which allows the annual return to include the dividend and currency gains. The gross domestic product is totaled using the expenditure method, where it sums the country’s expenditure of investments, government spending, individuals consumption and foreign/trade surplus (deficit). We believe this method will yield the correct strength and size of the economy because it provides how much the nation’s require to survive.

**Methodology**

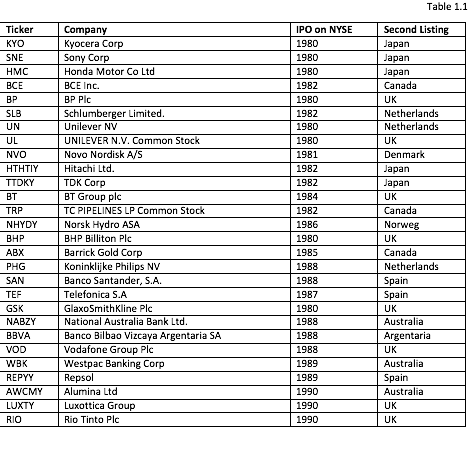
**Panel 1)**

The study is broken down into two parts, we first focus on the correlation changes year-to-year and looking at each periodical fluctuation. The time interval is divided into four periods; the first period ranges from the January 1980 to December 1990, the second period starts in January 1991 and finishes in December 2000. The third period looks at January 2001 to December 2010, and the last period looks at January 2011 to December 2017. The average correlation index of each period was computed to measure the periodical jumps and marginal changes in each market. The reason behind choosing such a methodology to measure how the correlation index changes from period to another. As mentioned before, the rise of trade blocs in the 1990s and introduction of Internet in the late 1990s is a pivotal point to measure the changes in correlation before and after this era of innovation. The correlation was measured against the S&P 500 to access the changes of the US market against different markets like Canada, Japan, Germany, France, Belgium, Europe as a whole, Taiwan, Australia, Indonesia, Malaysia, Mexico, South Korea, India, and Latin America.

**Panel 2)**

The second part we used traditional portfolio construction to measure the change across time. To do this we used six portfolios computing their Sharpe ratio and Beta and comparing it against both the S&P 500 and the global index (Portfolio G) while also measuring information ratio using the global index as our control index.

Our portfolios were constructed as follows: The first one is using the S&P 500 as a passive portfolio to check the impact of globalization to see if it is present for the passive investor. Keep in mind, that the United States has more than 50% of the world market capitalization [[3]](#footnote-3). The second portfolio is using hundred percent foreign indices; using all the major indices around the world excluding the United States. This portfolio is constructed using market capital weights to check whether the behaviour of this portfolio is going to mirror the behaviour of other portfolios. The third portfolio is constructed using equal-weights of the first two portfolios. This will allow for a insight on how traditional investors operate internationally. The fourth portfolio is constructed using cross-listed companies with an IPO after the 1980s. This portfolio is based on the common misconception that dual-listed stocks tend to offer superior return and minimal risk. These cross-listed companies on NYSE are randomly selected to avoid any selection biases. Selected companies operate both domestically and internationally, so they are exposed to economic changes on multiple levels. This portfolio is going to give insightful information on whether dual-listed organizations are only attached to the listing markets. Thus, if the behaviour of this market changes along with a global index (Portfolio G) it would be reasonable to assume an increase of correlation among markets.



The fifth portfolio is constructed using GDP weights. As mentioned before, the capital allocation weights favour the United States and do not include countries with low access to market capital. This alternative weighting scheme allocates countries by their Gross Domestic Product (GDP). Proponents of GDP-weighting highlight several advantages, it weighs the country according to its economic size instead of market cap, which will reflect a wider view of the county's growth. GDP provides the investor with higher exposure to emerging markets which provides a superior risk premium as shown in previous studies. The last portfolio is construction in a similar method to the fifth portfolio but excluding the US economy. This portfolio will offer the opportunity to show the interconnectivity of the world to the US regardless if the US economy was not added to the mix.

VI. Findings

**Panel 1**:

Table 2.1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **INDICES Against S&P 500** | **Period 1** | **Period 2** | **Period 3** | **Period 4** |
| **Dow Jones Indus. Av** | 0.9734454 | 0.924559 | 0.971463 | 0.961809 |
| **TSX** | 0.125628743 | 0.611758 | 0.721786 | 0.732369 |
| **CAC 40** |  | 0.320441 | 0.548398 | 0.598309 |
| **DAX** | -0.023002374 | 0.330278 | 0.597685 | 0.582731 |
| **ESTX 50 PR.EUR** | 0.242271557 | 0.314682 | 0.571456 | 0.589769 |
| **EURONEXT 100** |  | 0.391294 | 0.548496 | 0.604087 |
| **BEL 20** |  | 0.257859 | 0.496456 | 0.574155 |
| **Nikkei 225** | 0.033663029 | 0.111458 | 0.129172 | 0.157582 |
| **HANG SENG INDEX** | 0.229863157 | 0.082083 | 0.176646 | 0.183253 |
| **SSE Composite Index** |  | -0.05303 | 0.040062 | 0.087803 |
| **S&P/ASX 200** |  | 0.178806 | 0.232831 | 0.321046 |
| **ALL ORDINARIES** | -0.022430645 | 0.198418 | 0.233977 | 0.324784 |
| **S&P BSE SENSEX** |  | 0.065403 | 0.164979 | 0.260264 |
| **Jakarta Composite Index** |  | -0.03382 | 0.085753 | 0.113365 |
| **S&P/NZX 50 INDEX GROSS** |  |  | 0.35855 | 0.292175 |
| **KOSPI Composite Index** |  | 0.091463 | 0.165085 | 0.180449 |
| **TSEC weighted index** |  | 0.034732 | 0.114654 | 0.135936 |
| **IBOVESPA** |  | 0.536692 | 0.623615 | 0.505519 |
| **IPC MEXICO** |  | 0.401745 | 0.672834 | 0.563688 |
| **IPSA SANTIAGO DE CHILE** |  |  | 0.473376 | 0.419758 |
| **MERVAL** |  | 0.456435 | 0.443028 | 0.44821 |
| **NIFTY 50** |  |  | 0.298194 | 0.26329 |
| **MICEX Index** |  |  |  | 0.284297 |

In running the correlation test between the S&P 500 against various international indices to measure the year-to-year changes, table 2.1 in the appendix highlights the average correlation from period to another. As shown above, the change from period to period exist, which indicates that market interconnectivity is present in the equity market. Moreover, the dramatic increase between period 1 and period 2, indicates that the increase of economic unions and Internet revolution might be the primary factor behind such shift. Which highlights a critical point, as sectors and economies become more connected to the Internet, there is a high likelihood of market singularity. While these results show the feasibility of such impact, it is hard to conclude the full magnitude of such interconnectivity without looking at trade surplus of each nation.

**Panel 2:**

The compounded (geometric mean) return of each portfolio tends to share similar behaviour on different scales which highlight the connectivity of return regardless of the diversity of the portfolios. More importantly, as time goes by, the behaviour of these stocks is aligning and unifying accordingly. As shown in the appendix in Figure 1.1, period 1 returns were not as organized the return shown over period 4. The return provided accounts the gain on currency exchange and it includes the dividend yield of each security because currency strength plays a crucial part of the economic strength of the country and dividend return counts for a big portion of the expected return on a security. Therefore, looking at the best portfolio, Portfolio F, is constructed using cross-listed stocks, by isolating the stock along with the global index, Portfolio G, the initial period, between 1980 and 1990, the behaviour of those two portfolios varied slightly which indicates a low correlation with the world market. Moving along the horizontal axis, the behaviour of those two portfolios entered into constant movement, where both portfolios exhibit a similar behaviour with narrower scaling variations. Moving to 1997, a slight change occurred. Portfolio F scaled the gap between the returns. During the same year, the IT sector rose exponentially after the introduction of the official first public face of internet in 1993[[4]](#footnote-4) . In 1991, the World Wide Web was developed by Tim Berners-Lee[[5]](#footnote-5) , the behaviour of all stocks changes dramatically ever since. As for Portfolio Z and Portfolio A, while both portfolios were constructed using different factors, the behaviour of both portfolios stayed relatively constant across time; which suggests a strong correlation since the beginning of the study period. Lastly, by looking at the return alone, the US market yielded the lowest return, while cross-listed companies placed first with 45.7% of surplus. The second-place goes to portfolio Z, where it was built using GDP weights and excluding the US. Followed by the benchmark.

**Risks Assessment:**

The second assessment focuses on risk measurements, by focusing on the systematic risk measurement beta (β) of each portfolio against the S&P500 and the benchmark, Portfolio G. In the long-run we predicted the value of each beta (β) will reach 1.0. Looking at table 3.1, portfolios with a beta less than 1.0 increased over time to reach a value that is closer to 1.0 for the S&P 500. Similarly, portfolios had a duplicate behaviour toward the global index, Portfolio G. By focusing on the long-term changes, it is reasonable that all the portfolios are moving toward a beta (β) = 1.0. Which indicates a unified risk source and the systematic risk is no longer limited to a single market.

Table 3.1

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | *(1980-1990)* | | *(1991-2000)* | | *(2001-2010)* | | *(2011-2017)* | | ***Aggregate*** | |
| B-S&P 500 | B - Portfolio G | B-S&P 500 | B - Portfolio G | B-S&P 500 | B - Portfolio G | B-S&P 500 | B - Portfolio G | **B-S&P 500** | **B - Portfolio G** |
| *A* | 1.00 | 2.40 | 1.00 | 0.93 | 1.00 | 1.15 | **1.00** | **1.04** | **1.00** | **1.16** |
| *B* | 0.62 | 1.59 | 0.66 | 1.00 | 0.74 | 1.03 | **0.76** | **1.00** | **0.65** | **1.05** |
| *C* | 0.24 | 0.78 | 0.32 | 1.06 | 0.48 | 0.91 | **0.52** | **0.97** | **0.29** | **0.93** |
| *F* | 0.66 | 2.02 | 0.56 | 0.89 | 0.92 | 1.31 | **1.05** | **1.33** | **0.82** | **1.26** |
| *G* | 0.34 | 1.00 | 0.51 | 1.00 | 0.64 | 1.00 | **0.69** | **1.00** | **0.55** | **1.00** |
| *Z* | 0.08 | 0.50 | 0.31 | 1.07 | 0.48 | 1.03 | **0.64** | **1.07** | **0.37** | **1.26** |

Looking at the Sharpe ratio, it highlights how much risk it the manager to employ this excess return. The risk-free rate used to compute the excess return is the compounded US 10-year treasury bond over the given period. While international diversification is looking at the changes between period 1 and period 4, the growth of Sharpe ratio indicates either a drop in the standard deviation or an increase of excess return. All the portfolios are increasing in volatility except Portfolio A, with an extreme spike in period 3 due to the market meltdown in 2008. Overall, the safest portfolio is Portfolio B. We believe that this might stem from the fact that over 50% of the market capitalization is coming from the United States alone, so over time the international market is becoming less attractive and a riskier choice for organizations to consider.

Table 4.1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Standard Deviation** | **Period 1** | **Period 2** | **Period 3** | **Period 4** | **Aggregate** |
| **A** | 18.49% | 16.17% | 25.46% | 16.96% | **20.04%** |
| **B** | 12.51% | 14.01% | 20.59% | 15.70% | **16.69%** |
| **C** | 12.19% | 15.66% | 21.70% | 17.70% | **18.33%** |
| **F** | 26.93% | 15.80% | 27.61% | 21.93% | **24.74%** |
| **G** | 12.23% | 14.57% | 20.57% | 16.29% | **17.02%** |
| **Z** | 12.18% | 16.14% | 22.05% | 17.88% | **18.66%** |

Using Portfolio G as the benchmark, the Information Ratio (IR) highlights how much the excess return of the portfolio against the benchmark over the standard deviation of the tracking error. While using this ratio is most common among active management strategies, in this case, it highlights how these portfolios reacted against Portfolio G. It highlights an extreme drop in performance in period 2 for Portfolio A through F, while Portfolio Z saw a high spike during the same period. By focusing on portfolios’ ratios before and after period 2 have changed dramatically, which indicates an increase in unexplainable fluctuations after the introduction of the internet in period 2. By looking at the normalized aggregate ratios, the US market is a source of underperformance with a standard deviation of tracking error equal to 13.5%. Compared to 5.0% for Portfolio Z. To conclude, Portfolio Z offers the best allocation against the rise of correlation and risk across markets.

Table 5.1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Info Ratio* | *(1980-1990)* | *(1991-2000)* | *(2001-2010)* | *(2011- 2017)* | ***Aggregate*** |
| *A* | -0.376 | -2.383 | -0.936 | -0.988 | ***-1.107*** |
| *B* | -0.590 | -3.986 | -1.051 | -1.474 | ***-1.707*** |
| *C* | -0.094 | -1.243 | 0.282 | -0.268 | ***-0.276*** |
| *F* | 2.019 | 0.144 | 1.697 | 0.340 | ***1.239*** |
| *G* | ***Benchmark*** | | | | |
| *Z* | 0.579 | 2.240 | 1.131 | 0.894 | ***1.163*** |

VII. Conclusion

Putting everything together, these results suggest that over time the world markets will be unified, while the marginal growth of correlation is diminishing, these correlations could hurt the investor who is seeking international diversification as the means of highly superior return. Whereas, investors who seek long-term stability and growth, international diversification using GDP allocations offers the best results for investors. This is because it allows the investor to include emerging markets with strong economies instead of market capitalization. For foreign investors, investing in the US in no longer a necessity for stable return and more importantly, international companies are good medium/replacement for international investment managers.

VIII. Limitations and Considerations for Further Research

The current study focused on using country and regional indices, which provide some subjectivity toward strong companies that are listed on more than one the index. Thus, using a better medium of foreign investment might result in a superior return. Additionally, the portfolios were compared in against the S&P 500, against a passive portfolio, which limits the potential of the US market and overweighs foreign investments. Our results were computed using currency, while our goal was to show the potential and the strength of each economy, including currency gains from Indian Rupee and Chinese Yen. In this case, where the government controls it, it is going to change what is going in the market and tip the scale toward their currencies. Further research should be on separating the gain from the dividend and currency to measure the core connection of stock price fluctuations across markets. Lastly, the selection of assets in Portfolio F was random according to their NYSE IPO. The superior return might affect the result from the survivorship bias compared to choosing any cross-listed companies at any point in time.

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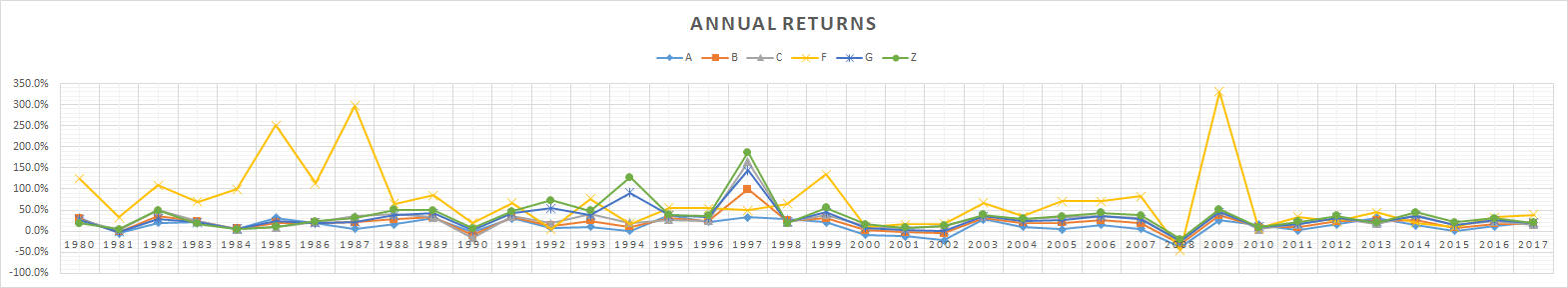
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**Appendix**

**Figure 1.1**

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**Returns: Figure 2.1**

**Periode 1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Portfolio** | **1980** | **1981** | **1982** | **1983** | **1984** | **1985** | **1986** | **1987** | **1988** | **1989** | **1990** |
| **A** | 31.7% | -4.7% | 20.4% | 22.3% | 6.1% | 31.2% | 18.5% | 5.8% | 16.5% | 31.5% | -3.1% |
| **B** | 29.5% | -0.8% | 35.0% | 23.1% | 5.3% | 20.5% | 19.6% | 20.6% | 28.1% | 32.5% | -9.5% |
| **C** | 27.4% | 3.0% | 49.6% | 23.8% | 4.5% | 9.7% | 20.7% | 35.4% | 39.7% | 33.5% | -15.9% |
| **F** | 123.9% | 32.7% | 109.3% | 69.8% | 99.5% | 251.2% | 113.1% | 296.8% | 64.7% | 85.2% | 19.8% |
| **G** | 27.5% | -1.8% | 29.9% | 20.8% | 5.7% | 23.9% | 20.2% | 21.7% | 38.2% | 42.5% | 2.7% |
| **Z** | 19.0% | 4.0% | 49.3% | 17.8% | 4.8% | 10.9% | 23.6% | 32.1% | 50.3% | 49.2% | 7.0% |

**Period 2 Figure 2.2**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1991** | **1992** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** | **1999** | **2000** |
| 30.2% | 7.5% | 10.0% | 1.3% | 37.2% | 22.7% | 33.1% | 28.3% | 20.9% | -9.0% |
| 32.5% | 13.3% | 25.1% | 10.9% | 32.2% | 23.9% | 98.9% | 25.0% | 30.1% | 1.8% |
| 34.8% | 19.1% | 40.2% | 20.4% | 27.2% | 25.2% | 164.7% | 21.6% | 39.4% | 12.6% |
| 67.4% | 4.0% | 76.4% | 17.6% | 55.4% | 54.1% | 49.1% | 65.4% | 134.8% | 10.2% |
| 42.6% | 54.8% | 37.5% | 91.3% | 38.3% | 32.6% | 144.2% | 21.8% | 44.7% | 7.9% |
| 47.6% | 73.1% | 48.1% | 127.7% | 38.7% | 36.2% | 187.3% | 19.0% | 55.6% | 16.0% |

**Period 3 Figure 2.3**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** |
| -11.8% | -22.0% | 28.4% | 10.7% | 4.8% | 15.6% | 5.5% | -36.6% | 25.9% | 14.8% |
| -2.7% | -5.2% | 31.6% | 20.0% | 19.6% | 25.9% | 18.9% | -30.7% | 38.0% | 9.4% |
| 6.5% | 11.5% | 34.9% | 29.3% | 34.4% | 36.3% | 32.2% | -24.8% | 50.1% | 4.1% |
| 16.8% | 18.0% | 67.0% | 35.8% | 70.9% | 70.4% | 83.0% | -45.4% | 330.2% | 6.6% |
| 1.6% | 0.8% | 35.4% | 23.5% | 26.4% | 35.2% | 28.4% | -23.9% | 45.1% | 10.6% |
| 8.3% | 12.9% | 39.0% | 29.5% | 35.8% | 43.8% | 38.2% | -19.0% | 51.9% | 9.1% |

**Period 4 Figure 2.4**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** |
| 2.1% | 15.9% | 32.1% | 13.5% | 1.4% | 11.8% | 21.6% |
| 8.9% | 23.5% | 24.8% | 26.3% | 7.5% | 17.7% | 18.1% |
| 15.8% | 31.1% | 17.4% | 39.1% | 13.7% | 23.6% | 14.7% |
| 34.6% | 23.4% | 45.0% | 19.6% | 8.8% | 33.2% | 38.9% |
| 17.4% | 31.8% | 22.8% | 36.8% | 15.8% | 25.4% | 20.2% |
| 22.7% | 36.9% | 19.8% | 44.6% | 20.6% | 30.7% | 19.6% |

**Period Averages Figure 2.4**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Portfolio** | **(1980-1990)** | **(1991-2000)** | **(2001-2010)** | **(2011-2017)** | **Aggregate** |
| **A** | 15.32% | 17.30% | 1.38% | 13.63% | 11.67% |
| **B** | 17.70% | 27.37% | 10.58% | 17.92% | 18.25% |
| **C** | 19.57% | 36.11% | 19.42% | 21.88% | 24.11% |
| **F** | 102.01% | 49.33% | 45.20% | 28.53% | 57.37% |
| **G** | 20.27% | 47.70% | 16.44% | 24.12% | 26.61% |
| **Z** | 23.21% | 58.55% | 23.06% | 27.52% | 32.46% |

**Portfolio Breakdown Figure 3.1**

|  |  |  |
| --- | --- | --- |
| Portfolio | Domestic (US) | International |
| A | 100% | 0% |
| B | 50% | 50% |
| C | 0% | 100% |
| F | Interlisted companies |  |
| G | Mix of International indices - Using Global/ Country weighted (in. US) | |
| Z | Mix of International indices - Using Global/ Country weighted (ex. US) | |

**Sharpe Ratio Figure 4.1**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sharpe Ratio** | **(1980-1990)** | **(1991-2000)** | **(2001-2010)** | **(2011-2017)** | **Aggregate** |
| **A** | 0.281 | 0.676 | -0.107 | 0.668 | 0.314 |
| **B** | 0.604 | 1.499 | 0.314 | 0.995 | 0.771 |
| **C** | 0.774 | 1.900 | 0.706 | 1.106 | 1.022 |
| **F** | 3.412 | 2.719 | 1.488 | 1.196 | 2.101 |
| **G** | 0.829 | 2.837 | 0.600 | 1.339 | 1.247 |
| **Z** | 1.074 | 3.233 | 0.860 | 1.410 | 1.451 |

1. Jorion, International Portfolio Diversification with Estimation Risk [↑](#footnote-ref-1)
2. *Romm, J. (2002). The internet and the new energy economy. Resources, Conservation And Recycling* [↑](#footnote-ref-2)
3. *US Means Over 50% Of Global Market Cap, But Not 50% Of The Opportunities. (2018)* [↑](#footnote-ref-3)
4. Imagining the Internet (2018) [↑](#footnote-ref-4)
5. Imagining the Internet(2018) [↑](#footnote-ref-5)