

Factor Exposures for the IPOX PORTFOLIO

Michael Kollo, Kat Liu, Josef Schuster*

11/3/2019

ABSTRACT

Factor investing has become increasingly popular in recent years. Institutional investors have been shifting to more transparent and systematic factor approaches where they can clearly see the exposures which they are carrying. We quantify the factor exposures of the IPOX 100 U.S. index portfolio using a combination of time-series correlations and weight-based exposures. We explore the portfolio's sensitivity to market beta, to GICS® sectors, and to fundamental factors such as value, quality, growth, small cap, momentum, low volatility and high dividend (yield). We find some evidence of industry factors, and the presence of mild growth, momentum and size exposures. We do not find evidence for beta (market risk) tilts. In aggregate, about 1/3 of the portfolio's outcome can be explained using industry and fundamental factors. The findings suggest that IPOs as measured by IPOX carry unique factor footprints that cannot be well captured using traditional factor exposures.

* Michael Kollo is the founder of Qurious Analytics. mike@quriousanalytics.com.
Kat Liu is a quantitative research analyst at IPOX Schuster, LLC. kat@ipox.com.
Josef Schuster is the founder of IPOX Schuster, LLC. josef@ipox.com.

1 Introduction

The Initial Public Offering (IPO) market is a fascinating space. From the red-hot market in the late 1990s to the decline during the 2000s dotcom bubble burst, from the recovery since the 2008 financial crisis to the recent unicorn valuation cut, IPOs have always been a hot topic for investors.

Performance aside, the rise and fall of the IPO market is often seen as an indicator of technological innovation and economic growth. IPOs promote new businesses and job opportunities. The ability to raise new capital and finance growth of new enterprises is crucial for the economy and employment. In spite of these positive attributes, IPO stocks have received mixed sentiments and have been the subject of much scrutiny from investors and academics alike. A large number of studies, see Ritter (1999) for example, have found that IPOs can also be the subject of speculation leading to initial underpricing, short-run outperformance followed by long-run underperformance. These studies and press articles have painted IPOs as a kind of hyped speculation, primarily focusing on unprofitable growth companies, from very specific industries. While there are clear anecdotal examples of disappointing companies (more recently the failed IPO of WeWork which resulted in massive write-downs for its owners), it is less clear that buying IPOs as a factor in a portfolio should only represent a specific speculative growth or industry bet. Our focus in the following study is to explore how much of a dedicated IPO portfolio (IPOX 100 U.S. index) can be consistently described with the above-mentioned stereotypes. In other words, is there a unique factor footprint for IPOs that is beyond the headlines of growth and technology?

1.1 Performance

We use the IPOX 100 U.S. index (“IPOX”) portfolio as our representative IPO portfolio, as it is composed of the 100 largest U.S. New Listings in the IPOX U.S. Composite index which represents new listings and spin-offs. The index is rebalanced quarterly and is based on a market-capitalization weighting scheme. Index constituents are selected using a rules-based methodology with quantitative initial screens, which considers criteria such as market capitalization, float and liquidity. The index provides a disciplined and transparent way for buy-and-hold investors seeking systematic exposure to U.S. new listings, while avoiding excessive concentration in a given (large) IPO for example. The performance of the IPOX 100 U.S. index is shown below and has generally outperformed the S&P 500 index over the past fifteen years since 2004. (see Figure 1).

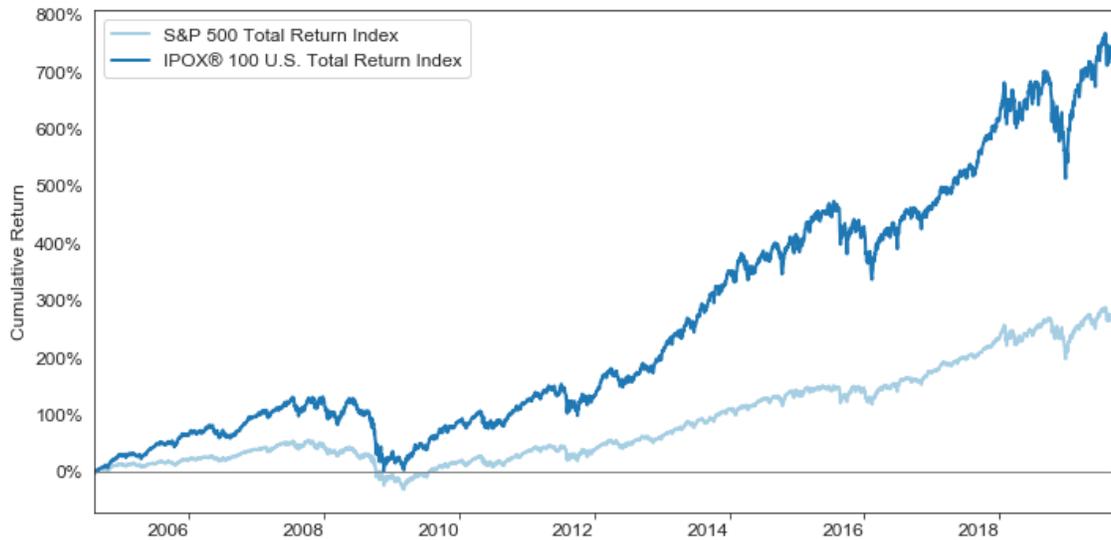


Figure 1: Cumulative Total Return (%): August 6, 2004 - August 30, 2019¹

1.2 Risk and Return

¹ Source: IPOX Schuster LLC. IPOX® 100 U.S. index performance since its inception on 08/06/2004. Past performance is not indicative of future results. The total return index tracks both the capital gains of the portfolio over time assuming all cash distributions are reinvested.

An analysis of relative return and risk provides a simplified comparison over long time periods of our IPO portfolio (IPOX) against a number of benchmarks (see Figure 2). With the annualized volatility among all selected indices, IPOX has exhibited the highest annualized return, and is generally more volatile than the broad index, but not as volatile as comparative mid and small cap indices.

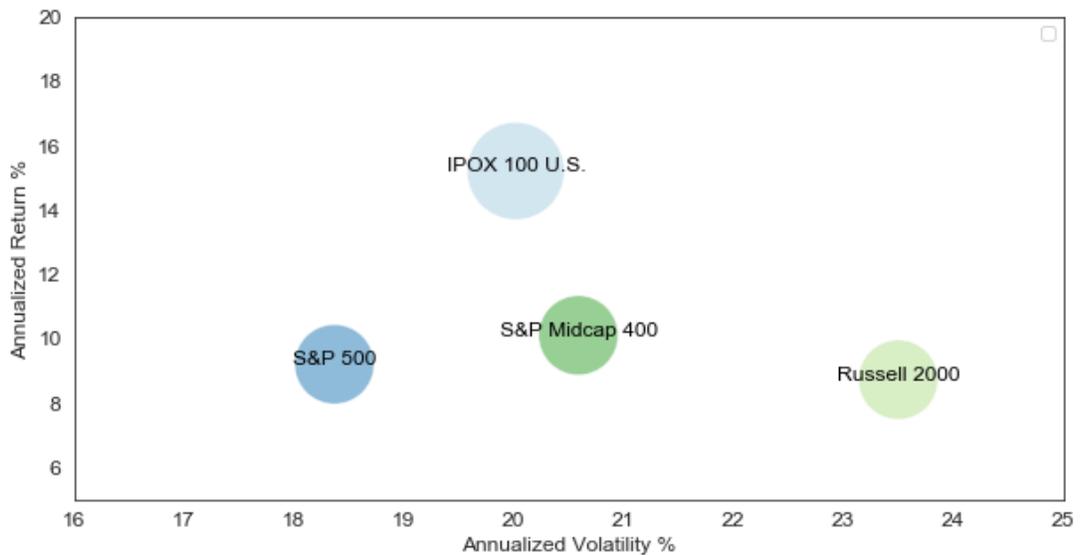


Figure 2: Annualized Returns & Volatility: August 6, 2004 - August 30, 2019²

In terms of the consistency of the returns, the IPO portfolio has also outperformed the benchmark indices over the past one, three, five and 10 years (see Figure 3), making the return stream fairly consistent.

Index Performance	1 Year	3 Year	5 Year	10 Year	YTD
IPOX 100 U.S. Index	5.66%	15.12%	11.19%	17.91%	28.08%
S&P 500 Index	2.92%	12.70%	10.11%	13.45%	18.34%
Russell 3000 Index	1.31%	12.24%	9.60%	13.35%	18.02%

Figure 3: Index Performance: Annualized Total Returns (%)³

The competitive advantage of IPOX is better seen over the long-term. Over the past ten years, for example, IPOX's 10-year annualized return has exceeded the performance of the respective benchmarks by more than 400 basis points (bps) annually. The findings underline that IPOs as measured by IPOX as a segment of the equity market have performed well over the long-run. We next turn to the potential drivers of this performance.

1.3 Market Betas

Our first test is to examine the market beta of the IPOX portfolio, looking for evidence of excessive beta tilt. The active beta is calculated as the covariance between the active returns of a portfolio and the return of the market divided by the variance of the market returns.

$$\beta_{\text{portfolio}} = \frac{\text{Cov}(r_{\text{active}}, r_{\text{market}})}{\text{Var}(r_{\text{market}})}$$

² Source: IPOX Schuster LLC, Bloomberg. The chart is provided for illustrative purposes only. Past performance is not indicative of future results. Annualized return and annualized volatility are calculated using the total return indices.

³ Source: IPOX Schuster LLC, Bloomberg. Data as of August 30, 2019. Past performance is not a guarantee of future results. Indices do not charge management fees or brokerage expenses, and no such fees or expenses were deducted from the performance shown. An investor cannot invest directly in an index. Performance data quoted represents past performance.

Investors may be inclined to consider IPOX as high-beta portfolio since New Listings in general, and IPOs in particular, are often associated with high risk. Several studies including Ibbotson (1975), Clarkson and Thompson (1990) and Ritter (1991) have shown that the average betas for IPOs are higher than those of non-IPO matching firms in the first three to five years following the IPO. However, while academic research indicates that IPOs display higher betas, on average, Ritter (1991) also shows that the average betas decline over time and that the difference in betas between IPOs and the matching portfolio is too small to be economically significant.

We find that the average beta of the IPO portfolio is 0.06, essentially the same as the market, though it does range from -0.1 to 0.3 over the past fifteen years (See Figure 4 for summary and Appendix 1 for detailed history).

We also calculate the beta for a peer index* of competitor funds with similar IPO exposures, and find that these peers similarly have a beta closer to the market, but typically are higher and have a larger dispersion over time (see Figure 4).

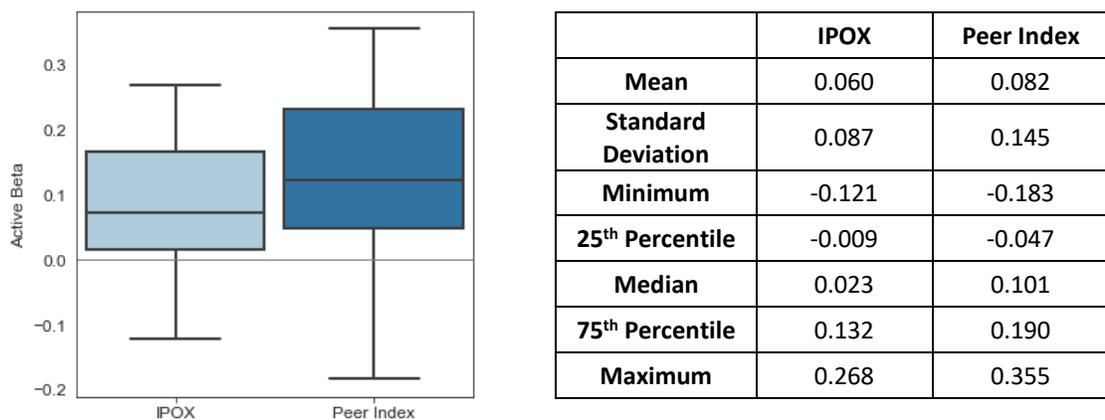


Figure 4: 12-Month Rolling Active Betas⁴

1.4 How Important is Market Beta in Explaining IPO Returns?

We find that very little of the IPO portfolio is explained by the beta to the market (R-squared of less than 1% reported in Appendix 2). We proceed with a more detailed analysis of the active portfolio to explain the excess returns in terms of some factors that are familiar to most investors including sector and fundamental styles.

2 The Role of Sector in IPO Returns

IPOs in the popular media articles are filled with stories of high-risk technology stocks that promise incredible growth, and ultimately disappoint investors with poor returns. Recent examples are filled with high-profile tech unicorn/deacorn IPOs, including brands like Uber and Lyft, for example. While this may be a notion portrayed in the media, it is really not reflected in the data. IPOs reflect a much richer array of investments, with a range of new and divested firms accessing capital markets, that often don't grab media attention. To clarify the importance of sector bias in IPOs, we calculate the exposures, both by weight and by correlation to the major GICS sectors.

2.1 Sector Weights

Starting with the weight of technology and other sectors in the IPO portfolio, we show that there is no significant concentration to any one sector (Figure 5).

* Peer comparison used here is the Renaissance IPO index.

⁴ Source: IPOX Schuster LLC, Bloomberg. Data as of August 30, 2019. Active beta is calculated using indices' excess return over benchmark with a 252-day look back window.

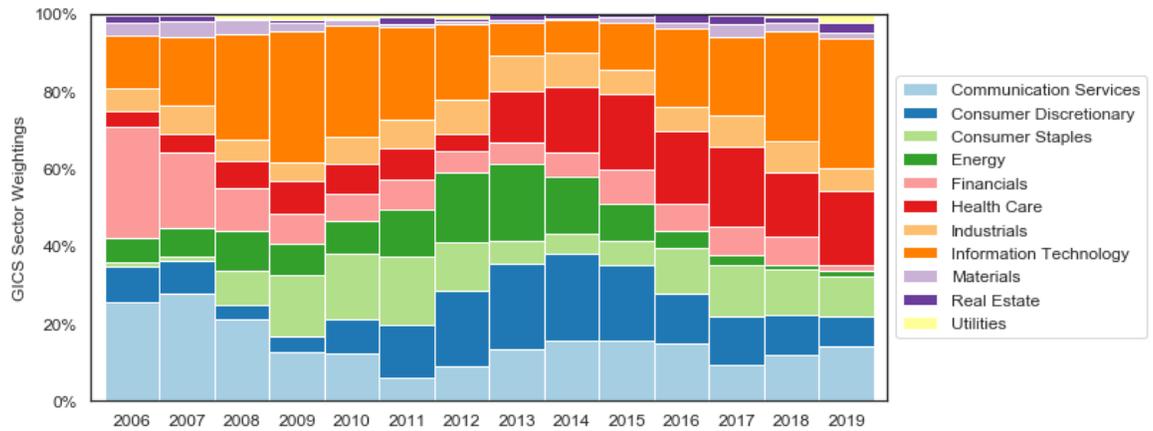


Figure 5: IPOX 100 U.S. Historical Sector Weightings: April 30, 2006 – August 30, 2019⁵

Over the past 15 years, weighted sector exposure has fluctuated considerably with technology stocks, constituting the largest exposure over time. Here, it is important to note that the relatively small weight in the information technology sector is largely due to the GICS re-classification of some of the top former tech holdings such as IPOX heavyweight social networking service provider Facebook (FB) as communication services. Moreover, the weight of the financial sector has considerably decreased over time. Since 2008, for example, the financial sector has undergone several rounds of consolidation and significant regulatory changes, which has resulted in an overall smaller share of financials as a percentage of total IPO activity. Moreover, the recent separation of equity REITs and other real estate stocks from the financial sector has further weakened its impact. Due to the decline in oil prices since 2014 and a lower number of energy firms entering the marketplace through an IPO, the weight of the energy sector has also shrunk.

While a lack of new IPOs in some traditional sectors has persisted over the years, Figure 5 highlights that the IPOX portfolio has maintained a rather steady exposure to most sectors over time, allowing for portfolio diversification and mitigation of idiosyncratic risks in specific industries. Over time, the portfolio has also provided substantial exposure to other more defensive sectors of the economy including consumer staples and industrials.

The historical sector weightings comparison between the IPO portfolio and the S&P 500 index suggests that the median exposure of IPOX across the board is mostly in line with the benchmark during the period of study (see Appendix 3). The larger dispersion of IPOX can be explained by the more dynamic nature of an IPO portfolio as opposed to the historically more static broad benchmark.

2.2 Regression Analysis

Next, we turn to a regression-based approach to tease out the empirical correlation with different sectors over time. This is a useful tool to measure if IPO stocks, although ranging from different sectors, behave like a specific kind of sector (for example, technology) in their returns. We use the excess returns of GICS sector portfolios drawn from the S&P 500 index as our sector portfolios ⁶.

Our result shows that an IPO portfolio is most sensitive to the relative returns to consumer discretionary and technology sectors, and inversely so to consumer staples. While we found little evidence of explicit market beta, this finding suggests a kind of pro-cyclical tilting of the IPO portfolio which is expressed in a relative sector correlation (see Figure 7).

⁵ Source: IPOX Schuster LLC. Data as of Aug 30, 2019. The chart is provided for illustrative purposes only. Analytics based on GICS® sectors. The Real Estate Sector was moved out from under the Financial Sector and being promoted to its own Sector on August 31, 2016. The Telecommunication Services Sector was broadened and renamed to Communication Services on September 28, 2018.

⁶ For example, we calculate the excess returns to technology sector as S&P 500 Technology Index minus S&P 500 broad index. This constitutes the Technology factor. We then calculate the beta of the active IPOX portfolio against this factor, as reported in Figure 7, on a univariate basis.

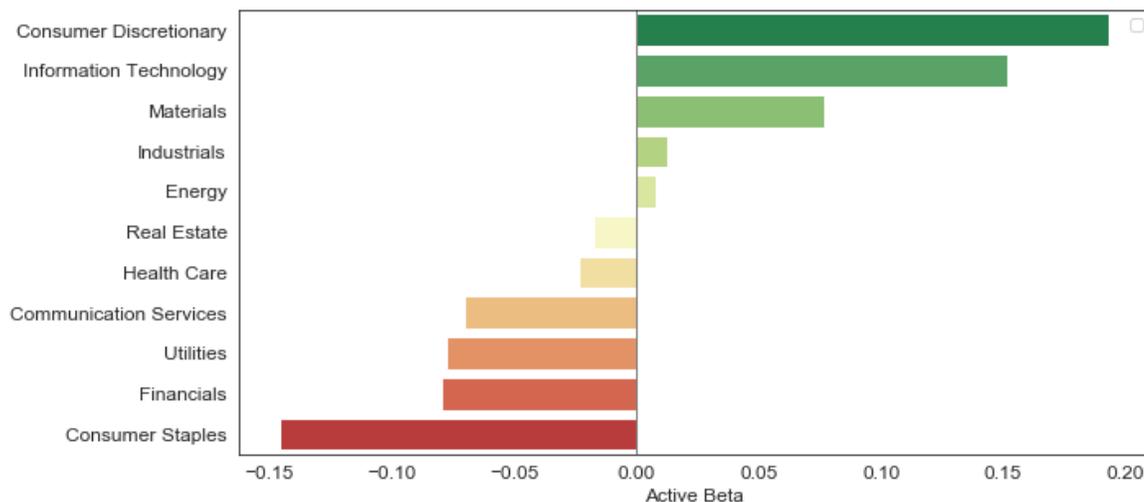


Figure 7: Median 12-Month Rolling Active Beta⁷

Our findings above are univariate, but we repeat the study using multivariate regressions and find similar results that are overall supportive in Appendix 4.

2.3 How Important is Sector in Explaining IPO Returns?

We find that the portion of the IPO portfolio explained by relative sector behavior is small and constitutes only about 14% of the total explained variance. Thus, 86% of the active portfolio is explained by non-sector related factors. In order to shed more light onto this finding, we turn to the analysis of fundamental factors.

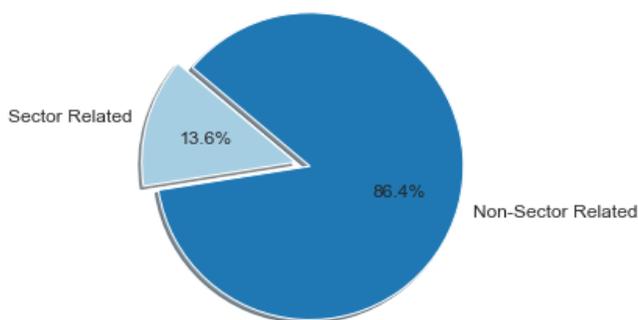


Figure 8: Excess Returns Explained by Sectors⁸

3 Fundamental Factors

Since IPOs are traditionally associated with smaller, high growth, and still emerging companies, investors may naturally view an IPO portfolio as more akin to a small cap exposure, represented by something like the Russell 2000 index. We proceed to study the underlying style exposures to better understand the embedded characteristics of the most significant factors driving the IPO portfolio's returns.

3.1 Fundamental Factor Exposures

In Figure 9, we study factor exposures using time-series return based analysis, whereby IPOX excess returns are regressed against a set of MSCI factor indices over the past 15 years. MSCI factor indices are used as proxy for each investment style, and as with sectors, are calculated as active returns to the broad market.

⁷ Source: IPOX Schuster LLC, S&P Dow Jones Indices LLC, Bloomberg. The chart is provided for illustrative purposes only.

⁸ Source: IPOX Schuster LLC. Multivariate regressions using all active S&P 500 sector indices and taking the explanatory power over past 15 years. The chart is provided for illustrative purposes only.

The estimated beta coefficients from the regression are our factor exposures⁹. The 12-month rolling active betas from the univariate regression with respect to each active style indices returns shows that IPOX has a significant positive exposure to growth, momentum, and small caps and negative exposure to value and high dividend stocks.

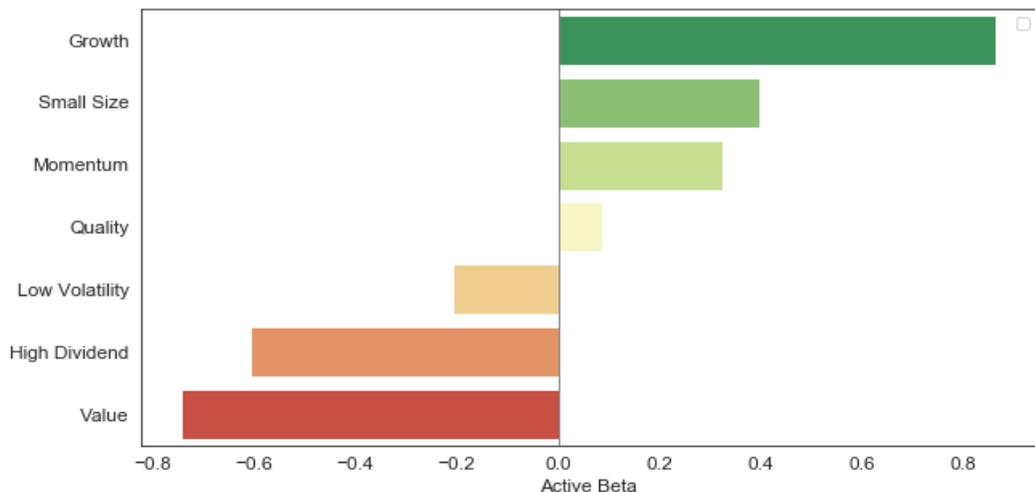


Figure 9: Median 12-Month Rolling Active Beta¹⁰

3.2 Comparing to Benchmark Exposures

It is challenging to quantify significance for the factor betas we calculated, so we next calculate the same exposures for a peer index (of other IPO portfolios) and a diversified small cap index (the Russell 2000 index) as comparison.

When using the S&P 500 index as a benchmark, IPOX and its peer index have demonstrated very similar exposures to each single fundamental factor. Both active portfolios have displayed positive exposures to high-growth, high-momentum and small caps. As highlighted in Figure 10, IPOX has had less pronounced exposures to style factors when compared to its peer index. Moreover, when compared to the Russell 2000 index, IPOX has had, on average, more positive exposure to growth and momentum, less exposure to small caps, and marginally positive exposure to quality. The above findings suggest that when compared to Russell 2000 index, IPOX has had a higher exposure to stocks displaying a higher growth rate in earnings, a better market growth trend and relative price strength (momentum), is significantly less concentrated in small-caps than one may assume for a portfolio with a majority of holdings in IPOs, and has relatively more exposure in companies with investment quality and earning quality. Both IPOX and the Russell 2000 index have negative exposure to the dividend yield and low volatility factors. However, the smaller absolute beta coefficients for both dividend yield and low volatility factors may support the view that the active IPOX portfolio has more exposure to stocks that are less volatile and pay a higher dividend when compared to the Russell 2000 index. While IPOX has been presumably expected to exhibit very similar characteristic as a small cap benchmark, the active IPOX portfolio displays a more diversified and controlled exposure to the individual factors. However, it is important to note that the exposures (betas) vary over time due to market volatility and the changing profile of New Listings over time (see Appendix 5 and 6). The effects of factors are therefore not time persistent.

⁹ These are distinct from factor exposures that a fundamental factor model, such as a BARRA or Axioma model may provide, that are based on cross-sectional ranking, and are generally in z-score form.

¹⁰ Source: IPOX Schuster LLC, MSCI Inc., Bloomberg. The chart is provided for illustrative purposes only.

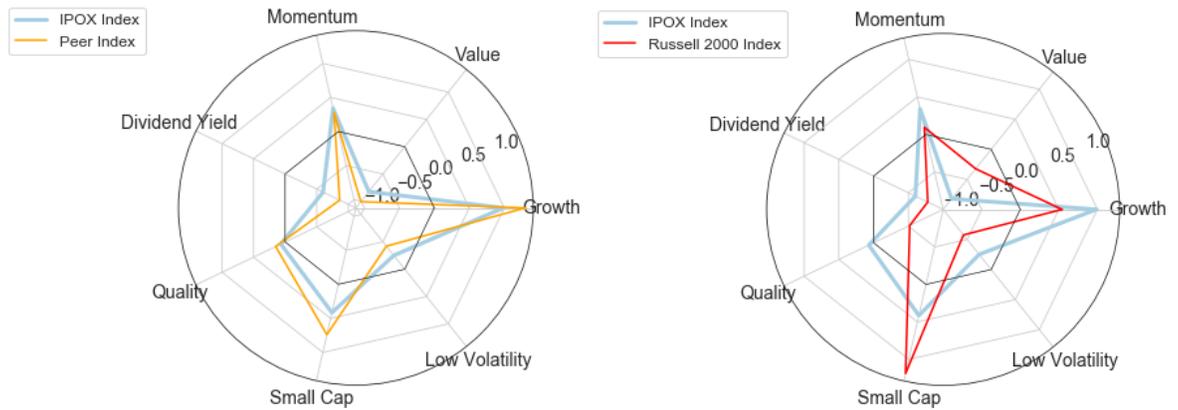


Figure 10: Average Active Factor Exposure Comparison: IPOX vs Peer index and Russell 2000 index¹¹

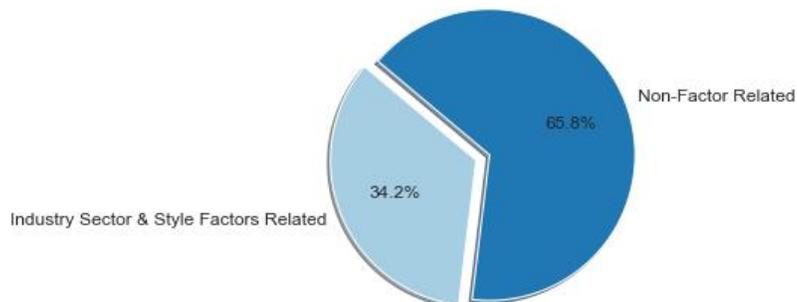
3.3 Regression Analysis

Before we combine all the factors to study how multiple factors explain the excess returns of IPOX, we observe that the growth and value factors show significant negative correlation. Value is also negatively related to quality (see Appendix 7). In order to avoid a severe multicollinearity problem, we therefore remove value from the model.

As highlighted in Appendix 8, the multivariate regression with all active style factor portfolio returns shows that IPOX has large positive exposure to high-growth, small cap and high-momentum stocks. In the multi-factor model, IPOX also displays statistically significant negative exposure to the quality factor. Though the beta coefficient for high dividend is negative, we consider this result statistically insignificant, given its low t-statistic. The small positive exposure to low volatility is likely due to the high positive correlation (0.60, see Appendix 7) between low volatility and dividend yield. While Bender, Hammond and Mok (2014) find that up to 80% of active returns to an IPO exposure can be explained by exposure to systematic factors, our results are much milder, at around 32%. The difference is likely to be a result of the portfolio construction and rebalance frequency of the IPOX portfolio which allows for a more diversified, and slower-moving exposure to IPO stocks.

3.4 The Sector and Style Effects Combined

Given that both sector and style factors have some explanatory power over the IPO portfolio, we combine these in a single test to measure how much of the returns are characterized by factors. The regression output shows that a multi-factor model explains 34.2% of the IPOX excess returns to the market (see Appendix 9). IPOX has economically and statistically significant positive exposure to growth, momentum, small-caps and negative exposure to quality, consumer staples, industrial and real estate sectors. Two thirds of the portfolio's active returns remain unexplained by fundamental and sector exposures.



¹¹ Source: IPOX Schuster LLC, MSCI Inc., Bloomberg. The chart is provided for illustrative purposes only.

Figure 11: Excess Returns Explained by Sectors and Fundamental Factors¹²

4 Unique Exposures of IPOX

If not for their strong sector footprint or stylistic tilts, we turn to unique characteristics of the IPO market to further characterize our IPO portfolio.

4.1 Sources of Capital

Companies can come to IPO in the public equity market from many different backgrounds, one important characteristic being the source of pre-IPO financing; such as the degree to which a deal has been backed by private funding (see Figure 12). While in 2006, around 76% of IPOX portfolio holdings had no significant VC or PE funding rounds pre-IPO, this figure fell to just 26% by 2019.

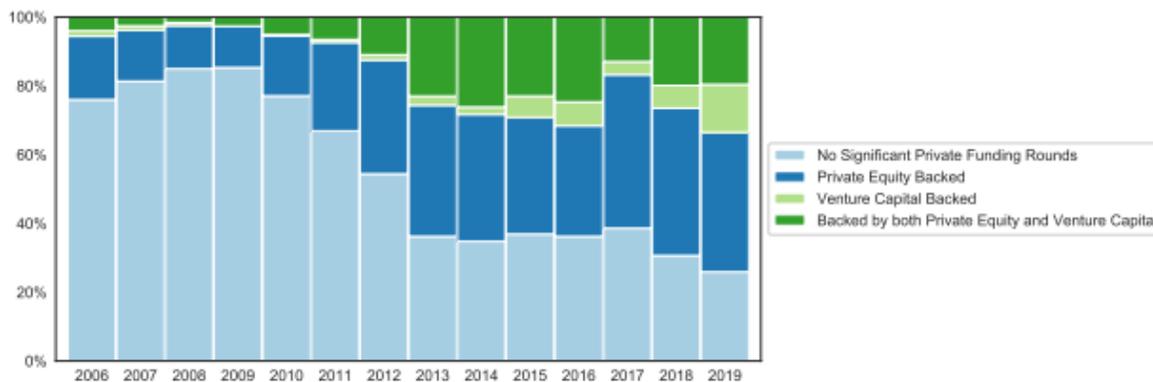


Figure 12: IPOX 100 U.S. IPO Holdings' Historical Pre-IPO Funding: April 30, 2006 - August 30, 2019¹³

When an IPO provides investors with an opportunity to participate in the exponential growth of the next big thing, investment is likely to be extremely speculative. The sources of pre-IPO funding may, to some extent, function as an insurance policy for post-IPO performance, especially for less experienced retail investors. Specialized private backers may exhibit superior investment selectivity and provide more support by retaining shares and offering corporate governance guidelines to newly public companies. Krishnan et al., (2011) find that there is a significant positive relation between lead VC investor's reputation, measured by IPO market share, and the issuers' long-run post-IPO performance. Cronqvist and Fahlenbrach (2008) find that existence of large shareholders (including private equity investors) can significantly improve firm performance. Therefore, start-ups with well-known private backers may have a better future.

Private equity-backed IPOs are, on average, larger in terms of total market capitalization, more profitable with a longer operating history and may demonstrate better buy-and-hold return opportunities, particularly in the earlier publicly traded days.

The studies regarding aftermarket performance of PE-backed IPOs have shown contrasting views, whereby some evidence stated the superior performance of PE-and VC-backed offerings in comparison to non-backed issues and others found no evidence of PE-backed issues' long-term outperformance. Despite the lack of general consensus on the long-run aftermarket performance of PE-backed IPOs, we find that PE-backed IPOs display lower average initial returns and higher average long-term returns when compared to companies with other types of pre-IPO financing.

In consistency with our results, Mogilevsky and Murgulov (2012) find, on average, private equity backed IPOs experience a significantly lower level of underpricing than when compared to venture capital backed or non-

¹² Source: IPOX Schuster LLC. Multivariate regressions using active MSCI factor indices and S&P 500 sector indices and taking the explanatory power over past fifteen years. The chart is provided for illustrative purposes only.

¹³ Source: IPOX Schuster LLC, Bloomberg. The chart is provided for illustrative purposes only.

sponsored IPOs. Bergstrom et al., (2006) also found lower first day returns amongst PE-backed offerings as opposed to the non-backed issues. Brav and Gompers (1997), provide evidence that U.S. companies with a venture capital or a private equity fund among its pre-IPO shareholders outperform non-sponsors backed IPOs. Levis (2011) focuses on the aftermarket performance of PE-backed IPOs issued on the London Stock Exchange between 1992 and 2005. He finds that three years following the public listing, PE-backed IPOs display better market performance when compared to other IPOs and the market as a whole. Similar empirical evidence is also provided by Bessler and Seim (2012) who find that a group of sponsored IPOs consistently and significantly outperform the non-sponsored backed IPOs in the European market.

Our findings also suggest that the overall good performance of PE-backed offerings is not due to the hot issue market effect because PE-backed IPOs may be less subject to investor sentiment. Companies which have received pre-IPO private financing are more likely to raise post-IPO additional capitals regardless of market uncertainty (Iliev & Lowry, 2019). Further, Cao (2011) has found that sponsors which maintain a post-IPO involvement as significant shareholders or maintain board seats are more likely to facilitate takeovers and being acquired when ready to exit. Thus, PE backed IPOs can be potential targets for future M&As, which may provide investors with opportunity to liquidate at significant premium. With an average of proportion of PE backed IPOs as a percentage of total U.S. deal flow at 30%, IPOX provides an alternative method of investing in private equity firms' portfolio.

4.2 Deal Type

In addition to traditional IPOs, IPOX has also captured a significant number of spin-off listings over time (see Figure 13). Spin-offs have received substantial attention from investors for some of their extraordinary returns. Many academic studies and industry research have indicated that on average, spin-offs generate better long-term returns than the general market.

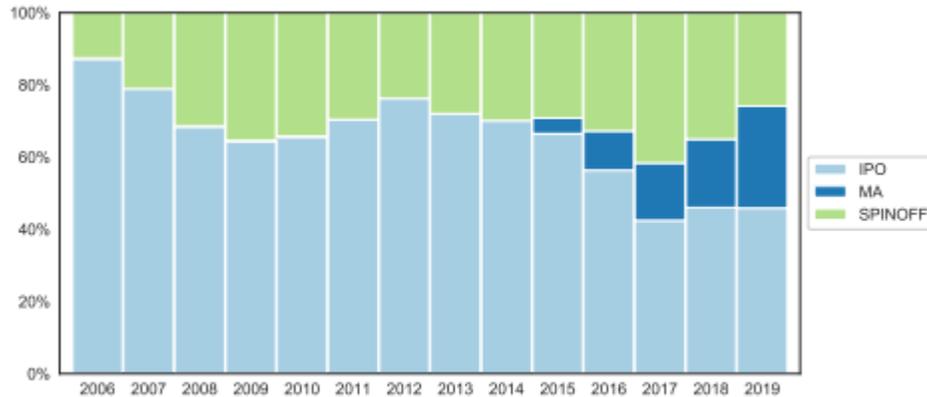


Figure 13: IPOX 100 U. S. IPO Holdings' Historical Deal Type: April 30, 2006 - August 30, 2019¹⁴

McConnell and Ovtchinnikov (2004) have found significant average excess returns of spin-offs with up to 36-month holding period from 1965 to 2000. The average cumulative excess return for the industry and size-matched benchmark of a spin-off was reported at 19.4%, 24.4% and 26.3% for the first 12-month, 24-month and 36-month immediately following the spinoff, respectively. The average excess return of a spin-off for the size- and book-to-market matched benchmark was also above 20% for all holding periods within the first 36 months. After adjusting for risk, the study also reveals that the excess returns are both economically and statistically significant. Hollowell (2009) also finds that spin-offs consistently outperform market indices over an average four-year holding period, even during the bear market between 1999 to 2003.

A more recent study with data from 2001 to 2013 suggests an impressive spin-off buy-and-hold average return of 49.4% for the first 36 months, when compared to the benchmark's average return of 22.8% (McConnell, Sibley, & Xu, 2015). Thus, adding spin-offs to a well-diversified portfolio may provide asset allocation benefits.

¹⁴ Source: IPOX Schuster LLC, Bloomberg. The chart is provided for illustrative purposes only.

Another focus of IPOX has been IPO M&A, defined as the allocation to selective companies which have merged or acquired recent IPO companies in the IPOX universe. Over time, merger and acquisition deals have become increasingly popular. Doidge, Karolyi and Stulz (2017), followed by Bennett and Dam (2018) find that between 1975 and 2015, an average of 5.08% publicly traded companies have been acquired. In addition to the steady M&A deal flow in the market, we observe a significant number of IPOs that have been taken over during their first few years of trading. Such observation can be explained by research on the motivation behind a company's decision to go public. For example, the Brau and Fawcett (2004) survey shows that the two most important reasons for company to go public are the creation of public shares for acquisition purposes and the establishment of a market value of a firm. Ragozzino and Reuer (2007) postulate that IPOs serve as a communication channel to help reduce the information asymmetry of an M&A offer.

Because the addition of IPO M&A deals may provide access to capitalize on stock price gains of the combined companies, IPOX also includes IPO M&A as a source of IPOX portfolio holdings. This may seem to contradict findings reported in a number of studies. Several researches have indicated that acquirers underperform their peers and the overall market over the long-run. For example, Giannopoulos et. al (2017), have found that acquirers suffer significant negative buy-and-hold abnormal returns in the three years after a M&A announcement. Bouwman, Fuller and Nain (2007) provide evidence that acquirers buying in high-valuation market significantly underperform in the two years following the acquisition. The post-acquisition long-term underperformance is often attributed to acquirers overpaying during period of high market valuations and overestimating synergies of a deal. However, in most cases, the empirical studies use data from 1960s to early 2000s, which is significantly out of date. Moreover, most studies excluded target companies with less than few years of trading history, which set them apart from the IPOX case.

In a separate unpublished study¹⁵, we find underperformance amongst a sample of 204 acquirers in the United States from 2005 to 2019 when using average and median equally weighted buy-and-hold returns. The result is consistent with most studies in the sense that the share price of an acquiring firm typically declines over the long-run after a deal is consummated. However, similar to IPOs, the median returns are significantly lower than the average returns whereby the return distribution is significantly skewed with some big winners driving average performance. In a study conducted by S&P Global (Tortoriello et al., 2016), although the percentage of M&A acquirer returns decline through one year pre-close to three years post-close, there still exists 40% of acquirers that have outperformed their industry- or universe-relative benchmarks by the third year following the acquisition. While the performance of the combined companies can differ significantly, we also find large cross-sectional differences, whereby larger acquiring firms tend to create long-term value for shareholders in the years following the M&A completion. For example, when applying a calendar time portfolio construction methodology, we find that a portfolio of IPO M&A companies has outperformed the benchmark by 478 bps per year during the period of study (see Appendix 10).

5 Conclusion

A factor approach allows investors to understand portfolios through the lens of factor exposures, giving greater transparency and often translating complex investments into the same 'factor language'. This also allows investors to discern between unique alpha characteristics of portfolios against more commoditized and cheaper factor alternatives. We study the IPOX 100 US Index to test its factor exposures and footprint over the past fifteen years. We find a mild positive exposure to growth, momentum and small caps, but no significant tilt toward beta nor evidence of an overwhelming sector tilt (e.g. technology). The sum of all of these factor exposures can explain around 1/3 of IPOX portfolio returns leaving 2/3 as potentially unique factor footprint specific to new listings as defined by IPOX that cannot be fully duplicated by traditional factor-based investing.

Further research may explore how an IPO factor exposure may complement a traditional factor-based portfolio, by increasing the breadth of return drivers, while not increasing the concentration of the factors themselves.

¹⁵ Please contact IPOX Schuster LLC for more details.

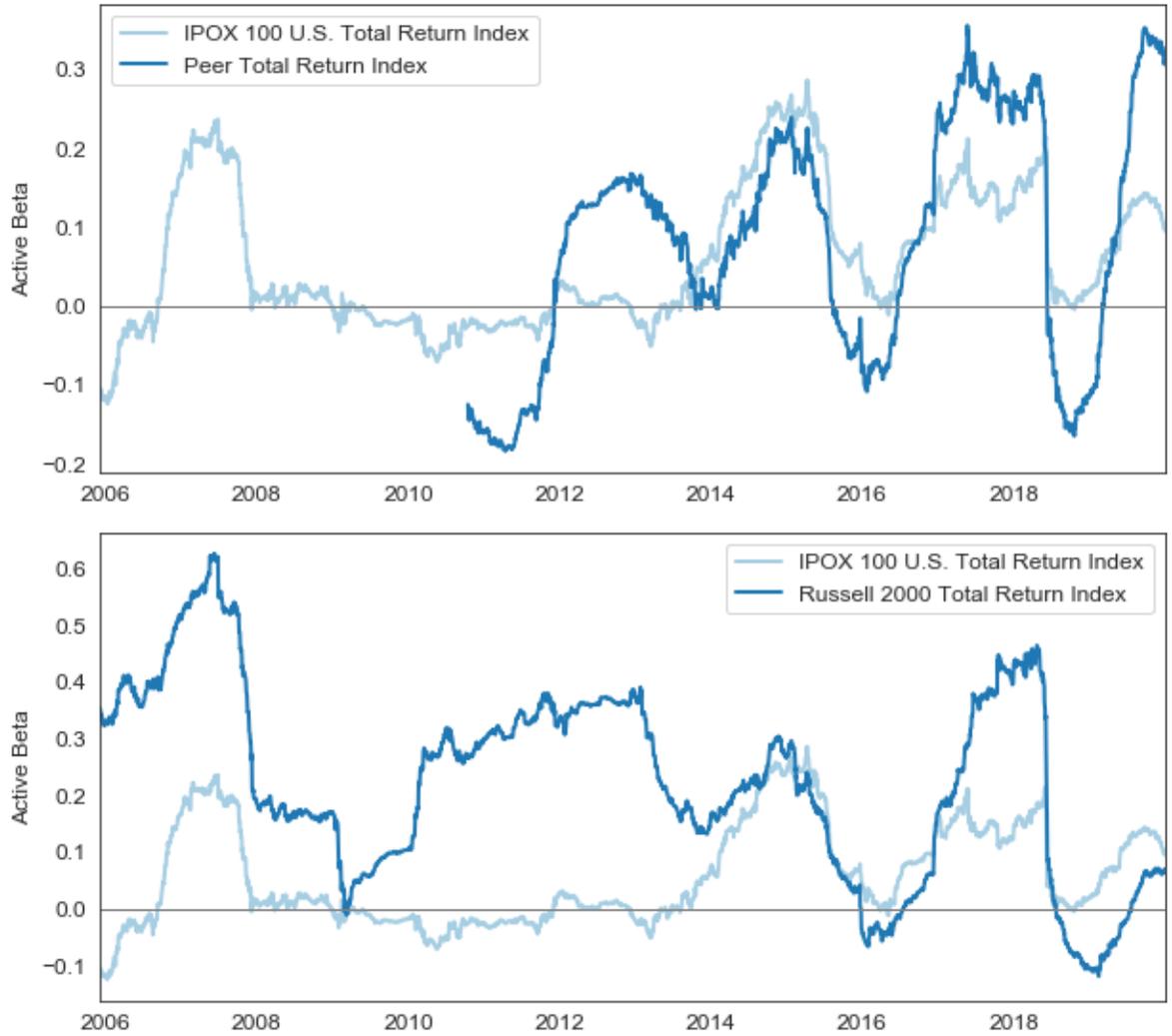
6 References

- Bennett, B., & Dam, R. A. (2018). Merger Activity, Stock Prices, and Measuring Gains from M&A. *SSRN Electronic Journal*. doi: 10.2139/ssrn.3000574
- Bender, J., Hammond, P. B., & Mok, W. (2013). Can Alpha Be Captured by Risk Premia? *SSRN Electronic Journal*. doi: 10.2139/ssrn.2543987
- Bergström, C., Nilsson, D., & Wahlberg, M. (2006). Underpricing and Long-Run Performance Patterns of European Private-Equity-Backed and Non-Private-Equity-Backed IPOs. *The Journal of Private Equity*, 9(4), 16–47. doi: 10.3905/jpe.2006.650457
- Bessler, W., & Seim, M. (2012). The performance of venture-backed IPOs in Europe. *Venture Capital*, 14(4), 215–239. doi: 10.1080/13691066.2012.702447
- Bouwman, C. H. S., Fuller, K., & Nain, A. S. (2007). Market Valuation and Acquisition Quality: Empirical Evidence. *Review of Financial Studies*, 22(2), 633–679. doi: 10.1093/rfs/hhm073
- Brau, J. C., & Fawcett, S. E. (2006). Initial Public Offerings: An Analysis of Theory and Practice. *The Journal of Finance*, 61(1), 399–436. doi: 10.1111/j.1540-6261.2006.00840.x
- Brav, A., & Gompers, P. A. (1997). Myth or Reality? The Long-Run Underperformance of Initial Public Offerings: Evidence from Venture and Nonventure Capital-Backed Companies. *The Journal of Finance*, 52: 1791-1821. doi:10.1111/j.1540-6261.1997.tb02742.x
- Cao, J. (2011). IPO Timing, Buyout Sponsors' Exit Strategies, and Firm Performance of RLBOs, *Journal of Financial and Quantitative Analysis* 46, 1001-1024.
- Celikyurt, U., Sevilir, M., & Shivdasani, A. (2008). Going Public to Acquire? The Acquisition Motive in IPOs. *SSRN Electronic Journal*. doi: 10.2139/ssrn.1153508
- Chen, H.-C., & Ho, K.-Y. (2009). Do IPO index portfolios improve the investment opportunities for mean-variance investors? *Finance Research Letters*, 6(3), 159–170. doi: 10.1016/j.frl.2009.03.001
- Clarkson, P. M., & Thompson, R. (1990). Empirical Estimates of Beta When Investors Face Estimation Risk. *The Journal of Finance*, 45(2), 431. doi: 10.2307/2328664
- Cronqvist, H., & Fahlenbrach, R. (2008). Large Shareholders and Corporate Policies. *Review of Financial Studies*, 22(10), 3941–3976. doi: 10.1093/rfs/hhn093
- Doidge, C., Karolyi, G. A., & Stulz, R. M. (2017). The U.S. listing gap. *Journal of Financial Economics*, 123(3), 464–487. doi: 10.1016/j.jfineco.2016.12.002
- Giannopoulos, G., Holt, A., Khansalar, E., & Mogoya, P. (2017). The Long-Run Performance of U.S. Bidding Firms in the Post M&A Period: The Impact of Bid Type, Payment Method and Industry Specialisation. *International Journal of Business and Management*, 12(2), 230. doi: 10.5539/ijbm.v12n2p230
- Hollowell, Byron J., The Long-Term Performance of Parent Firms and Their Spin-Offs (2009). *The International Journal of Business and Finance Research*, Vol. 3, No. 1, pp. 119-129.
- Ibbotson, R. G. (1975). Price performance of common stock new issues. *Journal of Financial Economics*, 2(3), 235–272. doi: 10.1016/0304-405x(75)90015-x
- Iliev, P., & Lowry, M. (2016). Venturing Beyond the IPO: Venture Capitalists Investments in Newly Public Firms. *SSRN Electronic Journal*. doi: 10.2139/ssrn.2766125
- Krishnan, C., Ivanov, V., Masulis, R., & Singh, A. (2011). Venture Capital Reputation, Post-IPO Performance, and Corporate Governance. *Journal of Financial and Quantitative Analysis*, 46(5), 1295-1333. doi:10.1017/S0022109011000251
- Levis, M. (2011). The Performance of Private Equity-Backed IPOs. *Financial Management*, 40(1), 253-277. Retrieved from <http://www.jstor.org/stable/41237903>
- McConnell, John & Ovtchinnikov, Alexei. (2004). Predictability of Long-Term Spin-Off Returns. *Journal of Investment Management*. 2.
- McConnell, J. J., Sibley, S. E., & Xu, W. (2015). The Stock Price Performance of Spin-Off Subsidiaries, Their Parents, and the Spin-Off ETF, 2001–2013. *The Journal of Portfolio Management*, 42(1), 143–152. doi: 10.3905/jpm.2015.42.1.143
- Mogilevsky, V., & Murgulov, Z. (2012). Underpricing of private equity backed, venture capital backed and non-sponsored IPOs. *Investment Management and Financial Innovations*, 9(3), 47 - 59.
- Ragozzino, R., & Reuer, J. J. (2007). Initial public offerings and the acquisition of entrepreneurial firms. *Strategic Organization*, 5(2), 155–176. doi: 10.1177/1476127007079139
- Ritter, J. R. (1991). The Long-Run Performance of initial Public Offerings. *The Journal of Finance*, 46(1), 3–27. doi: 10.1111/j.1540-6261.1991.tb03743.x

Tortoriello, R., Oyeniyi, T., Pope, D., Fruin, P., & Falk, R. (2016, August 26). Mergers & Acquisitions: The Good, the Bad, and the Ugly (and How to Tell Them Apart). Retrieved from <https://www.spglobal.com/en/research-insights/articles/Mergers-Acquisitions-The-Good-The-Bad-And-The-Ugly-And-How-To-Tell-Them-Apart>.

Appendix

Appendix 1: 12-Month Rolling Market Betas Overtime: August 6, 2004 - August 30, 2019¹⁶



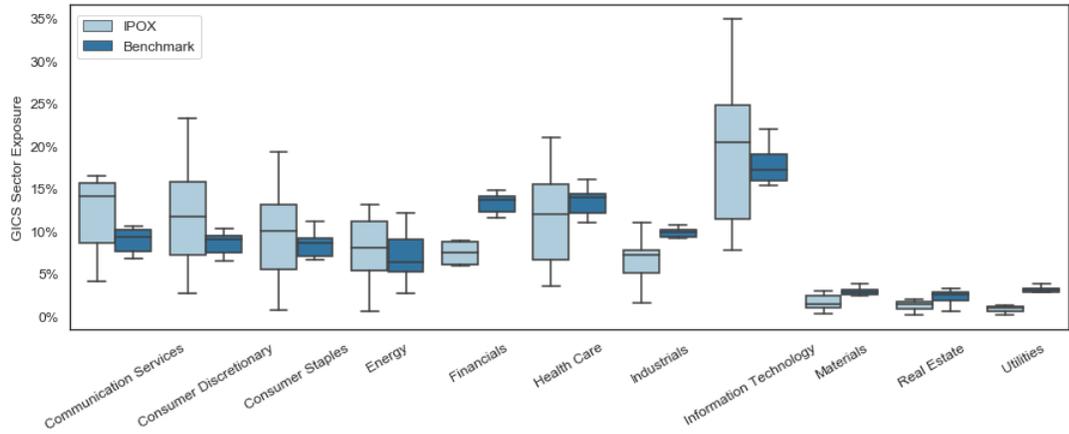
¹⁶Source: IPOX Schuster LLC, S&P Dow Jones Indices LLC, Bloomberg. The chart is provided for illustrative purposes only.

Appendix 2: Regression Result on Market Coefficient: August 6, 2004 - August 30, 2019¹⁷

Dep. Variable	IPOX excess return		R-squared:	0.001		
Model	OLS		Adj. R-squared:	0.001		
Method	Least Square		F-statistic:	5.563		
No. Observations	3874		Prob (F-statistic):	0.018		
Df Residuals	3872		Log-Likelihood:	15406		
Df Model	1		AIC:	-3.08E+04		
Covariance Type	nonrobust		BIC:	-3.08E+04		
	coef	std err	t	P> t 	[0.025	0.975]
S&P 500	0.015	0.006	2.359	0.018	0.003	0.027
Omnibus:	397.033		Durbin-Watson:	1.889		
Prob(Omnibus):	0.000		Jarque-Bera (JB):	2580.001		
Skew:	-0.25		Prob(JB):	0.00		
Kurtosis:	6.967		Cond. No.	87.3		

¹⁷Source: IPOX Schuster LLC, S&P Dow Jones Indices LLC, Bloomberg. Linear regression where the market index (S&P 500 index) return is the independent variable and the excess return of IPOX 100 U.S. index is the dependent variable.

Appendix 3: Sector Weightings Comparison: April 30, 2006 – August 30, 2019¹⁸



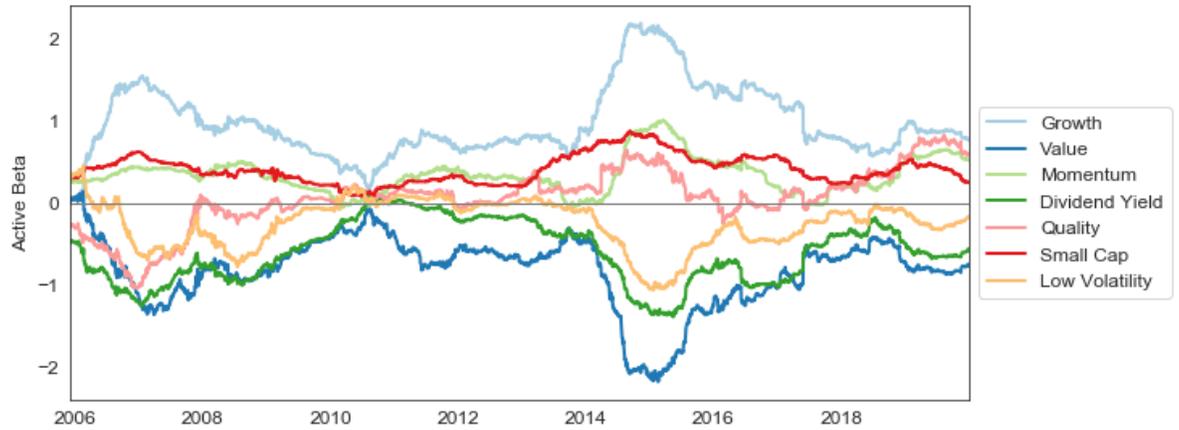
¹⁸Source: IPOX Schuster LLC, S&P Dow Jones Indices LLC, Bloomberg. Linear regression where the market index (S&P 500 index) return is the independent variable and the excess return of IPOX 100 U.S. index is the dependent variable.

Appendix 4: Regression Result on Sector Coefficients: August 6, 2004 - August 30, 2019¹⁹

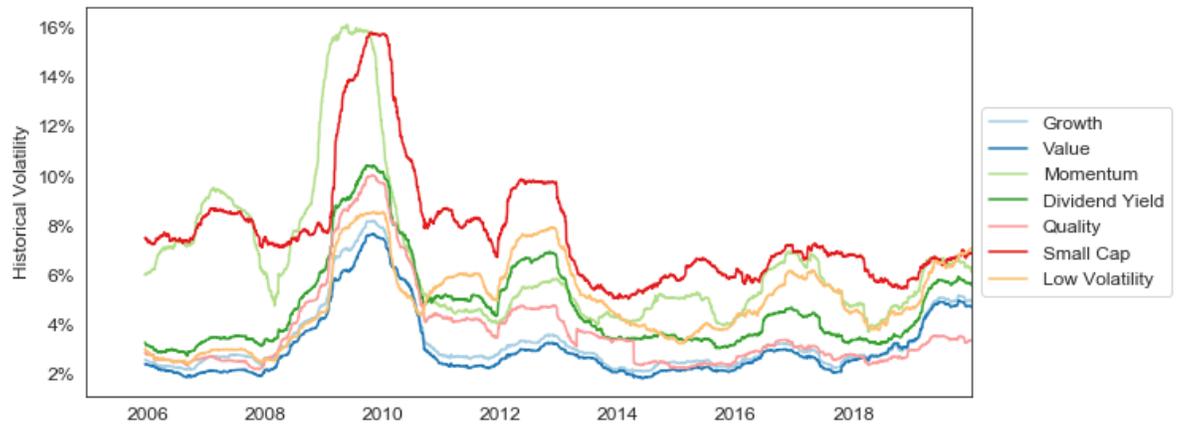
Dep. Variable	IPOX excess return		R-squared:	0.139		
Model	OLS		Adj. R-squared:	0.136		
Method	Least Square		F-statistic:	56.57		
No. Observations	3874		Prob (F-statistic):	8.72E-117		
Df Residuals	3862		Log-Likelihood:	15693		
Df Model	11		AIC:	-3.14E+04		
Covariance Type	nonrobust		BIC:	-3.13E+04		
	coef	std err	t	P> t 	[0.025	0.975]
Consumer Staples	-0.166	0.019	-8.896	0.000	-0.203	-0.130
Consumer Discretionary	0.117	0.020	5.759	0.000	0.077	0.156
Information Technology	-0.009	0.026	-0.345	0.730	-0.059	0.042
Industrials	-0.134	0.020	-6.857	0.000	-0.173	-0.096
Energy	-0.047	0.014	-3.410	0.001	-0.075	-0.020
Financials	-0.127	0.017	-7.241	0.000	-0.161	-0.092
Health Care	0.014	0.022	0.651	0.515	-0.028	0.056
Utilities	-0.046	0.011	-4.101	0.000	-0.067	-0.024
Communication Services	-0.061	0.010	-6.349	0.000	-0.079	-0.042
Materials	0.090	0.012	7.498	0.000	0.066	0.114
Real Estate	0.004	0.006	0.696	0.487	-0.008	0.016
Omnibus:	375.157		Durbin-Watson:	1.953		
Prob(Omnibus):	0.000		Jarque-Bera (JB):	2768.204		
Skew:	-0.082		Prob(JB):	0.00		
Kurtosis:	7.138		Cond. No.	632		

¹⁹Source: IPOX Schuster LLC, S&P Dow Jones Indices LLC, Bloomberg. Linear regression where the excess sector returns are the independent variables and the excess return of IPOX 100 U.S. index is the dependent variable.

Appendix 5: 12-Month Rolling Fundamental Factor Betas: August 6, 2004 - August 30, 2019²⁰



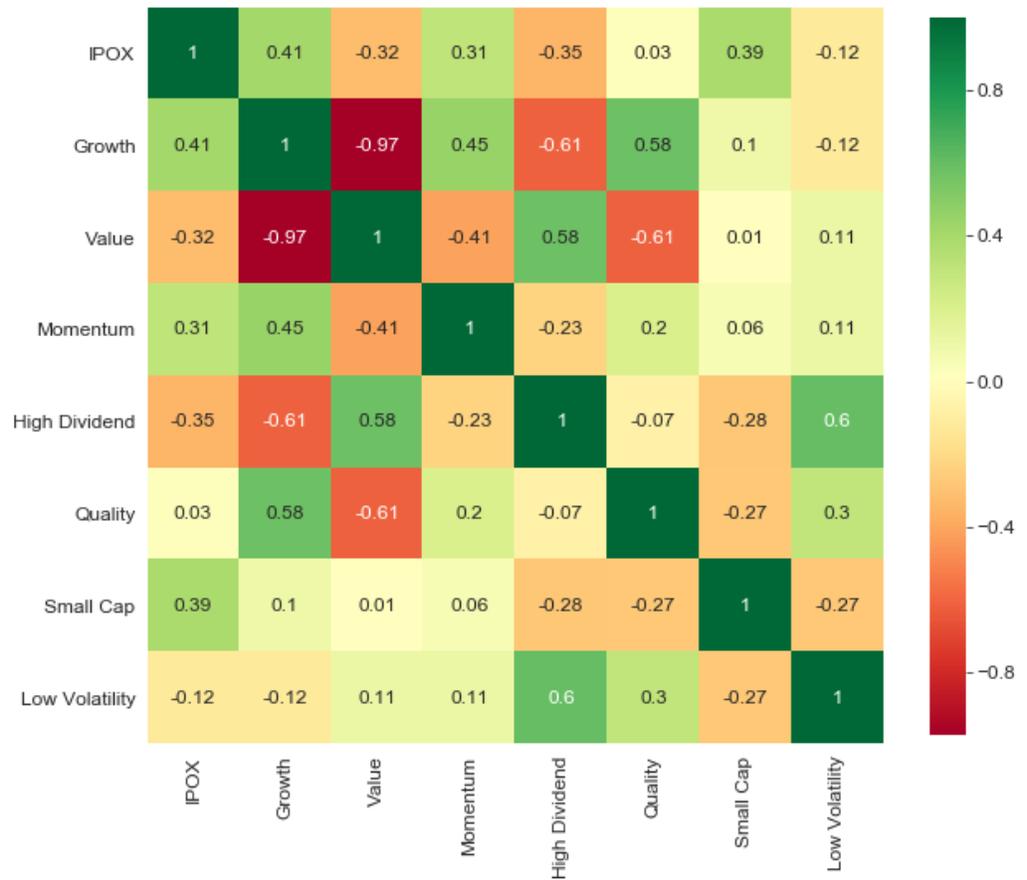
Appendix 6: 12-Month Rolling Historical Volatilities (%): August 6, 2004 - August 30, 2019²¹



²⁰Source: IPOX Schuster LLC, MSCI Inc., Bloomberg. The chart is provided for illustrative purposes only.

²¹Source: IPOX Schuster LLC, MSCI Inc., Bloomberg. The chart is provided for illustrative purposes only. Rolling volatilities are calculated based on portfolio excess returns.

Appendix 7: Correlation Heatmap for Active Factor Portfolio²²



²²Source: IPOX Schuster LLC, MSCI Inc., Bloomberg. The chart is provided for illustrative purposes only. Correlation is calculated by the one-to-one relationship between IPOX’s excess returns over benchmark to the excess returns of MSCI USA factor indices over the past 15 years (August 2004 - August 2019), respectively.

Appendix 8: Regression Result on Fundamental Factor Coefficients: August 6, 2004 - August 30, 2019²³

Dep. Variable	IPOX excess return		R-squared:	0.323		
Model	OLS		Adj. R-squared:	0.322		
Method	Least Square		F-statistic:	308.1		
No. Observations	3874		Prob (F-statistic):	1.48e-323		
Df Residuals	3867		Log-Likelihood:	16160		
Df Model	6		AIC:	-3.23E+04		
Covariance Type	nonrobust		BIC:	-3.23E+04		
	coef	std err	t	P> t 	[0.025	0.975]
Growth	0.817	0.049	16.670	0.000	0.721	0.913
Momentum	0.122	0.016	7.763	0.000	0.091	0.153
High Dividend	-0.053	0.033	-1.580	0.114	-0.118	0.013
Quality	-0.300	0.034	-8.693	0.000	-0.367	-0.232
Small Size	0.270	0.013	20.446	0.000	0.244	0.296
Low Volatility	0.099	0.026	3.760	0.000	0.047	0.150
Omnibus:	436.298		Durbin-Watson:	2.016		
Prob(Omnibus):	0.000		Jarque-Bera (JB):	3400.675		
Skew:	0.233		Prob(JB):	0.00		
Kurtosis:	7.566		Cond. No.	973		

²³Source: IPOX Schuster LLC, MSCI Inc., Bloomberg. Linear regression where the excess factor returns are the independent variables and the excess return of IPOX 100 U.S. index is the dependent variable.

Appendix 9: Regression Result on All Factor Coefficients: August 6, 2004 - August 30, 2019²⁴

Dep. Variable	IPOX excess return		R-squared:	0.345		
Model	OLS		Adj. R-squared:	0.342		
Method	Least Square		F-statistic:	127		
No. Observations	3874		Prob (F-statistic):	0		
Df Residuals	3857		Log-Likelihood:	16223		
Df Model	16		AIC:	-3.24E+04		
Covariance Type	nonrobust		BIC:	-3.23E+04		
	coef	std err	t	P> t 	[0.025	0.975]
Growth	0.960	0.065	15.011	0.000	0.843	1.096
Momentum	0.083	0.017	4.974	0.000	0.050	0.116
High Dividend	0.027	0.035	0.777	0.437	-0.042	0.096
Quality	-0.290	0.038	-7.573	0.000	-0.365	-0.215
Small Size	0.292	0.015	20.097	0.000	0.264	0.321
Low Volatility	0.182	0.040	4.584	0.000	0.104	0.259
Consumer Staples	-0.066	0.016	-4.038	0.000	-0.098	-0.034
Consumer Discretionary	-0.009	0.017	-0.521	0.602	-0.042	0.024
Information Technology	-0.093	0.021	-4.363	0.000	-0.135	-0.051
Industrials	-0.102	0.015	-6.700	0.000	-0.132	-0.072
Energy	-0.007	0.009	-0.763	0.446	-0.024	0.010
Health Care	-0.012	0.016	-0.741	0.459	-0.042	0.019
Utilities	-0.021	0.010	-2.200	0.028	-0.040	-0.002
Communication Services	-0.007	0.008	-0.808	0.419	-0.022	0.009
Materials	0.026	0.010	2.583	0.010	0.006	0.046
Real Estate	-0.036	0.006	-6.451	0.047	-0.047	-0.025
Omnibus:	444.225		Durbin-Watson:	2.022		
Prob(Omnibus):	0.000		Jarque-Bera (JB):	3663.537		
Skew:	0.216		Prob(JB):	0.00		
Kurtosis:	7.744		Cond. No.	1.21E+03		

²⁴Source: IPOX Schuster LLC, MSCI Inc., Bloomberg. Linear regression where the excess sector and fundamental factor returns are the independent variables and the excess return of IPOX 100 U.S. index is the dependent variable.

Appendix 10: Cumulative Price Return Comparison between IPO M&As Portfolio and S&P 500 Index: January 3, 2011 - August 30, 2019²⁵



²⁵Source: IPOX Schuster LLC, Bloomberg. Past performance is not a guarantee of future results. IPO M&A performance as captured by the IPOX® GINDEX™ Index.