Homework 4

Evaluation of Portfolio Performance

107B (5587) Investments　王傳鈞　0416047

第一題

* 使用[Morningstar Fund Screener](http://screen.morningstar.com/FundResults.html)進行條件篩選之後，挑選出其中兩個具特殊的US equity fund：[JPMorgan Large Cap Growth R5](https://am.jpmorgan.com/us/en/asset-management/gim/adv/products/d/jpmorgan-large-cap-growth-fund-r5-4812c2379) ([JLGRX](https://www.morningstar.com/funds/XNAS/JLGRX/quote.html))、  
  [AB Growth Fund Advisor Class](https://www.alliancebernstein.com/funds/us/equities/us/growth/growth.htm) ([AGRYX](https://www.morningstar.com/funds/XNAS/AGRYX/quote.html))。
* 上述基金名稱的後綴字：「R5」代表Retirement shares，也就是只能透過401k等退休基金來購買；「Advisor Class」則代表該基金通常只能透過理財顧問等管道來購買。
* 關於JLGRX和AGRYX的一些特點，請詳閱表格一、表格二或上述網址。

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| JPMorgan Large Cap Growth R5 ( JLGRX ) | | | | | | | | |
| Overview | | | | | | | | |
| Fund Family | JPMorgan | | Inception Date | | | 2009-04-14 | | |
| Category | Large Growth | | Manager | | | Giri Devulapally | | |
| Objectives | Targeting companies with large markets, sustainable competitive advantages and strong price momentum, JLGRX seeks to harness the return potential of America’s fastest growing companies. | | | | | | | |
| NAV | $40.87 (@2019-05-24) | | Total Assets | | | $14.9 Billion (@2019-05-24) | | |
| Turnover | 24% | | Total Cost Projections | | |  | Per $10K | |
| Net Expense | 0.59% | | 3 Yr | 208 | |
| Other Fees | N/A | | 5 Yr | 374 | |
| Top 5 Holdings | Amazon (5.91%), Microsoft (4.73%), Mastercard (4.59%), Alphabet (4.50%), Apple (4.10%) | | | | | | | |
| Performance | | | | | | | | |
|  | YTD | 1 Mo | | 1 Yr | 3 Yr | | | 5 Yr |
| JLGRX (A) | 20.85% | -1.40% | | 8.61% | 20.32% | | | 14.63% |
| S&P500 TR(B) | 13.67% | -3.25% | | 5.71% | 13.09% | | | 10.51% |
| VFINX (C) | 13.62% | -3.26% | | 5.57% | 12.95% | | | 10.36% |
| (A) - (B) | +7.17% | +1.85% | | +2.90% | +7.23% | | | +4.12% |
| (A) – (C) | +7.23% | +1.86% | | +3.04% | +7.37% | | | +4.27% |

Table 1 Summary of Some Key Information of JLGRX

Table 2 Summary of Some Key Information of AGRYX

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| AB Growth Fund Advisor Class ( AGRYX ) | | | | | | | | |
| Overview | | | | | | | | |
| Fund Family | AllianceBernstein | | Inception Date | | | 1996-10-01 | | |
| Category | Large Growth | | Manager | | | Frank Caruso | | |
| Objectives | Seeks stocks with the potential to deliver better-than-expected long-term growth potential and target firms with strong, experienced management teams and strong market positions. | | | | | | | |
| NAV | $84.83 (@2019-05-24) | | Total Assets | | | $1.1 Billion (@2019-05-24) | | |
| Turnover | 46% | | Total Cost Projections | | |  | Per $10K | |
| Net Expense | 0.93% | | 3 Yr | 302 | |
| Other Fees | N/A | | 5 Yr | 525 | |
| Top 5 Holdings | Alphabet (7.76%), Visa (3.91%), Costco (3.31%), Home Depot (3.24%), Monster Beverage (3.13%) | | | | | | | |
| Performance | | | | | | | | |
|  | YTD | 1 Mo | | 1 Yr | 3 Yr | | | 5 Yr |
| AGRYX (A) | 16.60% | -3.70% | | 11.66% | 18.87% | | | 15.18% |
| S&P500 TR(B) | 13.67% | -3.25% | | 5.71% | 13.09% | | | 10.51% |
| VFINX (C) | 13.62% | -3.26% | | 5.57% | 12.95% | | | 10.36% |
| (A) - (B) | +2.93% | -0.45% | | +5.94% | +5.77% | | | +4.67% |
| (A) – (C) | +2.98% | -0.44% | | +6.09% | +5.92% | | | +4.82% |

第二題

1. 表格三提供了有關於JLGRX、AGRYX以及VFINX，從2014年1月到2018年12月的每月報酬率，表格四則提供了利用每月報酬率再去計算所得到的其他統計數據。

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Date | VFINX | JLGRX | AGRYX | Date | VFINX | JLGRX | AGRYX |
| Feb-2014 | 4.56% | 5.73% | 5.50% | Jul-2016 | 4.17% | 5.20% | 5.47% |
| Mar-2014 | 0.40% | -5.06% | -3.24% | Aug-2016 | 0.13% | -0.40% | -0.14% |
| Apr-2014 | 1.15% | -1.62% | -0.65% | Sep-2016 | -0.42% | 1.57% | -0.12% |
| May-2014 | 2.33% | 4.03% | 3.20% | Oct-2016 | -1.41% | -1.57% | -2.39% |
| Jun-2014 | 1.62% | 1.42% | 2.07% | Nov-2016 | 3.70% | 0.46% | 1.01% |
| Jul-2014 | -0.97% | 0.03% | -1.17% | Dec-2016 | 1.35% | 1.11% | 1.33% |
| Aug-2014 | 3.99% | 5.10% | 4.08% | Jan-2017 | 2.49% | 4.59% | 2.97% |
| Sep-2014 | -1.86% | -1.57% | -0.30% | Feb-2017 | 3.96% | 3.39% | 4.36% |
| Oct-2014 | 2.88% | 3.33% | 3.61% | Mar-2017 | -0.34% | 2.39% | 1.21% |
| Nov-2014 | 2.68% | 1.77% | 3.06% | Apr-2017 | 1.46% | 2.95% | 4.13% |
| Dec-2014 | -0.79% | -2.13% | -5.15% | May-2017 | 1.39% | 6.05% | 3.05% |
| Jan-2015 | -2.49% | 1.18% | 3.14% | Jun-2017 | 0.18% | -0.59% | -0.31% |
| Feb-2015 | 5.73% | 6.55% | 7.44% | Jul-2017 | 2.48% | 2.87% | 1.61% |
| Mar-2015 | -2.06% | -1.38% | -0.44% | Aug-2017 | 0.29% | 1.57% | 2.14% |
| Apr-2015 | 1.44% | 0.58% | -0.89% | Sep-2017 | 1.56% | 1.03% | 1.37% |
| May-2015 | 1.27% | 2.76% | 1.93% | Oct-2017 | 2.82% | -8.83% | 3.43% |
| Jun-2015 | -2.36% | -1.06% | 0.16% | Nov-2017 | 3.06% | 18.51% | 4.58% |
| Jul-2015 | 2.53% | 4.48% | 3.45% | Dec-2017 | 0.64% | 0.05% | -8.15% |
| Aug-2015 | -6.04% | -6.32% | -5.58% | Jan-2018 | 6.19% | 9.89% | 16.20% |
| Sep-2015 | -2.98% | -4.06% | -2.12% | Feb-2018 | -3.70% | -1.37% | -1.56% |
| Oct-2015 | 8.96% | 7.18% | 7.50% | Mar-2018 | -2.97% | -2.94% | -1.31% |
| Nov-2015 | 0.29% | 1.17% | 0.79% | Apr-2018 | 0.80% | 1.11% | 0.62% |
| Dec-2015 | -2.14% | -5.14% | -9.29% | May-2018 | 2.39% | 4.89% | 3.99% |
| Jan-2016 | -4.45% | -5.18% | 2.73% | Jun-2018 | 0.16% | 1.32% | 1.89% |
| Feb-2016 | -0.15% | -2.36% | -0.41% | Jul-2018 | 4.16% | 1.21% | 2.50% |
| Mar-2016 | 6.23% | 5.61% | 5.55% | Aug-2018 | 3.25% | 6.97% | 4.48% |
| Apr-2016 | 0.89% | -1.16% | -1.12% | Sep-2018 | 0.13% | 0.93% | 0.21% |
| May-2016 | 1.78% | 2.91% | 1.98% | Oct-2018 | -6.45% | -10.46% | -7.88% |
| Jun-2016 | -0.22% | -2.36% | -1.47% | Nov-2018 | 2.03% | -0.52% | 3.81% |
|  |  |  |  | Dec-2018 | -9.50% | -20.40% | -19.68% |

Table 3 Monthly Returns of VFINX, JLGRX, and AGRYX during Feb-2014 to Dec-2018

|  |  |  |  |
| --- | --- | --- | --- |
|  | VFINX | JLGRX | AGRYX |
| Mean | 0.78% | 0.77% | 0.90% |
| Standard Deviation | 3.22% | 5.32% | 4.84% |

Table 4 Means and Standard Deviations of Table 2

1. 根據[Kenneth R. French - Data Library](https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html)所提供的[資料](https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/F-F_Research_Data_Factors_CSV.zip)，將市場指數的每月報酬率與JLGRX、AGRYX以及VFINX分別進行CAPM分析，再經過若干計算之後，即可得到Sharpe Ratio、Treynor measure、Jensen’s measure、M2、T2以及information ratio等指標，詳細數據請見表格五。

根據表格五所顯示的數據，我們可以發現到VFINX在各項指標上均勝過JLGRX和AGRYX。事實上，JLGRX和AGRYX都是Morningstar五星基金裡頭的常客，而且也被Morningstar認為是五星等級裡頭前10%優良的開放型基金，反倒是VFINX僅獲四星評價。雖然從今年初(2019)到5/24為止，JLGRX和AGRYX的累積報酬率都超越了VFINX(請見表格一和表格二)，但是若我們以長期表現來看，VFINX並不會表現得比較差。

|  |  |  |  |
| --- | --- | --- | --- |
| ( in decimals ) | VFINX | JLGRX | AGRYX |
| Sharpe Ratio | 0.2287 | 0.1356 | 0.1763 |
| Treynor Measure | 0.7574 | 0.5765 | 0.7566 |
| Jensen’s Measure | 0.0354 | -0.1810 | 0.0402 |
| M Square | 0.0232 | -0.2796 | -0.1473 |
| T Square | 0.0364 | -0.1445 | 0.0356 |
| Information Ratio | 0.0588 | -0.0528 | 0.0127 |

Table 5 Several Performance Evaluation Ratios of VFINX, JLGRX, and AGRYX (CAPM)

1. 根據課本裡Treynor & Mazuy (TM model)和Henriksson & Merton (HM model)對於市場擇時所定義的公式，將其套用到JLGRX、AGRYX以及VFINX每月報酬率資料，我們可以得到表格六。

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ( in decimals ) | VFINX | | JLGRX | | AGRYX | |
| Model | TM | HM | TM | HM | TM | HM |
| Alpha (a) | -0.0173 | -0.0727 | 0.3735 | 0.3784 | 0.2456 | -0.0929 |
| Beta (b) | 0.9760 | 0.9303 | 1.2132 | 1.4697 | 1.1138 | 1.0767 |
| Timing (c) | 0.0045 | 0.0860 | -0.0479 | -0.4447 | -0.0177 | 0.1058 |
| Adj. R Square | 0.9647 | 0.9649 | 0.5985 | 0.5814 | 0.5655 | 0.5618 |

Table 6 Tests of Market Timing Ability for VFINX, JLGRX, and AGRYX

根據表格六所顯示的數據，我們可以觀察到以下點：首先，即使VFINX的投資策略相當簡單，但它仍然具有市場擇時的跡象；接著，JLGRX完全不具有市場擇時的跡象，縱使該基金的投資理念表明管理者想要「駕馭」美國高成長公司所帶來的獲利性；最後，雖然AGRYX以HM model來看似乎具有市場擇時能力，但是基金管理者顯然沒辦法運用這樣的能力去獲取positive abnormal returns。

1. 根據[Kenneth R. French - Data Library](https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html)所提供的[資料](https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/F-F_Research_Data_Factors_CSV.zip)，將市場指數的每月報酬率與JLGRX、AGRYX以及VFINX分別進行三因子模型分析，再經過若干計算，我們可以得到一些指標，詳細請見表格七之「3 FA」橫列。

觀察表格七，我們可以明顯地發現到三因子模型比CAPM，對於JLGRX、AGRYX以及VFINX的每月報酬率資料，有更佳的解釋能力(adj. R2上升)，而且原本在CAPM認為的positive abnormal returns，都被三因子模型認為是負的異常報酬。另外，雖然三者在CAPM和三因子模型之下都沒辦法得到Jensen’s measure不顯著異於零的結果，不過三者從CAPM到三因子模型的過程中，Jensen’s measure的p-value均下降，也顯示三因子模型具有較強的報酬率解釋力。

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ( in decimals ) | VFINX | JLGRX | AGRYX |
| CAPM | Jensen’s Measure | 0.0354 | -0.1810 | 0.0402 |
| Adj. R Square | 0.9647 | 0.5802 | 0.5689 |
| 3 FA | Jensen’s Measure | -0.0298 | -0.2690 | -0.0568 |
| Adj. R Square | 0.9841 | 0.6185 | 0.5886 |
| 4 FA | Jensen’s Measure | -0.0261 | -0.2767 | -0.1194 |
| Adj. R Square | 0.9840 | 0.6116 | 0.5954 |
| 5 FA | Jensen’s Measure | -0.0375 | -0.3386 | -0.1644 |
| Adj. R Square | 0.9847 | 0.6134 | 0.5997 |

Table 7 Comparison of Some Ratios between CAPM and 3-, 4-, &5-Factor Models

1. 根據[Kenneth R. French - Data Library](https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html)所提供的[資料](https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/F-F_Momentum_Factor_CSV.zip)，搭配上第四小題的部分資料，重複如同第四小題的分析方法，我們可以得到四因子模型分析的結果，詳細請見表格七之「4 FA」橫列。

和三因子模型相比，Carhart四因子模型多了衡量股價動能的momentum factor，將持續上漲或持續下跌這樣子常見的因素納入解釋股價月報酬率的模型之中。然而，在JLGRX、AGRYX以及VFINX於2014年1月到2018年12月的每月報酬率資料當中，似乎並沒有因為多了這個因子而讓模型的解釋能力有顯著提升，甚至對於JLGRX來說，adj. R2是不升反降的。

1. 根據[Kenneth R. French - Data Library](https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html)所提供的[資料](https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/F-F_Research_Data_5_Factors_2x3_CSV.zip)，重複如同第四小題的分析方法，我們可以得到五因子模型分析的結果，詳細請見表格七之  
   「5 FA」橫列。

和三因子模型相比，五因子模型是在大約20年之後由原作者們所推出的修正版本，加入有關於公司獲利能力與公司投資金額大小的兩個因子，希望能夠提升模型解釋股價月報酬率的能力。表格七清楚地展現了由CAPM(a.k.a.單因子模型)、三因子模型、到五因子模型adj. R2的改變趨勢。毫無疑問地，五因子模型均比CAPM來的更有解釋能力，但五因子模型是否勝過三因子模型則沒有明顯的趨勢。對於VFINX和AGRYX來說，五因子模型稍微地比三因子模型更具解釋力，但是我們卻看不到這樣子的現象於JLGRX之上。

Appendix

* 以下附上有關於CAPM、3-factor model、4-factor model、5-factor model、TM model以及HM model的回歸詳細結果。

1. Vanguard 500 Index Fund Investor Shares (VFINX)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Regression Results of VFINX | | | | | | | | | |
| CAPM | | | | | | | | | |
| Regression  Statistics | Multiple R | 0.982489 | | | | | | | |
| R Square | 0.965284 | | | | | | | |
| Adj. R Square | 0.964675 | | | | | | | |
| Standard Error | 0.607041 | | | | | | | |
| Observations | 59 | | | | | | | |
| ANOVA |  | df | SS | | MS | | F | | Sign. F |
| Regression | 1 | 584.030889 | | 584.030889 | | 1584.893351 | | ≈ 0 |
| Residual | 57 | 21.004417 | | 0.368499 | |  | |  |
| Total | 58 | 605.035305 | |  | |  | |  |
| Results |  | Coef. | | Std. Error | | t Stat. | | p-value | |
| Alpha | 0.035410 | | 0.080968 | | 0.437332 | | 0.663523 | |
| BetaMarket | 0.972264 | | 0.024422 | | 39.810719 | | ≈ 0 | |
| 3-Factor Model | | | | | | | | | |
| Regression  Statistics | Multiple R | 0.992456 | | | | | | | |
| R Square | 0.984969 | | | | | | | |
| Adj. R Square | 0.984149 | | | | | | | |
| Standard Error | 0.406639 | | | | | | | |
| Observations | 59 | | | | | | | |
| ANOVA |  | df | SS | | MS | | F | | Sign. F |
| Regression | 3 | 595.940781 | | 198.646927 | | 1201.336108 | | ≈ 0 |
| Residual | 55 | 9.094525 | | 0.165355 | |  | |  |
| Total | 58 | 605.035305 | |  | |  | |  |
| Results |  | Coef. | | Std. Error | | t Stat. | | p-value | |
| Alpha | -0.029847 | | 0.054833 | | -0.544316 | | 0.588424 | |
| BetaMarket | 1.010440 | | 0.017109 | | 59.060491 | | ≈ 0 | |
| BetaSMB | -0.180017 | | 0.021481 | | -8.380311 | | ≈ 0 | |
| BetaHML | -0.011459 | | 0.022299 | | -0.513876 | | 0.609397 | |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Regression Results of VFINX (cont.) | | | | | | | | | |
| 4-Factor Model | | | | | | | | | |
| Regression  Statistics | Multiple R | 0.992510 | | | | | | | |
| R Square | 0.985076 | | | | | | | |
| Adj. R Square | 0.983971 | | | | | | | |
| Standard Error | 0.408915 | | | | | | | |
| Observations | 59 | | | | | | | |
| ANOVA |  | df | SS | | MS | | F | | Sign. F |
| Regression | 4 | 596.005875 | | 149.001469 | | 891.094912 | | ≈ 0 |
| Residual | 54 | 9.029430 | | 0.167212 | |  | |  |
| Total | 58 | 605.035305 | |  | |  | |  |
| Result |  | Coef. | | Std. Error | | t Stat. | | p-value | |
| Alpha | -0.026112 | | 0.055464 | | -0.470786 | | 0.639690 | |
| BetaMarket | 1.007607 | | 0.017794 | | 56.627487 | | ≈ 0 | |
| BetaSMB | -0.179740 | | 0.021606 | | -8.319094 | | ≈ 0 | |
| BetaHML | -0.020705 | | 0.026878 | | -0.770330 | | 0.444461 | |
| BetaMOM | -0.012548 | | 0.020111 | | -0.623935 | | 0.535298 | |
| 5-Factor Model | | | | | | | | | |
| Regression  Statistics | Multiple R | 0.992979 | | | | | | | |
| R Square | 0.986007 | | | | | | | |
| Adj. R Square | 0.984687 | | | | | | | |
| Standard Error | 0.399680 | | | | | | | |
| Observations | 59 | | | | | | | |
| ANOVA |  | df | SS | | MS | | F | | Sign. F |
| Regression | 5 | 596.568873 | | 119.313775 | | 746.906126 | | ≈ 0 |
| Residual | 53 | 8.466432 | | 0.159744 | |  | |  |
| Total | 58 | 605.035305 | |  | |  | |  |
| Result |  | Coef. | | Std. Error | | t Stat. | | p-value | |
| Alpha | -0.037513 | | 0.054532 | | -0.687916 | | 0.494506 | |
| BetaMarket | 1.017443 | | 0.017405 | | 58.457413 | | ≈ 0 | |
| BetaSMB | -0.177613 | | 0.023789 | | -7.466186 | | ≈ 0 | |
| BetaHML | -0.004357 | | 0.029388 | | -0.148252 | | 0.882707 | |
| BetaRMW | 0.022288 | | 0.042223 | | 0.527859 | | 0.599800 | |
| BetaCMA | 0.035428 | | 0.047875 | | 0.740013 | | 0.462558 | |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Regression Results of VFINX (cont.) | | | | | | | | | |
| TM Model | | | | | | | | | |
| Regression  Statistics | Multiple R | 0.982801 | | | | | | | |
| R Square | 0.965897 | | | | | | | |
| Adj. R Square | 0.964679 | | | | | | | |
| Standard Error | 0.607005 | | | | | | | |
| Observations | 59 | | | | | | | |
| ANOVA |  | df | SS | | MS | | F | | Sign. F |
| Regression | 2 | 584.401837 | | 292.200918 | | 793.044141 | | ≈ 0 |
| Residual | 56 | 20.633469 | | 0.368455 | |  | |  |
| Total | 58 | 605.035305 | |  | |  | |  |
| Result |  | Coef. | | Std. Error | | t Stat. | | p-value | |
| Alpha (a) | -0.017299 | | 0.096512 | | -0.179242 | | 0.858395 | |
| Beta (b) | 0.976008 | | 0.024704 | | 39.507823 | | ≈ 0 | |
| Timing (c) | 0.004550 | | 0.004534 | | 1.003378 | | 0.319995 | |
| HM Model | | | | | | | | | |
| Regression  Statistics | Multiple R | 0.982923 | | | | | | | |
| R Square | 0.966138 | | | | | | | |
| Adj. R Square | 0.964928 | | | | | | | |
| Standard Error | 0.604858 | | | | | | | |
| Observations | 59 | | | | | | | |
| ANOVA |  | df | SS | | MS | | F | | Sign. F |
| Regression | 2 | 584.547505 | | 292.273753 | | 798.881778 | | ≈ 0 |
| Residual | 56 | 20.487800 | | 0.365854 | |  | |  |
| Total | 58 | 605.035305 | |  | |  | |  |
| Result |  | Coef. | | Std. Error | | t Stat. | | p-value | |
| Alpha (a) | -0.072726 | | 0.121613 | | -0.598011 | | 0.552244 | |
| Beta (b) | 0.930308 | | 0.042881 | | 21.695270 | | ≈ 0 | |
| Timing (c) | 0.085954 | | 0.072333 | | 1.188312 | | 0.239726 | |

1. JPMorgan Large Cap Growth R5 (JLGRX)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Regression Results of JLGRX | | | | | | | | | |
| CAPM | | | | | | | | | |
| Regression  Statistics | Multiple R | 0.766457 | | | | | | | |
| R Square | 0.587456 | | | | | | | |
| Adj. R Square | 0.580219 | | | | | | | |
| Standard Error | 3.455879 | | | | | | | |
| Observations | 59 | | | | | | | |
| ANOVA |  | df | SS | | MS | | F | | Sign. F |
| Regression | 1 | 969.387914 | | 969.387914 | | 81.167186 | | ≈ 0 |
| Residual | 57 | 680.756769 | | 11.943101 | |  | |  |
| Total | 58 | 1650.144683 | |  | |  | |  |
| Results |  | Coef. | | Std. Error | | t Stat. | | p-value | |
| Alpha | -0.180996 | | 0.460950 | | -0.392659 | | 0.696036 | |
| BetaMarket | 1.252608 | | 0.139035 | | 9.009283 | | ≈ 0 | |
| 3-Factor Model | | | | | | | | | |
| Regression  Statistics | Multiple R | 0.992456 | | | | | | | |
| R Square | 0.984969 | | | | | | | |
| Adj. R Square | 0.984149 | | | | | | | |
| Standard Error | 0.406639 | | | | | | | |
| Observations | 59 | | | | | | | |
| ANOVA |  | df | SS | | MS | | F | | Sign. F |
| Regression | 3 | 595.940781 | | 198.646927 | | 1201.336108 | | ≈ 0 |
| Residual | 55 | 9.094525 | | 0.165355 | |  | |  |
| Total | 58 | 605.035305 | |  | |  | |  |
| Results |  | Coef. | | Std. Error | | t Stat. | | p-value | |
| Alpha | -0.029847 | | 0.054833 | | -0.544316 | | 0.588424 | |
| BetaMarket | 1.010440 | | 0.017109 | | 59.060491 | | ≈ 0 | |
| BetaSMB | -0.180017 | | 0.021481 | | -8.380311 | | ≈ 0 | |
| BetaHML | -0.011459 | | 0.022299 | | -0.513876 | | 0.609397 | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Regression Results of JLGRX (cont.) | | | | | | | | | |
| 4-Factor Model | | | | | | | | | |
| Regression  Statistics | Multiple R | 0.798996 | | | | | | | |
| R Square | 0.638394 | | | | | | | |
| Adj. R Square | 0.611608 | | | | | | | |
| Standard Error | 3.324161 | | | | | | | |
| Observations | 59 | | | | | | | |
| ANOVA |  | df | SS | | MS | | F | | Sign. F |
| Regression | 4 | 1053.442214 | | 263.360554 | | 23.833436 | | ≈ 0 |
| Residual | 54 | 596.702468 | | 11.050046 | |  | |  |
| Total | 58 | 1650.144683 | |  | |  | |  |
| Result |  | Coef. | | Std. Error | | t Stat. | | p-value | |
| Alpha | -0.276698 | | 0.450881 | | -0.613683 | | 0.542001 | |
| BetaMarket | 1.230416 | | 0.144648 | | 8.506275 | | ≈ 0 | |
| BetaSMB | -0.022050 | | 0.175638 | | -0.125542 | | 0.900561 | |
| BetaHML | -0.477792 | | 0.218498 | | -2.186713 | | 0.033115 | |
| BetaMOM | 0.025856 | | 0.163488 | | 0.158153 | | 0.874926 | |
| 5-Factor Model | | | | | | | | | |
| Regression  Statistics | Multiple R | 0.804197 | | | | | | | |
| R Square | 0.646733 | | | | | | | |
| Adj. R Square | 0.613405 | | | | | | | |
| Standard Error | 3.316461 | | | | | | | |
| Observations | 59 | | | | | | | |
| ANOVA |  | df | SS | | MS | | F | | Sign. F |
| Regression | 5 | 1067.202289 | | 213.440458 | | 19.405595 | | ≈ 0 |
| Residual | 53 | 582.942394 | | 10.998913 | |  | |  |
| Total | 58 | 1650.144683 | |  | |  | |  |
| Result |  | Coef. | | Std. Error | | t Stat. | | p-value | |
| Alpha | -0.338553 | | 0.452494 | | -0.748194 | | 0.457650 | |
| BetaMarket | 1.225960 | | 0.144422 | | 8.488740 | | ≈ 0 | |
| BetaSMB | 0.083071 | | 0.197396 | | 0.420832 | | 0.675579 | |
| BetaHML | -0.503627 | | 0.243858 | | -2.065251 | | 0.043805 | |
| BetaRMW | 0.394491 | | 0.350358 | | 1.125965 | | 0.265253 | |
| BetaCMA | -0.039931 | | 0.397256 | | -0.100516 | | 0.920314 | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Regression Results of JLGRX (cont.) | | | | | | | | | |
| TM Model | | | | | | | | | |
| Regression  Statistics | Multiple R | 0.782515 | | | | | | | |
| R Square | 0.612330 | | | | | | | |
| Adj. R Square | 0.598485 | | | | | | | |
| Standard Error | 3.379854 | | | | | | | |
| Observations | 59 | | | | | | | |
| ANOVA |  | df | SS | | MS | | F | | Sign. F |
| Regression | 2 | 1010.433740 | | 505.216870 | | 44.226451 | | ≈ 0 |
| Residual | 56 | 639.710942 | | 11.423410 | |  | |  |
| Total | 58 | 1650.144683 | |  | |  | |  |
| Result |  | Coef. | | Std. Error | | t Stat. | | p-value | |
| Alpha (a) | 0.373453 | | 0.537387 | | 0.694942 | | 0.489965 | |
| Beta (b) | 1.213222 | | 0.137555 | | 8.819910 | | ≈ 0 | |
| Timing (c) | -0.047860 | | 0.025248 | | -1.895556 | | 0.063184 | |
| HM Model | | | | | | | | | |
| Regression  Statistics | Multiple R | 0.771904 | | | | | | | |
| R Square | 0.595836 | | | | | | | |
| Adj. R Square | 0.581401 | | | | | | | |
| Standard Error | 3.451009 | | | | | | | |
| Observations | 59 | | | | | | | |
| ANOVA |  | df | SS | | MS | | F | | Sign. F |
| Regression | 2 | 983.214804 | | 491.607402 | | 41.278724 | | ≈ 0 |
| Residual | 56 | 666.929878 | | 11.909462 | |  | |  |
| Total | 58 | 1650.144683 | |  | |  | |  |
| Result |  | Coef. | | Std. Error | | t Stat. | | p-value | |
| Alpha (a) | 0.378434 | | 0.693858 | | 0.545406 | | 0.587640 | |
| Beta (b) | 1.469663 | | 0.244655 | | 6.007084 | | ≈ 0 | |
| Timing (c) | -0.444678 | | 0.412695 | | -1.077497 | | 0.285878 | |

1. AB Growth Fund Advisor Class (AGRYX)

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Regression Results of AGRYX | | | | | | | | | |
| CAPM | | | | | | | | | |
| Regression  Statistics | Multiple R | 0.759163 | | | | | | | |
| R Square | 0.576329 | | | | | | | |
| Adj. R Square | 0.568896 | | | | | | | |
| Standard Error | 3.185170 | | | | | | | |
| Observations | 59 | | | | | | | |
| ANOVA |  | df | SS | | MS | | F | | Sign. F |
| Regression | 1 | 786.650293 | | 786.650293 | | 77.538320 | | ≈ 0 |
| Residual | 57 | 578.282673 | | 10.145310 | |  | |  |
| Total | 58 | 1364.932966 | |  | |  | |  |
| Results |  | Coef. | | Std. Error | | t Stat. | | p-value | |
| Alpha | 0.040200 | | 0.424842 | | 0.094624 | | 0.924946 | |
| BetaMarket | 1.128385 | | 0.128144 | | 8.805585 | | ≈ 0 | |
| 3-Factor Model | | | | | | | | | |
| Regression  Statistics | Multiple R | 0.798891 | | | | | | | |
| R Square | 0.638226 | | | | | | | |
| Adj. R Square | 0.618493 | | | | | | | |
| Standard Error | 3.294565 | | | | | | | |
| Observations | 59 | | | | | | | |
| ANOVA |  | df | SS | | MS | | F | | Sign. F |
| Regression | 3 | 1053.165825 | | 351.055275 | | 32.342921 | | ≈ 0 |
| Residual | 55 | 596.978858 | | 10.854161 | |  | |  |
| Total | 58 | 1650.144683 | |  | |  | |  |
| Results |  | Coef. | | Std. Error | | t Stat. | | p-value | |
| Alpha | -0.269002 | | 0.444256 | | -0.605511 | | 0.547330 | |
| BetaMarket | 1.224578 | | 0.138613 | | 8.834525 | | ≈ 0 | |
| BetaSMB | -0.021480 | | 0.174037 | | -0.123420 | | 0.902224 | |
| BetaHML | -0.496844 | | 0.180665 | | -2.750079 | | 0.008048 | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Regression Results of AGRYX (cont.) | | | | | | | | | |
| 4-Factor Model | | | | | | | | | |
| Regression  Statistics | Multiple R | 0.789483 | | | | | | | |
| R Square | 0.623283 | | | | | | | |
| Adj. R Square | 0.595378 | | | | | | | |
| Standard Error | 3.085790 | | | | | | | |
| Observations | 59 | | | | | | | |
| ANOVA |  | df | SS | | MS | | F | | Sign. F |
| Regression | 4 | 850.739655 | | 212.684914 | | 22.335929 | | ≈ 0 |
| Residual | 54 | 514.193311 | | 9.522098 | |  | |  |
| Total | 58 | 1364.932966 | |  | |  | |  |
| Result |  | Coef. | | Std. Error | | t Stat. | | p-value | |
| Alpha | -0.119427 | | 0.418549 | | -0.285335 | | 0.776479 | |
| BetaMarket | 1.180139 | | 0.134276 | | 8.788935 | | ≈ 0 | |
| BetaSMB | -0.125978 | | 0.163043 | | -0.772669 | | 0.443087 | |
| BetaHML | -0.179791 | | 0.202830 | | -0.886415 | | 0.379324 | |
| BetaMOM | 0.210542 | | 0.151765 | | 1.387289 | | 0.171053 | |
| 5-Factor Model | | | | | | | | | |
| Regression  Statistics | Multiple R | 0.796378 | | | | | | | |
| R Square | 0.634218 | | | | | | | |
| Adj. R Square | 0.599710 | | | | | | | |
| Standard Error | 3.069226 | | | | | | | |
| Observations | 59 | | | | | | | |
| ANOVA |  | df | SS | | MS | | F | | Sign. F |
| Regression | 5 | 865.664978 | | 173.132996 | | 18.379005 | | ≈ 0 |
| Residual | 53 | 499.267988 | | 9.420151 | |  | |  |
| Total | 58 | 1364.932966 | |  | |  | |  |
| Result |  | Coef. | | Std. Error | | t Stat. | | p-value | |
| Alpha | -0.164372 | | 0.418762 | | -0.392518 | | 0.696250 | |
| BetaMarket | 1.097740 | | 0.133656 | | 8.213202 | | ≈ 0 | |
| BetaSMB | -0.023257 | | 0.182681 | | -0.127308 | | 0.899179 | |
| BetaHML | -0.132040 | | 0.225679 | | -0.585080 | | 0.560977 | |
| BetaRMW | 0.452890 | | 0.324240 | | 1.396777 | | 0.168302 | |
| BetaCMA | -0.526374 | | 0.367642 | | -1.431757 | | 0.158085 | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Regression Results of AGRYX (cont.) | | | | | | | | | |
| TM Model | | | | | | | | | |
| Regression  Statistics | Multiple R | 0.761877 | | | | | | | |
| R Square | 0.580457 | | | | | | | |
| Adj. R Square | 0.565473 | | | | | | | |
| Standard Error | 3.197791 | | | | | | | |
| Observations | 59 | | | | | | | |
| ANOVA |  | df | SS | | MS | | F | | Sign. F |
| Regression | 2 | 792.284556 | | 396.142278 | | 38.739246 | | ≈ 0 |
| Residual | 56 | 572.648410 | | 10.225864 | |  | |  |
| Total | 58 | 1364.932966 | |  | |  | |  |
| Result |  | Coef. | | Std. Error | | t Stat. | | p-value | |
| Alpha (a) | 0.245622 | | 0.508440 | | 0.483089 | | 0.630916 | |
| Beta (b) | 1.113792 | | 0.130145 | | 8.558072 | | ≈ 0 | |
| Timing (c) | -0.017732 | | 0.023888 | | -0.742281 | | 0.461019 | |
| HM Model | | | | | | | | | |
| Regression  Statistics | Multiple R | 0.759541 | | | | | | | |
| R Square | 0.576903 | | | | | | | |
| Adj. R Square | 0.561792 | | | | | | | |
| Standard Error | 3.211307 | | | | | | | |
| Observations | 59 | | | | | | | |
| ANOVA |  | df | SS | | MS | | F | | Sign. F |
| Regression | 2 | 787.433373 | | 393.716686 | | 38.178615 | | ≈ 0 |
| Residual | 56 | 577.499593 | | 10.312493 | |  | |  |
| Total | 58 | 1364.932966 | |  | |  | |  |
| Result |  | Coef. | | Std. Error | | t Stat. | | p-value | |
| Alpha (a) | -0.092933 | | 0.645664 | | -0.143934 | | 0.886069 | |
| Beta (b) | 1.076730 | | 0.227662 | | 4.729517 | | ≈ 0 | |
| Timing (c) | 0.105824 | | 0.384030 | | 0.275563 | | 0.783898 | |