

Online Appendix for “Asset Pricing with Systematic Skewness: Two Decades Later”

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ABSTRACT

This document includes supplementary material to the paper. Section 1 provides a variable description and the significance levels for skewness and coskewness used in Table 1 in the paper and Tables IA.3 to IA.9 in this Internet Appendix. Section 2 describes the test assets used in this Internet Appendix and shows (i) replications of Table 1 in the paper for other test assets, including those used in Table 1 in Harvey and Siddique (2000), (ii) replications of Table 4 Panel C in the paper when the NASDAQ stocks are removed from the sample, and (iii) replications of Table 5 in the paper for other sample periods. Section 3 shows summary statistics and the results of asset pricing tests of several coskewness proxies for different sample periods. Section 4 shows robustness checks for asset pricing tests of coskewness proxies.

Keywords: Coskewness, three-moment CAPM, persistent factors.

JEL Codes: G12

1 Variable Description

Table IA.1: Variable Description

| | |
|--------|--|
| $Cosk$ | Standardized coskewness, measured as: $Cosk_{i,t} = \frac{E_{t-1}[\varepsilon_{i,t}\varepsilon_{M,t}^2]}{\sqrt{E_{t-1}[\varepsilon_{i,t}^2]E_{t-1}[\varepsilon_{M,t}^2]}}$. |
| Csk | Coskewness, measured as: $Csk_{i,t} = Cov_{t-1}(r_{i,t}, r_{M,t}^2)$. |
| S^- | Return of the portfolio of the 30% of stocks with the lowest past standardized coskewness. |
| S^+ | Return of the portfolio of the 30% of stocks with the highest past standardized coskewness. |
| r_f | Risk-free rate (one-month Treasury bill rate), from Ken French's online data library. |
| HS^- | Long-short portfolio return calculated as $S^- - r_f$. |
| HS | Long-short portfolio return calculated as the return difference between the highest 30% and the lowest 30% of stocks ranked by past standardized coskewness, as in Harvey and Siddique (2000); $HS = S^- - S^+$. |
| PSS | Long-short portfolio return calculated as the return difference between the highest 30% and the lowest 30% of stocks ranked by predicted coskewness, as in Langlois (2020). |
| $mPSS$ | Modified PSS : long-short portfolio return calculated as the return difference between the highest 30% and the lowest 30% of stocks ranked by predicted coskewness; $mPSS$ uses market-only predictors, while the PSS factor of Langlois (2020) also uses firm characteristics to predict the coskewness rank. |
| MKT | Excess return of the market portfolio; $MKT = r_M - r_f$. |
| SMB | Small minus Big (market equity) factor, from Ken French's online data library. |
| HML | High minus Low (book-to-market) factor, from Ken French's online data library. |
| MOM | Momentum ($t - 12$ to $t - 2$ months) factor, from Ken French's online data library. |
| RMW | Robust minus Weak (profitability) factor, from Ken French's online data library. |
| CMA | Conservative minus Aggressive (investment) factor, from Ken French's online data library. |
| FF3 | Fama-French three-factor model: MKT , SMB , and HML . |
| FF4 | Carhart-Fama-French four-factor model: MKT , SMB , HML , and MOM . |
| FF5 | Fama-French five-factor model: MKT , SMB , HML , RMW , and CMA . |

Table IA.2: Significance Levels for Skewness and Coskewness

| Panel A. Sample Period January 1994 to December 2019 (312 Months) | | | |
|---|-----|---------|--------|
| Skewness | 1% | -0.3588 | 0.3591 |
| | 5% | -0.2699 | 0.2701 |
| | 10% | -0.2255 | 0.2249 |
| Coskewness | 1% | -0.2527 | 0.2521 |
| | 5% | -0.1918 | 0.1913 |
| | 10% | -0.1608 | 0.1606 |
| Panel B. Sample Period July 1963 to December 1993 (366 Months) | | | |
| Skewness | 1% | -0.3312 | 0.3318 |
| | 5% | -0.2498 | 0.2496 |
| | 10% | -0.2088 | 0.2087 |
| Coskewness | 1% | -0.2325 | 0.2332 |
| | 5% | -0.1772 | 0.1770 |
| | 10% | -0.1486 | 0.1485 |
| Panel C. Sample Period July 1926 to June 1963 (444 Months) | | | |
| Skewness | 1% | -0.3013 | 0.3010 |
| | 5% | -0.2270 | 0.2274 |
| | 10% | -0.1899 | 0.1902 |
| Coskewness | 1% | -0.2110 | 0.2112 |
| | 5% | -0.1608 | 0.1608 |
| | 10% | -0.1347 | 0.1348 |
| Panel D. Sample Period July 1963 to December 2019 (678 Months) | | | |
| Skewness | 1% | -0.2424 | 0.2431 |
| | 5% | -0.1838 | 0.1841 |
| | 10% | -0.1540 | 0.1541 |
| Coskewness | 1% | -0.1713 | 0.1714 |
| | 5% | -0.1299 | 0.1303 |
| | 10% | -0.1092 | 0.1093 |
| Panel E. Sample Period July 1926 to December 2019 (1122 Months) | | | |
| Skewness | 1% | -0.1890 | 0.1886 |
| | 5% | -0.1014 | 0.1013 |
| | 10% | -0.0849 | 0.0850 |
| Coskewness | 1% | -0.1332 | 0.1330 |
| | 5% | -0.1014 | 0.1013 |
| | 10% | -0.0849 | 0.0850 |

Description: The table shows significance levels for standardized skewness and coskewness. Standardized (unconditional) skewness is the third central moment about the mean. Standardized (unconditional) coskewness of the i^{th} asset is defined as $E[\varepsilon_{i,t}\varepsilon_{M,t}^2]/(\sqrt{E[\varepsilon_{i,t}^2]}E[\varepsilon_{M,t}^2])$, where $\varepsilon_{i,t}$ is the residual from regressing i 's excess return on the excess market return, and $\varepsilon_{M,t}$ is the market return minus its unconditional average. The significance levels are computed by generating the statistics 10,000 times simulating it under the null using a standard normal distribution for skewness and a bivariate standard normal distribution for coskewness.

Interpretation: With 366 observations (i.e., the number of months between July 1963 and December 1993), skewness is significant approximately at ± 0.331 at the 1% level, ± 0.250 at the 5% level, and ± 0.193 at the 10% level; and coskewness is significant at ± 0.233 at the 1% level, ± 0.177 at the 5% level, and ± 0.149 at the 10% level.

2 Test Assets and Summary Statistics

In this section, we replicate Table 1 in the paper for other portfolio groups.

All portfolio groups used in this Internet Appendix are value-weighted. The groups that are constructed from multivariate sorts use as cutoffs only the values for the NYSE stocks. Independent sorts are used in all portfolio groups except the 27 Carhart portfolios, which are constructed using dependent sorts. The portfolio groups are:

- 32 industry portfolios, constructed by taking the industry names from Panel A in Table I in Harvey and Siddique (2000) and identifying the industry by its SIC code classification. The only industry that we could not identify is “Distributors,” which we replaced by “Other.”
- 30 Fama-French industry portfolios, from Ken French’s online data library.
- 10 Fama-French portfolios sorted on size (market value of equity), from Ken French’s online data library.
- 10 Fama-French portfolios sorted on momentum (past return performance between months $t - 12$ and $t - 2$), from Ken French’s online data library.
- 25 Fama-French portfolios sorted on size and book-to-market (B/M), from Ken French’s online data library.
- 25 Fama-French portfolios sorted on size and momentum, from Ken French’s online data library.
- 25 portfolios sorted on size and the coskewness measure in Equation (15) in the paper.
- 27 Carhart portfolios with dependent sorts on B/M, size, and momentum. To construct these portfolios, we sort all stocks into terciles, first by B/M, then by size, then by momentum.¹

¹We construct our own book-to-market variable from Compustat data, using the methodology in Davis *et al.* (2000). The portfolios are constructed at the end of every month, using the last known book equity value and the current market equity value.

Table IA.3: Properties of 32 Industry Portfolios as in Harvey and Siddique (2000)

| Panel A. Sample Period 1963 to 1993, Original Results | | | | | | | | | | |
|---|------------|------------|---------------|----------------------------|-----------------------------|---------------|------------------|----------------|---------------|--|
| Industry | Std. Skew. | Std. Cosk. | β to HS | β to HS ⁻ | β to MKT ² | Time-V. Cosk. | Av.E.Ret. (%/mo) | β to MKT | Stdev. (%/mo) | |
| Aerospace, aircraft | -0.118 | -0.087 | 0.069 | 1.196** | -0.015 | Yes | 0.562 | 1.241** | 6.421 | |
| Agriculture and forestry | 0.592** | -0.075 | 0.128 | 1.100** | -0.016 | No | 0.462 | 1.119** | 9.920 | |
| Auto and gas retailers | 0.363** | 0.074 | 0.089 | 1.195** | -0.012 | Yes | 1.430 | 1.226** | 9.205 | |
| Beverages | -0.166 | 0.109** | 0.310** | 0.981** | -0.006 | No | 0.800 | 0.961** | 5.150 | |
| Building and construction | 0.037 | 0.103** | -0.058 | 1.223** | -0.010 | No | 0.467 | 1.278** | 6.257 | |
| Chemicals | -0.258** | -0.003 | 0.043 | 0.953** | -0.010 | Yes | 0.402 | 0.976** | 4.723 | |
| Computers and electronics | -0.140 | 0.103** | 0.079 | 1.040** | -0.008 | Yes | 0.377 | 1.065** | 5.355 | |
| Depository financial inst's | 0.129 | 0.140** | 0.182 | 1.111** | -0.005 | Yes | 0.342 | 1.120** | 6.432 | |
| Electric and water | 0.462 | 0.184** | 0.193** | 0.612** | 0.002 | No | 0.251 | 0.595** | 4.085 | |
| Engin.-Prim. metals, mach. | -0.364** | -0.157** | -0.230* | 1.058** | -0.013* | Yes | 0.363 | 1.129** | 5.551 | |
| Extractive | -0.305** | -0.102** | -0.518** | 0.745** | -0.013* | Yes | 0.642 | 0.834** | 5.414 | |
| Food manufacturers | 0.081 | -0.012 | 0.167 | 0.854** | -0.009 | Yes | 0.641 | 0.848** | 4.638 | |
| Food retailers | 0.715** | -0.005 | 0.051 | 0.900** | -0.009 | No | 0.455 | 0.909** | 5.429 | |
| General retailers | -0.143 | -0.139** | 0.382** | 1.174** | -0.018** | No | 0.593 | 1.151** | 6.060 | |
| Healthcare | 0.112 | 0.136** | 0.198 | 1.469** | -0.005 | Yes | 0.952 | 1.465** | 9.597 | |
| Holding and investment co's | -0.171 | 0.089 | -0.200* | 0.888** | -0.006 | No | 0.486 | 0.952** | 4.512 | |
| Household goods | 0.075 | 0.118** | 0.145 | 1.095** | -0.005 | No | 0.574 | 1.111** | 5.865 | |
| Leisure and hotels | -0.436** | -0.212** | 0.482** | 1.381** | -0.023** | Yes | 0.889 | 1.351** | 7.163 | |
| Media | -0.194 | -0.163** | 0.158 | 1.155** | -0.018** | Yes | 0.801 | 1.175** | 6.214 | |
| Nondep. financial inst's | 0.283** | 0.280** | 0.168 | 1.124** | -0.000 | Yes | 0.530 | 1.135** | 6.023 | |
| Oil and gas | -0.016 | -0.032 | -0.738** | 0.746** | -0.010 | No | 0.499 | 0.879** | 5.276 | |
| Oil and gas transportation | 0.118 | 0.045 | -0.488** | 0.725** | -0.006 | Yes | 0.408 | 0.824** | 4.605 | |
| Distributors | -0.293** | -0.058 | -0.053 | 1.174** | -0.014* | No | 0.583 | 1.223** | 6.258 | |
| Paper, pulp, and printing | 0.476** | 0.063 | -0.078 | 1.010** | -0.009 | Yes | 1.071 | 1.056** | 6.644 | |
| Pharmaceuticals | -0.129 | 0.009 | -0.269* | 1.033** | -0.010 | Yes | 0.486 | 1.099** | 5.756 | |
| Property | 0.173 | -0.068 | 0.069 | 1.263** | -0.017 | Yes | 0.327 | 1.312** | 7.830 | |
| Support services | -0.014 | 0.078 | 0.078 | 1.273** | -0.012 | No | 0.609 | 1.309** | 6.628 | |
| Telecommunications | 0.068 | 0.002 | 0.110 | 0.572** | -0.004 | No | 0.356 | 0.573** | 4.087 | |
| Textiles and apparel | -0.284** | -0.204** | 0.127 | 1.130** | -0.019** | No | 0.570 | 1.148** | 6.162 | |
| Tobacco | 0.018 | 0.077 | 0.128 | 0.888** | -0.006 | Yes | 0.994 | 0.891** | 5.683 | |
| Transportation | -0.178 | -0.020 | -0.077 | 1.147** | -0.012 | No | 0.446 | 1.196** | 6.265 | |
| Vehicles | 0.052 | -0.230* | 0.221 | 0.934** | -0.020** | No | 0.461 | 0.941** | 5.914 | |
| Corr. with Ave.Ret. | -0.143 | -0.067 | 0.207 | 0.288 | -0.161 | | | 0.260 | 0.348 | |

| Panel B. Sample Period 1963 to 1993, Replication Results | | | | | | | | | | |
|--|------------|------------|---------------|----------------------------|-----------------------------|---------------|------------------|----------------|---------------|--|
| Industry | Std. Skew. | Std. Cosk. | β to HS | β to HS ⁻ | β to MKT ² | Time-V. Cosk. | Av.E.Ret. (%/mo) | β to MKT | Stdev. (%/mo) | |
| Aerospace, aircraft | 0.032 | -0.134 | 0.394** | 1.122*** | -0.020** | Yes | 0.623 | 1.240*** | 6.993 | |
| Agriculture and forestry | 0.532*** | -0.209** | 0.346* | 0.978*** | -0.029*** | No | 0.340 | 1.094*** | 8.726 | |
| Auto and gas retailers | -0.005 | 0.060 | 0.476*** | 1.114*** | -0.010 | Yes | 0.710 | 1.225*** | 6.693 | |
| Beverages | -0.070 | 0.096 | 0.362*** | 0.847*** | -0.006 | No | 0.777 | 0.924*** | 5.270 | |
| Building and construction | -0.269** | -0.138 | 0.348** | 1.091*** | -0.017** | No | 0.396 | 1.206*** | 5.936 | |
| Chemicals | -0.143 | 0.115 | 0.233** | 0.896*** | -0.008 | Yes | 0.398 | 1.002*** | 4.855 | |
| Computers and electronics | -0.114 | 0.107 | 0.407*** | 1.004*** | -0.009 | Yes | 0.351 | 1.106*** | 5.494 | |
| Depository financial inst's | 0.120 | 0.124 | 0.362** | 0.914*** | -0.005 | No | 0.370 | 1.000*** | 6.014 | |
| Electric and water | 0.413*** | 0.207** | 0.101 | 0.533*** | 0.001 | No | 0.285 | 0.601*** | 4.120 | |
| Engin.-Prim. metals, mach. | -0.403*** | -0.127 | 0.284** | 1.012*** | -0.015** | Yes | 0.350 | 1.130*** | 5.484 | |
| Extractive | -0.316** | -0.114 | 0.530*** | 0.941*** | -0.016** | No | 0.480 | 1.034*** | 5.964 | |
| Food manufacturers | 0.189 | 0.008 | 0.100 | 0.753*** | -0.009 | No | 0.610 | 0.850*** | 4.684 | |
| Food retailers | 0.130 | 0.010 | 0.220* | 0.805*** | -0.009 | No | 0.550 | 0.894*** | 4.997 | |
| General retailers | -0.177 | -0.149* | 0.334** | 1.059*** | -0.018** | No | 0.591 | 1.165*** | 6.026 | |
| Healthcare | 0.055 | 0.069 | 0.427* | 1.304*** | -0.012 | Yes | 0.867 | 1.470*** | 9.655 | |
| Holding and investment co's | -0.317** | 0.011 | 0.261** | 0.943*** | -0.011* | No | 0.553 | 1.051*** | 5.073 | |
| Household goods | -0.322** | -0.227** | 0.399*** | 1.091*** | -0.021*** | No | 0.587 | 1.195*** | 6.161 | |
| Leisure and hotels | -0.405*** | -0.219** | 0.652*** | 1.253*** | -0.024*** | No | 0.867 | 1.356*** | 7.127 | |
| Media | -0.090 | -0.077 | 0.428*** | 1.063*** | -0.015** | No | 0.859 | 1.167*** | 6.121 | |
| Nondep. financial inst's | 0.110 | 0.149* | 0.171 | 0.948*** | -0.006 | Yes | 0.536 | 1.069*** | 5.671 | |
| Oil and gas | 0.243* | 0.008 | 0.415*** | 0.735*** | -0.008 | No | 0.592 | 0.797*** | 5.249 | |
| Oil and gas transportation | 0.152 | 0.041 | 0.349*** | 0.734*** | -0.007 | Yes | 0.447 | 0.806*** | 4.606 | |
| Other | -0.235* | 0.006 | 0.430*** | 1.008*** | -0.012* | Yes | 0.418 | 1.105*** | 5.485 | |
| Paper, pulp, and printing | -0.118 | -0.006 | 0.257* | 0.981*** | -0.012* | No | 0.504 | 1.091*** | 5.557 | |
| Pharmaceuticals | 0.332** | 0.179** | 0.223* | 0.829*** | -0.003 | Yes | 0.567 | 0.931*** | 5.299 | |
| Property | 0.331** | -0.130 | 0.655*** | 1.241*** | -0.022** | Yes | 0.223 | 1.346*** | 7.810 | |
| Support services | 0.049 | 0.159* | 0.356** | 1.225*** | -0.008 | Yes | 0.608 | 1.375*** | 7.125 | |
| Telecommunications | 0.035 | 0.086 | 0.050 | 0.506*** | -0.003 | No | 0.408 | 0.572*** | 4.143 | |
| Textiles and apparel | -0.370** | -0.230** | 0.322** | 1.050*** | -0.022** | No | 0.584 | 1.163*** | 6.278 | |
| Tobacco | 0.057 | 0.115 | -0.085 | 0.710*** | -0.003 | No | 0.894 | 0.825*** | 5.513 | |
| Transportation | -0.178 | -0.065 | 0.323** | 1.093*** | -0.015* | No | 0.450 | 1.206*** | 6.417 | |
| Vehicles | -0.011 | -0.181** | 0.143 | 0.898*** | -0.018** | No | 0.446 | 1.004*** | 5.810 | |
| Corr. with Ave.Ret. | -0.197 | 0.011 | 0.041 | 0.231 | 0.004 | | | 0.245 | 0.257 | |

(Continued)

Table IA.3: (Continued)

Panel C. Sample Period 1994 to 2019, Post-Sample Results

| Industry | Std. Skew. | Std. Cosk. | β to HS | β to HS ⁻ | β to MKT ² | Time-V. Cosk. | Av.E.Ret. (%/mo) | β to MKT | Stdev. (%/mo) |
|-----------------------------|------------|------------|---------------|----------------------------|-----------------------------|---------------|------------------|----------------|---------------|
| Aerospace, aircraft | -0.789*** | -0.045 | 0.059 | 0.987*** | -0.035*** | No | 1.061 | 0.908*** | 5.721 |
| Agriculture and forestry | -0.089 | -0.169* | -0.141 | 0.779*** | -0.043*** | No | 0.975 | 0.776*** | 6.200 |
| Auto and gas retailers | 0.083 | -0.001 | -0.084 | 0.884*** | -0.031*** | No | 1.137 | 0.865*** | 5.587 |
| Beverages | -0.596*** | -0.272*** | 0.318*** | 0.596*** | -0.036*** | Yes | 0.745 | 0.498*** | 4.505 |
| Building and construction | -0.260* | 0.065 | -0.514*** | 1.233*** | -0.042*** | No | 0.542 | 1.302*** | 6.946 |
| Chemicals | -0.266* | 0.102 | 0.047 | 0.772*** | -0.022*** | No | 0.719 | 0.730*** | 4.064 |
| Computers and electronics | -0.483*** | 0.135 | -1.121*** | 1.176*** | -0.040*** | No | 0.991 | 1.368*** | 6.940 |
| Depository financial inst's | -0.666*** | 0.024 | 0.234 | 1.210*** | -0.036*** | Yes | 0.735 | 1.058*** | 6.531 |
| Electric and water | -0.384*** | -0.038 | 0.271*** | 0.460*** | -0.016** | No | 0.615 | 0.396*** | 3.993 |
| Engin.-Prim. metals, mach. | -0.534*** | 0.068 | -0.306** | 1.233*** | -0.041*** | Yes | 0.641 | 1.249*** | 6.082 |
| Extractive | -0.011 | 0.009 | 0.123 | 1.093*** | -0.037*** | No | 0.605 | 1.054*** | 7.504 |
| Food manufacturers | -0.005 | -0.058 | 0.215** | 0.496*** | -0.018*** | No | 0.739 | 0.974*** | 3.747 |
| Food retailers | -0.325** | -0.014 | 0.004 | 0.636*** | -0.022*** | No | 0.492 | 0.592*** | 4.535 |
| General retailers | -0.281** | 0.112 | -0.284*** | 0.832** | -0.024** | No | 0.692 | 0.837*** | 4.622 |
| Healthcare | -0.391*** | -0.059 | 0.320** | 0.850*** | -0.032*** | No | 0.632 | 0.753*** | 5.844 |
| Holding and investment co's | -0.243* | 0.098 | 0.165 | 1.071*** | -0.027*** | No | 0.548 | 0.957*** | 5.725 |
| Household goods | 0.027 | 0.037 | -0.114 | 1.108*** | -0.036*** | No | 0.470 | 1.075*** | 6.018 |
| Leisure and hotels | -0.622*** | -0.126 | -0.234** | 0.976** | -0.041*** | No | 0.771 | 0.974*** | 5.056 |
| Media | -0.389*** | 0.025 | -0.453*** | 1.021*** | -0.037*** | No | 0.727 | 1.081*** | 5.465 |
| Nondep. financial inst's | -0.549*** | -0.118 | -0.077 | 1.153*** | -0.044*** | No | 0.703 | 1.088*** | 5.437 |
| Oil and gas | 0.083 | 0.018 | 0.072 | 0.745*** | -0.023** | Yes | 0.855 | 0.685*** | 5.333 |
| Oil and gas transportation | -0.463*** | 0.016 | 0.207 | 0.771*** | -0.025** | Yes | 0.646 | 0.724*** | 5.578 |
| Other | -0.618*** | -0.131 | -0.461*** | 0.910*** | -0.040*** | Yes | 0.809 | 0.987*** | 4.802 |
| Paper, pulp, and printing | 0.044 | 0.084 | -0.019 | 0.976** | -0.029*** | Yes | 0.544 | 0.932*** | 5.149 |
| Pharmaceuticals | -0.173 | -0.019 | -0.045 | 0.661*** | -0.024** | Yes | 0.873 | 0.636*** | 4.392 |
| Property | -0.173 | 0.010 | -0.151 | 1.187*** | -0.042** | Yes | 0.486 | 1.198*** | 7.118 |
| Support services | -0.179 | 0.109 | -1.144*** | 1.233*** | -0.041*** | Yes | 1.010 | 1.335*** | 6.802 |
| Telecommunications | 0.052 | 0.020 | -0.634*** | 0.774** | -0.029*** | No | 0.439 | 0.861*** | 5.565 |
| Textiles and apparel | -0.399*** | -0.062 | -0.148 | 1.110*** | -0.042*** | No | 0.509 | 1.067*** | 6.296 |
| Tobacco | -0.047 | 0.063 | 0.197 | 0.570** | -0.011 | No | 1.106 | 0.500*** | 6.815 |
| Transportation | -0.307** | 0.122 | -0.049 | 0.999*** | -0.026** | No | 0.674 | 0.946*** | 5.385 |
| Vehicles | 0.306** | 0.149 | -0.211 | 1.290*** | -0.034** | Yes | 0.477 | 1.266*** | 6.922 |
| Corr. with Ave.Ret. | -0.148 | -0.131 | -0.144 | -0.221 | 0.062 | | | -0.141 | 0.013 |

Panel D. Sample Period 1963 to 2019, Extended-Sample Results

| Industry | Std. Skew. | Std. Cosk. | β to HS | β to HS ⁻ | β to MKT ² | Time-V. Cosk. | Av.E.Ret. (%/mo) | β to MKT | Stdev. (%/mo) |
|-----------------------------|------------|------------|---------------|----------------------------|-----------------------------|---------------|------------------|----------------|---------------|
| Aerospace, aircraft | -0.238** | -0.073 | 0.224** | 1.068*** | -0.025*** | No | 0.825 | 1.092*** | 6.438 |
| Agriculture and forestry | 0.379*** | -0.179*** | 0.096 | 0.898*** | -0.034*** | No | 0.637 | 0.953*** | 7.649 |
| Auto and gas retailers | 0.021 | 0.055 | 0.192* | 1.022*** | -0.018*** | Yes | 0.907 | 1.065*** | 6.208 |
| Beverages | -0.239** | -0.049 | 0.342*** | 0.746** | -0.017*** | No | 0.762 | 0.733*** | 4.929 |
| Building and construction | -0.273*** | -0.029 | -0.087 | 1.147*** | -0.026*** | Yes | 0.463 | 1.247*** | 6.416 |
| Chemicals | -0.185** | 0.135** | 0.139* | 0.846*** | -0.013*** | No | 0.545 | 0.880*** | 4.508 |
| Computers and electronics | -0.338*** | 0.094 | -0.368*** | 1.073*** | -0.020*** | Yes | 0.645 | 1.222*** | 6.205 |
| Depository financial inst's | -0.292*** | 0.072 | 0.297*** | 1.032*** | -0.016** | Yes | 0.538 | 1.025*** | 6.255 |
| Electric and water | 0.066 | 0.104 | 0.187*** | 0.503*** | -0.005 | No | 0.437 | 0.509*** | 4.063 |
| Engin.-Prim. metals, mach. | -0.477*** | -0.039 | -0.014 | 1.102*** | -0.024*** | No | 0.484 | 1.182*** | 5.764 |
| Extractive | -0.136 | -0.044 | 0.325*** | 1.002*** | -0.023*** | No | 0.537 | 1.041*** | 6.712 |
| Food manufacturers | 0.148 | 0.015 | 0.159** | 0.650** | -0.012*** | Yes | 0.669 | 0.657*** | 4.276 |
| Food retailers | -0.036 | 0.023 | 0.113 | 0.736*** | -0.013*** | No | 0.523 | 0.758*** | 4.787 |
| General retailers | -0.194** | -0.006 | 0.022 | 0.968*** | -0.020*** | No | 0.638 | 1.018*** | 5.422 |
| Healthcare | 0.024 | 0.051 | 0.375*** | 1.112*** | -0.019** | No | 0.748 | 1.134*** | 7.948 |
| Holding and investment co's | -0.289*** | 0.070 | 0.214** | 0.994** | -0.017** | No | 0.550 | 1.008*** | 5.379 |
| Household goods | -0.165* | -0.083 | 0.142 | 1.097*** | -0.026*** | No | 0.534 | 1.139*** | 6.091 |
| Leisure and hotels | -0.440*** | -0.146** | 0.206** | 1.141*** | -0.030*** | No | 0.822 | 1.184*** | 6.256 |
| Media | -0.191** | -0.025 | -0.015 | 1.045*** | -0.023*** | No | 0.798 | 1.126*** | 5.825 |
| Nondep. financial inst's | -0.172* | 0.036 | 0.047 | 1.030*** | -0.019*** | Yes | 0.613 | 1.076*** | 5.561 |
| Oil and gas | 0.167* | 0.020 | 0.242*** | 0.739*** | -0.013** | No | 0.713 | 0.746*** | 5.285 |
| Oil and gas transportation | -0.232** | 0.032 | 0.278*** | 0.749** | -0.013** | No | 0.539 | 0.769*** | 5.074 |
| Other | -0.379*** | -0.039 | -0.021 | 0.969** | -0.022*** | Yes | 0.598 | 1.052*** | 5.182 |
| Paper, pulp, and printing | -0.046 | 0.053 | 0.119 | 0.978** | -0.018*** | Yes | 0.522 | 1.019*** | 5.369 |
| Pharmaceuticals | 0.170* | 0.111* | 0.088 | 0.761*** | -0.010** | Yes | 0.708 | 0.800*** | 4.901 |
| Property | 0.134 | -0.060 | 0.247** | 1.219*** | -0.029*** | Yes | 0.344 | 1.279*** | 7.495 |
| Support services | -0.049 | 0.140** | -0.403*** | 1.184*** | -0.020*** | No | 0.793 | 1.356*** | 6.976 |
| Telecommunications | 0.020 | 0.031 | -0.294*** | 0.613*** | -0.012** | Yes | 0.422 | 0.699*** | 4.845 |
| Textiles and apparel | -0.383*** | -0.137** | 0.086 | 1.073*** | -0.029*** | No | 0.549 | 1.118*** | 6.282 |
| Tobacco | -0.014 | 0.099 | 0.058 | 0.654*** | -0.006 | No | 0.991 | 0.680*** | 6.143 |
| Transportation | -0.219** | 0.038 | 0.135 | 1.055*** | -0.019*** | No | 0.553 | 1.089*** | 5.961 |
| Vehicles | 0.166* | -0.039 | -0.034 | 1.055*** | -0.024** | Yes | 0.460 | 1.118*** | 6.341 |
| Corr. with Ave.Ret. | 0.017 | 0.089 | 0.051 | -0.024 | 0.112 | | | -0.029 | 0.155 |

(Continued)

Table IA.3: (Continued)

| Panel E. Sample Period 1926 to 1963, Pre-Sample Results | | | | | | | | | |
|---|------------|------------|-----------------|-------------------|--------------------|---------------|------------------|------------------|---------------|
| Industry | Std. Skew. | Std. Cosk. | β to HS | β to HS^- | β to MKT^2 | Time-V. Cosk. | Av.E.Ret. (%/mo) | β to MKT | Stdev. (%/mo) |
| Aerospace, aircraft | 0.977*** | 0.022 | -1.614*** | 1.376*** | 0.016*** | No | 1.542 | 1.413*** | 12.054 |
| Agriculture and forestry | 2.158*** | 0.123 | -0.239 | 0.201 | 0.045 | No | 1.436 | 0.311 | 8.342 |
| Auto and gas retailers | 0.889*** | -0.220*** | -0.902*** | 0.861*** | 0.006** | Yes | 0.913 | 0.798*** | 7.970 |
| Beverages | 1.860*** | -0.162** | -1.300*** | 1.101*** | 0.009*** | Yes | 1.225 | 1.060*** | 9.479 |
| Building and construction | 1.498*** | 0.627*** | -1.455*** | 1.229*** | 0.018*** | Yes | 0.926 | 1.153*** | 8.237 |
| Chemicals | 0.591*** | 0.114 | -1.124*** | 1.035** | 0.012** | Yes | 1.077 | 1.012*** | 7.079 |
| Computers and electronics | 0.769*** | 0.350** | -1.375*** | 1.349*** | 0.016*** | Yes | 1.144 | 1.287*** | 8.857 |
| Depository financial inst's | 1.048*** | -0.331*** | -0.646*** | 0.767*** | -0.018*** | No | 1.004 | 0.725*** | 6.487 |
| Electric and water | 0.214* | -0.346*** | -0.834*** | 0.986*** | 0.007*** | No | 0.812 | 0.942*** | 7.259 |
| Engin.-Prim. metals, mach. | 1.638*** | 1.276*** | -1.768*** | 1.370*** | 0.022*** | No | 0.976 | 1.293*** | 8.836 |
| Extractive | 0.675*** | 0.234** | -1.142*** | 0.984*** | 0.014*** | No | 1.290 | 0.950*** | 8.495 |
| Food manufacturers | -0.074 | -0.410*** | -0.667*** | 0.823*** | 0.006*** | Yes | 0.767 | 0.752*** | 5.325 |
| Food retailers | -0.116 | -0.508*** | -0.721*** | 0.873*** | 0.004 | Yes | 0.962 | 0.814*** | 6.808 |
| General retailers | 0.236* | -0.073 | -0.879*** | 0.946*** | 0.009*** | Yes | 0.718 | 0.869*** | 6.355 |
| Holding and investment co's | 0.725*** | 0.121 | -1.437*** | 1.417*** | 0.016*** | Yes | 0.889 | 1.336*** | 9.510 |
| Household goods | 0.576*** | -0.159** | -0.960*** | 0.735*** | 0.007*** | Yes | 0.691 | 0.735*** | 6.190 |
| Leisure and hotels | 0.415*** | -0.037 | -1.438*** | 1.387*** | 0.014*** | Yes | 0.870 | 1.271*** | 9.654 |
| Media | 0.737*** | 0.171** | -1.286*** | 1.192*** | 0.014*** | Yes | 0.855 | 1.047*** | 8.933 |
| Nondep. financial inst's | 0.624*** | 0.065 | -1.117*** | 1.201*** | 0.013*** | Yes | 1.160 | 1.118*** | 8.333 |
| Oil and gas | 0.387*** | -0.072 | -0.962*** | 0.968*** | 0.009*** | Yes | 0.930 | 0.910*** | 6.973 |
| Oil and gas transportation | -0.228** | -0.499*** | -0.644*** | 0.843*** | 0.004* | No | 0.801 | 0.802*** | 6.509 |
| Other | 1.316*** | 0.608*** | -1.627*** | 1.344*** | 0.020*** | Yes | 1.135 | 1.275*** | 9.175 |
| Paper, pulp, and printing | 1.014*** | 0.288*** | -1.770*** | 1.478*** | 0.018*** | No | 0.952 | 1.366*** | 10.297 |
| Pharmaceuticals | 0.272** | 0.084 | -0.761*** | 0.941*** | 0.010*** | Yes | 1.009 | 0.847*** | 6.689 |
| Property | 1.023*** | 0.000 | -1.722*** | 1.403*** | 0.014*** | No | 0.748 | 1.283*** | 11.727 |
| Support services | 1.113*** | -0.580*** | -0.929*** | 0.990*** | 0.000 | Yes | 0.870 | 0.940*** | 9.672 |
| Telecommunications | 0.234** | -0.366*** | -0.493*** | 0.614*** | 0.004** | Yes | 0.730 | 0.576*** | 4.580 |
| Textiles and apparel | 1.669*** | 0.871*** | -1.581*** | 1.241*** | 0.021*** | Yes | 0.782 | 1.166*** | 8.508 |
| Tobacco | 0.156 | 0.080 | -0.629*** | 0.693*** | 0.007*** | Yes | 0.747 | 0.613*** | 5.530 |
| Transportation | 0.135 | -0.571*** | -1.042*** | 1.046*** | 0.002 | No | 0.772 | 0.934*** | 8.696 |
| Vehicles | 1.282*** | 0.561*** | -1.693*** | 1.342*** | 0.019*** | No | 1.258 | 1.282*** | 9.173 |
| Corr. with Ave.Ret. | 0.484 | 0.256 | -0.144 | 0.053 | 0.479 | | | 0.162 | 0.443 |

Description: The table summarizes properties of 32 industry portfolios constructed as in Harvey and Siddique (2000). Standardized (unconditional) skewness is the third central moment about the mean. Standardized (unconditional) coskewness of the i^{th} asset is defined as $E[\varepsilon_{i,t}\varepsilon_{M,t}^2]/(\sqrt{E[\varepsilon_{i,t}^2]}E[\varepsilon_{M,t}^2])$, where $\varepsilon_{i,t}$ is the residual from regressing i 's excess return on the excess market return, and $\varepsilon_{M,t}$ is the market return minus its unconditional average. Time-variation in conditional coskewness is captured through the autoregression $E_t[\varepsilon_{i,t+1}\varepsilon_{M,t+1}^2] = \rho_0 + \rho_1\varepsilon_{i,t}\varepsilon_{M,t}^2 + \rho_2\varepsilon_{i,t-1}\varepsilon_{M,t-1}^2$ and whether it is significant at 10% level (i.e., the p-value of the joint test of zero coefficients is below 10%). The coskewness factors are the long-short portfolios $HS = S^- - S^+$ and $HS^- = S^- - r_f$, where S^- (S^+) is the portfolio of the 30% of stocks with the lowest (highest) past standardized coskewness, and r_f is the one-month Treasury bill rate. We also report cross-sectional correlations between the average excess return and other variables. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels. For the original results, 3-star significance is not available.

Interpretation: Theory predicts that a portfolio's average (excess) return should be negatively correlated to the portfolio's (i) standardized coskewness, (ii) beta on $HS = S^- - S^+$, and (iii) beta on $HS^- = S^- - r_f$. For the replication sample period (1963 to 1993), the replicated results in Panel B are qualitatively similar to Harvey and Siddique (2000)'s original results in Panel A: Results (i)-(iii) do not hold, as the corresponding estimates are either positive or close to zero (and thus likely to be insignificant). Results (i)-(iii) also do not hold in the extended sample period (1963 to 2019) but hold for the post-sample period (1994 to 2019), while in the pre-sample period (1926 to 1963) only Result (ii) holds.

Table IA.4: Properties of the 30 Fama-French Industry Portfolios

| Panel A. Sample Period 1963 to 1993 | | | | | | | | | |
|-------------------------------------|------------|------------|---------------|----------------------------|-----------------------------|---------------|-----------------|----------------|---------------|
| Industry | Std. Skew. | Std. Cosk. | β to HS | β to HS ⁻ | β to MKT ² | Time-V. Cosk. | AvE.Ret. (%/mo) | β to MKT | Stdev. (%/mo) |
| Food | 0.108 | 0.048 | 0.159 | 0.780*** | -0.008 | No | 0.635 | 0.873*** | 4.706 |
| Beer | 0.159 | 0.032 | 0.384*** | 0.872*** | -0.009 | Yes | 0.729 | 0.954*** | 5.450 |
| Smoke | 0.150 | 0.094 | -0.067 | 0.690*** | -0.004 | No | 0.869 | 0.799*** | 5.451 |
| Games | -0.266** | -0.123 | 0.670*** | 1.249*** | -0.020** | Yes | 0.734 | 1.351*** | 7.270 |
| Books | -0.187 | -0.112 | 0.403*** | 1.029*** | -0.016** | Yes | 0.636 | 1.129*** | 5.832 |
| Hshld | -0.283** | 0.047 | 0.327*** | 0.892*** | -0.009 | No | 0.419 | 0.982*** | 5.021 |
| Ciths | -0.012 | -0.099 | 0.369** | 1.110*** | -0.018** | No | 0.608 | 1.221*** | 6.749 |
| Hlth | 0.178 | 0.155* | 0.242* | 0.860*** | -0.005 | Yes | 0.579 | 0.965*** | 5.277 |
| Chemis | -0.168 | 0.029 | 0.256** | 0.954*** | -0.010 | No | 0.401 | 1.064*** | 5.365 |
| Txtls | -0.467*** | -0.341*** | 0.382*** | 1.004*** | -0.027*** | No | 0.749 | 1.102*** | 6.227 |
| Cnstr | 0.003 | 0.147 | 0.375*** | 1.122*** | -0.009 | No | 0.502 | 1.240*** | 5.990 |
| Steel | -0.121 | -0.114 | 0.244* | 0.970*** | -0.017** | Yes | 0.232 | 1.085*** | 6.215 |
| FabPr | -0.334*** | -0.085 | 0.347** | 1.043*** | -0.015** | No | 0.393 | 1.159*** | 5.706 |
| ElcEq | -0.097 | 0.095 | 0.349** | 1.080*** | -0.010 | No | 0.644 | 1.198*** | 6.133 |
| Autos | -0.077 | -0.200** | 0.141 | 0.902*** | -0.019*** | No | 0.441 | 1.008*** | 5.903 |
| Carry | -0.074 | -0.150* | 0.406** | 1.114*** | -0.020** | Yes | 0.583 | 1.228*** | 6.661 |
| Mines | -0.204 | -0.128 | 0.538*** | 0.874*** | -0.018** | Yes | 0.566 | 0.955*** | 7.100 |
| Coal | 0.607*** | 0.138 | 0.421** | 0.998*** | -0.002 | Yes | 0.475 | 1.112*** | 7.911 |
| Oil | 0.130 | -0.035 | 0.446*** | 0.774*** | -0.010 | No | 0.515 | 0.840*** | 5.284 |
| Util | 0.321** | 0.241*** | 0.199** | 0.560*** | 0.001 | No | 0.325 | 0.621*** | 3.943 |
| Telec | -0.033 | 0.074 | 0.103 | 0.568*** | -0.004 | No | 0.462 | 0.637*** | 4.090 |
| Servs | -0.093 | 0.054 | 0.379** | 1.196*** | -0.012 | Yes | 0.604 | 1.335*** | 6.645 |
| BusEq | -0.061 | 0.070 | 0.448*** | 1.005*** | -0.009 | Yes | 0.330 | 1.105*** | 5.724 |
| Paper | -0.155 | -0.014 | 0.219* | 0.906*** | -0.011* | Yes | 0.463 | 1.010*** | 5.071 |
| Trans | -0.223* | -0.075 | 0.307** | 1.086*** | -0.016** | No | 0.504 | 1.200*** | 6.287 |
| Whisl | -0.277** | -0.067 | 0.356** | 1.105*** | -0.015** | No | 0.719 | 1.237*** | 6.250 |
| Rtail | -0.154 | -0.132 | 0.299** | 1.002*** | -0.016** | No | 0.598 | 1.103*** | 5.780 |
| Meals | -0.498*** | -0.215** | 0.495*** | 1.199*** | -0.024** | No | 0.824 | 1.312*** | 7.080 |
| Fin | -0.116 | 0.149* | 0.259** | 0.964*** | -0.008 | Yes | 0.492 | 1.075*** | 5.293 |
| Other | -0.278** | -0.038 | 0.366** | 1.086*** | -0.014* | No | 0.376 | 1.211*** | 5.982 |
| Corr. with Ave.Ret. | -0.150 | -0.280 | 0.129 | 0.216 | -0.294 | | | 0.211 | 0.303 |

| Panel B. Sample Period 1994 to 2019 | | | | | | | | | |
|-------------------------------------|------------|------------|---------------|----------------------------|-----------------------------|---------------|-----------------|----------------|---------------|
| Industry | Std. Skew. | Std. Cosk. | β to HS | β to HS ⁻ | β to MKT ² | Time-V. Cosk. | AvE.Ret. (%/mo) | β to MKT | Stdev. (%/mo) |
| Food | -0.271** | -0.059 | 0.174** | 0.554*** | -0.020** | No | 0.675 | 0.483*** | 3.669 |
| Beer | -0.438*** | -0.270*** | 0.312*** | 0.574*** | -0.036** | No | 0.768 | 0.479*** | 4.624 |
| Smoke | -0.226* | 0.044 | 0.083 | 0.522*** | -0.012 | No | 1.057 | 0.482*** | 6.783 |
| Games | -0.354** | -0.052 | -0.350** | 1.279*** | -0.050** | Yes | 0.863 | 1.291*** | 6.956 |
| Books | 0.228* | 0.194** | -0.141 | 1.058*** | -0.025** | No | 0.313 | 1.035*** | 5.698 |
| Hshld | -0.379*** | -0.054 | 0.101 | 0.619*** | -0.023** | Yes | 0.677 | 0.573*** | 4.061 |
| Ciths | -0.188 | 0.001 | -0.082 | 1.014*** | -0.034*** | No | 0.909 | 0.962*** | 6.032 |
| Hlth | -0.383*** | -0.057 | -0.014 | 0.692*** | -0.027*** | Yes | 0.834 | 0.661*** | 4.185 |
| Chemis | -0.125 | 0.156 | -0.125 | 1.072*** | -0.028*** | No | 0.731 | 1.044*** | 5.708 |
| Txtls | 0.857*** | 0.107 | 0.048 | 1.275*** | -0.031** | Yes | 0.456 | 1.206*** | 8.160 |
| Cnstr | -0.476*** | 0.004 | -0.142 | 1.164*** | -0.040** | No | 0.669 | 1.134*** | 6.089 |
| Steel | -0.180 | 0.029 | -0.498** | 1.560*** | -0.055** | No | 0.461 | 1.630*** | 8.578 |
| FabPr | -0.457*** | 0.045 | -0.384** | 1.305*** | -0.045** | No | 0.881 | 1.333*** | 6.689 |
| ElcEq | -0.309** | 0.139 | -0.410*** | 1.230*** | -0.037*** | Yes | 0.929 | 1.252*** | 6.328 |
| Autos | 0.396*** | 0.124 | -0.206 | 1.338*** | -0.036** | No | 0.448 | 1.314*** | 7.628 |
| Carry | -0.664*** | 0.008 | -0.003 | 1.067*** | -0.035** | No | 1.043 | 0.994*** | 5.934 |
| Mines | -0.074 | 0.003 | -0.101 | 0.999*** | -0.036** | No | 0.509 | 1.027*** | 8.028 |
| Coal | 0.048 | 0.087 | 0.138 | 1.254*** | -0.027 | Yes | 0.763 | 1.244*** | 12.593 |
| Oil | -0.073 | 0.022 | 0.087 | 0.862*** | -0.027*** | No | 0.650 | 0.809*** | 5.662 |
| Util | -0.569*** | -0.008 | 0.268*** | 0.449*** | -0.014** | Yes | 0.624 | 0.386*** | 3.966 |
| Telec | -0.286** | 0.028 | -0.473*** | 0.891*** | -0.032*** | No | 0.523 | 0.942*** | 5.084 |
| Servs | -0.190 | 0.119 | -1.014*** | 1.074*** | -0.038*** | Yes | 0.926 | 1.251*** | 6.268 |
| BusEq | -0.476*** | 0.099 | -1.236*** | 1.256*** | -0.045** | No | 1.038 | 1.478*** | 7.683 |
| Paper | -0.120 | 0.084 | 0.001 | 0.936*** | -0.027*** | No | 0.628 | 0.883*** | 4.986 |
| Trans | -0.385*** | 0.125 | -0.034 | 0.966*** | -0.025** | No | 0.656 | 0.910*** | 5.141 |
| Whisl | -0.631*** | -0.140 | -0.085 | 0.882*** | -0.037*** | No | 0.564 | 0.870*** | 4.643 |
| Rtail | -0.223 | 0.106 | -0.277** | 0.850*** | -0.024*** | No | 0.810 | 0.849*** | 4.820 |
| Meals | -0.446*** | -0.044 | -0.008 | 0.741*** | -0.027*** | No | 0.820 | 0.694*** | 4.507 |
| Fin | -0.680*** | -0.032 | 0.064 | 1.156*** | -0.039** | Yes | 0.758 | 1.056*** | 5.480 |
| Other | -0.532*** | 0.013 | -0.244* | 0.948*** | -0.033** | Yes | 0.282 | 0.946*** | 5.447 |
| Corr. with Ave.Ret. | -0.400 | -0.086 | -0.206 | -0.095 | -0.024 | | | -0.043 | 0.009 |

(Continued)

Table IA.4: (Continued)

Panel C. Sample Period 1963 to 2019

| Industry | Std. Skew. | Std. Cosk. | β to HS | β to HS ⁻ | β to MKT ² | Time-V. Cosk. | Av.E.Ret. (%/mo) | β to MKT | Stdev. (%/mo) |
|---------------------|------------|------------|---------------|----------------------------|-----------------------------|---------------|------------------|----------------|---------------|
| Food | 0.024 | 0.034 | 0.168** | 0.689*** | -0.012*** | No | 0.654 | 0.698*** | 4.257 |
| Beer | -0.032 | -0.078 | 0.349*** | 0.752*** | -0.018*** | Yes | 0.747 | 0.741*** | 5.083 |
| Smoke | -0.092 | 0.079 | 0.010 | 0.622*** | -0.007 | No | 0.956 | 0.657*** | 6.096 |
| Games | -0.302*** | -0.086 | 0.155 | 1.260*** | -0.030*** | Yes | 0.794 | 1.323*** | 7.123 |
| Books | 0.001 | 0.048 | 0.131 | 1.040*** | -0.019*** | No | 0.487 | 1.084*** | 5.768 |
| Hshld | -0.313*** | 0.033 | 0.213*** | 0.782*** | -0.014*** | No | 0.538 | 0.800*** | 4.602 |
| Ciths | -0.078 | -0.035 | 0.140 | 1.071*** | -0.023*** | No | 0.746 | 1.105*** | 6.426 |
| Hlth | 0.016 | 0.086 | 0.113 | 0.792*** | -0.012** | Yes | 0.696 | 0.829*** | 4.804 |
| Chems | -0.146 | 0.096 | 0.063 | 1.001*** | -0.017*** | No | 0.552 | 1.054*** | 5.524 |
| Txtls | 0.378*** | -0.087 | 0.216* | 1.111*** | -0.028*** | Yes | 0.614 | 1.145*** | 7.177 |
| Cnstr | -0.225** | 0.075 | 0.114 | 1.138*** | -0.020*** | Yes | 0.579 | 1.191*** | 6.032 |
| Steel | -0.175** | -0.072 | -0.131 | 1.207*** | -0.030*** | Yes | 0.337 | 1.326*** | 7.392 |
| FabPr | -0.404*** | -0.031 | -0.024 | 1.148*** | -0.025*** | No | 0.617 | 1.236*** | 6.178 |
| ElcEq | -0.201** | 0.111* | -0.035 | 1.140*** | -0.019*** | Yes | 0.775 | 1.221*** | 6.221 |
| Autos | 0.217** | -0.049 | -0.033 | 1.076*** | -0.025*** | No | 0.444 | 1.142*** | 6.746 |
| Carry | -0.302*** | -0.060 | 0.198* | 1.095*** | -0.025*** | No | 0.795 | 1.124*** | 6.336 |
| Mines | -0.142 | -0.066 | 0.216* | 0.923*** | -0.025*** | No | 0.539 | 0.985*** | 7.536 |
| Coal | 0.183** | 0.098 | 0.278 | 1.100*** | -0.011 | Yes | 0.607 | 1.170*** | 10.325 |
| Oil | 0.021 | -0.005 | 0.265*** | 0.809*** | -0.016*** | No | 0.577 | 0.825*** | 5.458 |
| Util | -0.093 | 0.131** | 0.234*** | 0.516*** | -0.004 | No | 0.462 | 0.516*** | 3.954 |
| Telec | -0.213** | 0.025 | -0.187** | 0.697*** | -0.014*** | No | 0.490 | 0.771*** | 4.571 |
| Servs | -0.133 | 0.092 | -0.326*** | 1.147*** | -0.021*** | No | 0.752 | 1.297*** | 6.472 |
| BusEq | -0.328*** | 0.054 | -0.406*** | 1.106*** | -0.022*** | No | 0.656 | 1.271*** | 6.701 |
| Paper | -0.138 | 0.050 | 0.109 | 0.917*** | -0.017*** | Yes | 0.539 | 0.952*** | 5.029 |
| Trans | -0.269*** | 0.038 | 0.135 | 1.037*** | -0.019*** | No | 0.574 | 1.070*** | 5.784 |
| Whsl | -0.342*** | -0.059 | 0.135 | 1.015*** | -0.023*** | No | 0.648 | 1.072*** | 5.565 |
| Rtail | -0.173* | -0.001 | 0.008 | 0.941*** | -0.019*** | No | 0.696 | 0.989*** | 5.357 |
| Meals | -0.485*** | -0.093 | 0.242** | 1.014*** | -0.025*** | No | 0.822 | 1.036*** | 6.030 |
| Fin | -0.393*** | 0.056 | 0.161* | 1.041*** | -0.019*** | Yes | 0.614 | 1.066*** | 5.378 |
| Other | -0.368*** | 0.014 | 0.060 | 1.030*** | -0.021*** | Yes | 0.333 | 1.091*** | 5.738 |
| Corr. with Ave.Ret. | -0.106 | -0.049 | 0.067 | -0.013 | 0.030 | | | -0.033 | 0.060 |

Panel D. Sample Period 1926 to 1963

| Industry | Std. Skew. | Std. Cosk. | β to HS | β to HS ⁻ | β to MKT ² | Time-V. Cosk. | Av.E.Ret. (%/mo) | β to MKT | Stdev. (%/mo) |
|---------------------|------------|------------|---------------|----------------------------|-----------------------------|---------------|------------------|----------------|---------------|
| Food | 0.078 | -0.316*** | -0.681*** | 0.834*** | 0.007*** | Yes | 0.757 | 0.758*** | 5.349 |
| Beer | 1.899*** | -0.153* | -1.302*** | 1.104*** | 0.009*** | Yes | 1.208 | 1.063*** | 9.496 |
| Smoke | 0.133 | 0.037 | -0.610*** | 0.683*** | 0.007*** | Yes | 0.738 | 0.606*** | 5.347 |
| Games | 0.973*** | 0.363*** | -1.665*** | 1.574*** | 0.021*** | Yes | 1.007 | 1.434*** | 11.107 |
| Books | 0.661** | 0.312*** | -1.494*** | 1.243*** | 0.016*** | No | 0.825 | 1.119*** | 8.846 |
| Hshld | 0.593*** | 0.005 | -0.916*** | 1.001*** | 0.011*** | No | 0.847 | 0.956*** | 7.245 |
| Ciths | 1.120*** | 0.011 | -0.910*** | 0.624*** | 0.007*** | No | 0.579 | 0.615*** | 5.567 |
| Hlth | 0.113 | -0.031 | -0.747*** | 0.927*** | 0.009*** | Yes | 0.988 | 0.837*** | 6.526 |
| Chems | 0.542*** | 0.131 | -1.184*** | 1.049*** | 0.012*** | Yes | 1.111 | 1.032*** | 7.314 |
| Txtls | 1.458*** | 0.756*** | -1.539*** | 1.205*** | 0.019*** | Yes | 0.804 | 1.137*** | 8.399 |
| Cnstr | 0.634*** | 0.017 | -1.379*** | 1.243*** | 0.013*** | No | 0.831 | 1.159*** | 8.002 |
| Steel | 2.084*** | 1.351*** | -2.003*** | 1.479*** | 0.027*** | No | 1.056 | 1.390*** | 9.848 |
| FabPr | 0.851*** | 0.418*** | -1.660*** | 1.308*** | 0.016*** | No | 1.049 | 1.249*** | 8.574 |
| ElcEq | 0.849*** | 0.387*** | -1.413*** | 1.392*** | 0.018*** | Yes | 1.079 | 1.326*** | 9.279 |
| Autos | 1.498*** | 0.671*** | -1.739*** | 1.375*** | 0.021*** | No | 1.340 | 1.320*** | 9.992 |
| Carry | 0.803*** | 0.190** | -1.585*** | 1.302*** | 0.015*** | No | 0.981 | 1.230*** | 9.157 |
| Mines | 0.726*** | 0.127 | -0.916*** | 0.940*** | 0.011*** | Yes | 0.759 | 0.874*** | 6.904 |
| Coal | 4.190*** | 0.918*** | -2.195*** | 1.525*** | 0.030*** | No | 0.874 | 1.385*** | 11.456 |
| Oil | 0.387*** | -0.078 | -0.967*** | 0.968*** | 0.009*** | Yes | 0.936 | 0.911*** | 6.974 |
| Util | 0.086 | -0.346*** | -0.841*** | 0.997*** | 0.007 | No | 0.838 | 0.946*** | 7.209 |
| Telec | 0.219* | -0.377*** | -0.494*** | 0.618*** | 0.004** | Yes | 0.737 | 0.579*** | 4.585 |
| Servs | 1.448*** | -0.407*** | -0.118 | 0.539*** | -0.004 | Yes | 1.258 | 0.474*** | 10.473 |
| BusEq | -0.808 | -0.480*** | -0.949*** | 1.009*** | 0.007*** | Yes | 1.215 | 0.941*** | 6.852 |
| Paper | 0.510*** | 0.103 | -1.033*** | 1.004*** | 0.011*** | Yes | 1.055 | 0.948*** | 6.932 |
| Trans | 1.564*** | 0.579*** | -1.607*** | 1.312*** | 0.018*** | Yes | 0.763 | 1.180*** | 8.665 |
| Whsl | 0.928*** | 0.148** | -1.423*** | 1.189*** | 0.014*** | Yes | 0.416 | 1.100*** | 9.341 |
| Rtail | 0.169 | -0.211*** | -0.944*** | 1.007*** | 0.009*** | Yes | 0.883 | 0.940*** | 6.780 |
| Meals | -0.216* | -0.927*** | -0.888*** | 0.921*** | 0.000 | No | 0.764 | 0.866*** | 7.057 |
| Fin | 0.808*** | 0.262*** | -1.283*** | 1.318*** | 0.015*** | Yes | 0.947 | 1.225*** | 8.447 |
| Other | 0.715*** | 0.139* | -1.150*** | 1.068*** | 0.013*** | Yes | 0.797 | 1.035*** | 8.048 |
| Corr. with Ave.Ret. | 0.152 | 0.108 | -0.110 | 0.224 | 0.083 | | | 0.250 | 0.381 |

(Continued)

Table IA.4: (Continued)

Description: The table summarizes properties of the 30 Fama-French industry portfolios. Standardized (unconditional) skewness is the third central moment about the mean. Standardized (unconditional) coskewness of the i^{th} asset is defined as $E[\varepsilon_{i,t}\varepsilon_{M,t}^2]/(\sqrt{E[\varepsilon_{i,t}^2]}E[\varepsilon_{M,t}^2])$, where $\varepsilon_{i,t}$ is the residual from regressing i 's excess return on the excess market return, and $\varepsilon_{M,t}$ is the market return minus its unconditional average. Time-variation in conditional coskewness is captured through the autoregression $E_t[\varepsilon_{i,t+1}\varepsilon_{M,t+1}^2] = \rho_0 + \rho_1\varepsilon_{i,t}\varepsilon_{M,t}^2 + \rho_2\varepsilon_{i,t-1}\varepsilon_{M,t-1}^2$ and whether it is significant at 10% level (i.e., the p-value of the joint test of zero coefficients is below 10%). The coskewness factors are the long-short portfolios $HS = S^- - S^+$ and $HS^- = S^- - r_f$, where S^- (S^+) is the portfolio of the 30% of stocks with the lowest (highest) past standardized coskewness, and r_f is the one-month Treasury bill rate. We also report cross-sectional correlations between the average excess return and other variables. The stars indicate significance at 1% (***) , 5% (**), and 10% (*) levels.

Interpretation: Theory predicts that a portfolio's average (excess) return should be negatively correlated to the portfolio's (i) standardized coskewness, (ii) beta on $HS = S^- - S^+$, and (iii) beta on $HS^- = S^- - r_f$. For the replication sample period (1963 to 1993), only Result (i) holds, while for the extended sample period (1963 to 2019), Results (i)-(iii) do not hold, as the corresponding numbers are either positive or close to zero (and thus likely to be insignificant). Results (i)-(iii) also do not hold in the extended sample period (1963 to 2019) but hold for the post-sample period (1994 to 2019), while in the pre-sample period (1926 to 1963) only Result (ii) holds.

Table IA.5: Properties of the 10 Fama-French Portfolios Sorted on Size

| Panel A. Sample Period 1963 to 1993, Original Results | | | | | | | | | | |
|--|-----------|------------|------------|---------------|----------------------------|-----------------------------|---------------|------------------|----------------|---------------|
| Size | Portfolio | Std. Skew. | Std. Cosk. | β to HS | β to HS ⁻ | β to MKT ² | Time-V. Cosk. | Av.E.Ret. (%/mo) | β to MKT | Stdev. (%/mo) |
| Smallest | 1 | 1.156** | -0.181** | 0.410** | 1.011** | -0.022** | No | 2.122 | 1.005** | 7.994 |
| | 2 | 0.390** | -0.292** | 0.249 | 1.026** | -0.026** | Yes | 1.051 | 1.052** | 6.992 |
| | 3 | 0.144 | -0.302** | 0.212 | 1.061** | -0.025** | Yes | 0.702 | 1.096** | 6.639 |
| | 4 | 0.112 | -0.294** | 0.235 | 1.097** | -0.024** | Yes | 0.664 | 1.130** | 6.465 |
| | 5 | -0.154 | -0.330** | 0.162 | 1.107** | -0.024** | Yes | 0.526 | 1.151** | 6.253 |
| | 6 | -0.213* | -0.307** | 0.163 | 1.120** | -0.021** | Yes | 0.516 | 1.163** | 6.052 |
| | 7 | -0.386** | -0.341** | 0.082 | 1.115** | -0.021** | Yes | 0.505 | 1.173** | 5.841 |
| | 8 | -0.445** | -0.312** | 0.076 | 1.090** | -0.018** | Yes | 0.574 | 1.145** | 5.548 |
| | 9 | -0.513** | 0.313** | 0.024 | 1.050** | -0.016** | Yes | 0.549 | 1.111** | 5.198 |
| | Largest | 10 | -0.232* | 0.236** | -0.011 | 0.984** | -0.007 | Yes | 0.437 | 1.044** |
| Corr. with Ave.Ret. | | 0.697 | 0.370 | 0.794 | -0.358 | -0.636 | | | -0.527 | 0.818 |
| Panel B. Sample Period 1963 to 1993, Replication Results | | | | | | | | | | |
| Size | Portfolio | Std. Skew. | Std. Cosk. | β to HS | β to HS ⁻ | β to MKT ² | Time-V. Cosk. | Av.E.Ret. (%/mo) | β to MKT | Stdev. (%/mo) |
| Smallest | 1 | -0.212* | -0.335*** | 0.593*** | 1.060*** | -0.027*** | No | 0.691 | 1.154*** | 6.460 |
| | 2 | -0.370*** | -0.314*** | 0.551*** | 1.115*** | -0.024*** | Yes | 0.617 | 1.218*** | 6.193 |
| | 3 | -0.391*** | -0.282*** | 0.469*** | 1.110*** | -0.021*** | Yes | 0.738 | 1.222*** | 6.028 |
| | 4 | -0.514*** | -0.343*** | 0.463*** | 1.088*** | -0.022*** | Yes | 0.720 | 1.196*** | 5.840 |
| | 5 | -0.555*** | -0.374*** | 0.409*** | 1.052*** | -0.021*** | Yes | 0.750 | 1.161*** | 5.550 |
| | 6 | -0.461*** | -0.211** | 0.346*** | 1.021*** | -0.016** | Yes | 0.633 | 1.132*** | 5.340 |
| | 7 | -0.348*** | -0.052 | 0.367*** | 1.028*** | -0.013* | Yes | 0.595 | 1.136*** | 5.253 |
| | 8 | -0.341*** | -0.030 | 0.299** | 0.982*** | -0.012* | Yes | 0.568 | 1.092*** | 5.011 |
| | 9 | -0.214* | 0.245*** | 0.258** | 0.916*** | -0.008 | Yes | 0.455 | 1.021*** | 4.656 |
| | Largest | 10 | -0.135 | 0.313*** | 0.284*** | 0.826*** | -0.006 | Yes | 0.336 | 0.914*** |
| Corr. with Ave.Ret. | | -0.767 | -0.949 | 0.672 | 0.911 | -0.851 | | | 0.916 | 0.837 |
| Panel C. Sample Period 1994 to 2019, Post-Sample Results | | | | | | | | | | |
| Size | Portfolio | Std. Skew. | Std. Cosk. | β to HS | β to HS ⁻ | β to MKT ² | Time-V. Cosk. | Av.E.Ret. (%/mo) | β to MKT | Stdev. (%/mo) |
| Smallest | 1 | -0.068 | -0.119 | -0.612*** | 0.940*** | -0.046*** | Yes | 0.762 | 1.062*** | 6.003 |
| | 2 | -0.126 | -0.001 | -0.595*** | 1.098*** | -0.043*** | No | 0.823 | 1.205*** | 6.382 |
| | 3 | -0.505*** | -0.046 | -0.451*** | 1.110*** | -0.044*** | No | 0.847 | 1.179*** | 5.907 |
| | 4 | -0.478*** | 0.011 | -0.404*** | 1.088*** | -0.040*** | No | 0.733 | 1.148*** | 5.674 |
| | 5 | -0.474*** | 0.073 | -0.427*** | 1.107*** | -0.039*** | Yes | 0.750 | 1.168*** | 5.548 |
| | 6 | -0.576*** | -0.005 | -0.361*** | 1.041*** | -0.039*** | No | 0.785 | 1.093*** | 5.089 |
| | 7 | -0.661*** | -0.048 | -0.406*** | 1.035*** | -0.040*** | No | 0.833 | 1.089*** | 4.980 |
| | 8 | -0.631*** | 0.019 | -0.440*** | 1.029*** | -0.038*** | No | 0.807 | 1.089*** | 4.913 |
| | 9 | -0.750*** | 0.013 | -0.268*** | 0.973*** | -0.035*** | Yes | 0.778 | 0.996*** | 4.418 |
| | Largest | 10 | -0.631*** | 0.095 | -0.372*** | 0.911*** | -0.032*** | Yes | 0.666 | 0.936*** |
| Corr. with Ave.Ret. | | 0.084 | -0.561 | -0.240 | 0.544 | -0.616 | | | 0.591 | 0.440 |
| Panel D. Sample Period 1963 to 2019, Extended-Sample Results | | | | | | | | | | |
| Size | Portfolio | Std. Skew. | Std. Cosk. | β to HS | β to HS ⁻ | β to MKT ² | Time-V. Cosk. | Av.E.Ret. (%/mo) | β to MKT | Stdev. (%/mo) |
| Smallest | 1 | -0.149 | -0.231*** | -0.016 | 1.012*** | -0.034*** | No | 0.724 | 1.111*** | 6.249 |
| | 2 | -0.253*** | -0.154** | -0.028 | 1.108*** | -0.030*** | Yes | 0.711 | 1.211*** | 6.277 |
| | 3 | -0.441*** | -0.161** | 0.005 | 1.109*** | -0.029*** | Yes | 0.788 | 1.201*** | 5.968 |
| | 4 | -0.495*** | -0.163** | 0.026 | 1.088*** | -0.028*** | Yes | 0.726 | 1.173*** | 5.760 |
| | 5 | -0.517*** | -0.155** | -0.012 | 1.074*** | -0.027*** | Yes | 0.750 | 1.162*** | 5.545 |
| | 6 | -0.508*** | -0.106 | -0.011 | 1.029*** | -0.024*** | Yes | 0.703 | 1.113*** | 5.223 |
| | 7 | -0.479*** | -0.040 | -0.024 | 1.030*** | -0.022*** | Yes | 0.705 | 1.114*** | 5.127 |
| | 8 | -0.470*** | -0.004 | -0.074 | 1.001*** | -0.021*** | Yes | 0.678 | 1.090*** | 4.964 |
| | 9 | -0.442*** | 0.142** | -0.008 | 0.939*** | -0.018*** | Yes | 0.604 | 1.009*** | 4.548 |
| | Largest | 10 | -0.361*** | 0.206** | -0.048 | 0.860*** | -0.015*** | No | 0.488 | 0.923*** |
| Corr. with Ave.Ret. | | -0.098 | -0.908 | 0.468 | 0.931 | -0.823 | | | 0.936 | 0.823 |

(Continued)

Table IA.5: (Continued)

| Panel E. Sample Period 1926 to 1963, Pre-Sample Results | | | | | | | | | | | |
|---|-----------|------------|------------|-----------------|-------------------|--------------------|---------------|------------------|------------------|----------------|--|
| Size | Portfolio | Std. Skew. | Std. Cosk. | β to HS | β to HS^- | β to MKT^2 | Time-V. Cosk. | Av.E.Ret. (%/mo) | β to MKT | Stddev. (%/mo) | |
| Smallest | 1 | 3.729*** | 0.855*** | -2.526*** | 1.692*** | 0.035*** | Yes | 1.645 | 1.618*** | 13.625 | |
| | 2 | 2.505*** | 0.695*** | -2.222*** | 1.569*** | 0.026*** | Yes | 1.372 | 1.497*** | 11.373 | |
| | 3 | 2.187*** | 0.882*** | -2.010*** | 1.485*** | 0.024*** | No | 1.247 | 1.409*** | 10.170 | |
| | 4 | 2.059*** | 0.936*** | -1.872*** | 1.389*** | 0.023*** | Yes | 1.240 | 1.310*** | 9.347 | |
| | 5 | 1.350*** | 0.634*** | -1.705*** | 1.356*** | 0.018*** | No | 1.081 | 1.271*** | 8.777 | |
| | 6 | 1.514*** | 1.173*** | -1.681*** | 1.348*** | 0.020*** | Yes | 1.201 | 1.263*** | 8.571 | |
| | 7 | 1.099*** | 0.744*** | -1.531*** | 1.231*** | 0.017*** | Yes | 1.019 | 1.175*** | 7.948 | |
| | 8 | 1.248*** | 1.165*** | -1.415*** | 1.198*** | 0.017*** | Yes | 0.992 | 1.127*** | 7.513 | |
| | 9 | 0.751*** | 0.671*** | -1.293*** | 1.173*** | 0.014*** | Yes | 0.928 | 1.097*** | 7.237 | |
| Largest | 10 | 0.243** | -0.664*** | -0.983*** | 0.988*** | 0.009*** | Yes | 0.821 | 0.929*** | 6.095 | |
| Corr. with Ave.Ret. | | 0.988 | 0.463 | -0.977 | 0.969 | 0.992 | | | 0.971 | 0.983 | |

Description: The table summarizes properties of the 10 Fama-French portfolios sorted on size, using as cutoffs the stocks listed on NYSE. Standardized (unconditional) skewness is the third central moment about the mean. Standardized (unconditional) coskewness of the i^{th} asset is defined as $E[\varepsilon_{i,t}\varepsilon_{M,t}^2]/(\sqrt{E[\varepsilon_{i,t}^2]}E[\varepsilon_{M,t}^2])$, where $\varepsilon_{i,t}$ is the residual from regressing i 's excess return on the excess market return, and $\varepsilon_{M,t}$ is the market return minus its unconditional average. Time-variation in conditional coskewness is captured through the autoregression $E_t[\varepsilon_{i,t+1}\varepsilon_{M,t+1}^2] = \rho_0 + \rho_1\varepsilon_{i,t}\varepsilon_{M,t}^2 + \rho_2\varepsilon_{i,t-1}\varepsilon_{M,t-1}^2$ and whether it is significant at 10% level (i.e., the p-value of the joint test of zero coefficients is below 10%). The coskewness factors are the long-short portfolios $HS = S^- - S^+$ and $HS^- = S^- - r_f$, where S^- (S^+) is the portfolio of the 30% of stocks with the lowest (highest) past standardized coskewness, and r_f is the one-month Treasury bill rate. We also report cross-sectional correlations between the average excess return and other variables. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels. For the original results, 3-star significance is not available.

Interpretation: Theory predicts that a portfolio's average (excess) return should be negatively correlated to the portfolio's (i) standardized coskewness, (ii) beta on $HS = S^- - S^+$, and (iii) beta on $HS^- = S^- - r_f$. For the replication sample period (1963 to 1993), the replicated results in Panel B are qualitatively different from Harvey and Siddique (2000)'s original results in Panel A: In Panel B only Result (i) holds, while in Panel A only Result (iii) holds. In the post-sample period (1994 to 2019) only Results (i) and (ii) hold, in the extended sample period (1963 to 2019) only Result (i) holds, and in the pre-sample period (1926 to 1963) only Result (ii) holds.

Table IA.6: Properties of 27 Portfolios Sorted on Book/Market, Size, and Momentum

Panel A. Sample Period 1963 to 1993, Original Results

| B/MSize | Port. Mom. No. | Std. Skew. | Std. Cosk. | β to HS | β to HS ⁻ | β to MKT ² | Time-V. Cosk. | Av.E.Ret. (%/mo) | β to MKT | Stdev. (%/mo) |
|---------------------|----------------|------------|------------|---------------|----------------------------|-----------------------------|---------------|------------------|----------------|---------------|
| Low | S Los 1 | -0.013 | -0.128* | 0.010 | 1.209** | -0.017* | Yes | -0.224 | 1.282** | 6.719 |
| | S Mid 2 | -0.465** | -0.264** | 0.035 | 1.165** | -0.019** | Yes | 0.388 | 1.231** | 6.146 |
| | S Win 3 | -0.718** | -0.425** | -0.020 | 1.271** | -0.028** | No | 0.995 | 1.354** | 6.822 |
| | M Los 4 | 0.086 | 0.164** | 0.024 | 1.153** | -0.006 | No | -0.074 | 1.216** | 6.017 |
| | M Mid 5 | -0.468** | -0.182** | -0.024 | 1.067** | -0.014** | Yes | 0.189 | 1.138** | 5.396 |
| | M Win 6 | -0.569 | -0.291** | -0.060 | 1.173** | -0.019** | No | 0.962 | 1.258** | 6.087 |
| | B Los 7 | 0.173 | 0.406* | -0.000 | 0.997** | 0.002 | Yes | 0.131 | 1.046** | 5.281 |
| | B Mid 8 | -0.159 | 0.135* | 0.028 | 0.913** | -0.006 | Yes | 0.271 | 0.960** | 4.547 |
| | B Win 9 | -0.312** | -0.102 | -0.138 | 0.981** | -0.012* | No | 0.655 | 1.069** | 5.399 |
| Med | S Los 10 | 0.454** | -0.058 | 0.180 | 1.057** | -0.012 | Yes | 0.361 | 1.093** | 6.058 |
| | S Mid 11 | -0.214* | -0.306** | 0.087 | 0.919** | -0.018** | Yes | 0.686 | 0.960** | 5.014 |
| | S Win 12 | -0.736** | -0.532** | 0.111 | 1.149** | -0.029** | Yes | 1.206 | 1.201** | 6.158 |
| | M Los 13 | 0.494** | 0.270** | 0.064 | 0.977** | 0.000 | No | 0.432 | 1.024** | 5.461 |
| | M Mid 14 | -0.359** | -0.272** | 0.042 | 0.879** | -0.014** | Yes | 0.567 | 0.924** | 4.546 |
| | M Win 15 | -0.905** | -0.592** | 0.052 | 1.041** | -0.025** | Yes | 0.825 | 1.095** | 5.384 |
| | B Los 16 | 0.466** | 0.499** | -0.003 | 0.844** | 0.008 | No | 0.471 | 0.893** | 4.855 |
| | B Mid 17 | 0.160 | 0.141* | -0.019 | 0.793** | -0.004 | No | 0.401 | 0.851** | 4.240 |
| | B Win 18 | -0.352** | -0.180** | -0.146 | 0.902** | -0.013** | No | 0.635 | 0.985** | 4.902 |
| High | S Los 19 | 0.961** | -0.109 | 0.294** | 1.043** | -0.015* | No | 0.596 | 1.057** | 6.519 |
| | S Mid 20 | 0.187 | -0.316** | 0.243** | 0.963** | -0.022** | No | 1.105 | 0.978** | 5.649 |
| | S Win 21 | -0.302** | -0.455** | 0.225* | 1.099** | -0.030** | Yes | 1.396 | 1.124** | 6.320 |
| | M Los 22 | 0.461** | -0.043 | 0.174 | 1.071** | -0.012 | No | 0.617 | 1.105** | 6.158 |
| | M Mid 23 | -0.026 | -0.250** | 0.158 | 0.992** | -0.017** | No | 0.963 | 1.021** | 5.360 |
| | M Win 24 | -0.832** | -0.538** | 0.094 | 1.092** | -0.029** | Yes | 1.371 | 1.142** | 5.928 |
| | B Los 25 | 0.709** | 0.225** | 0.133 | 0.959** | -0.000 | No | 0.645 | 0.998** | 5.629 |
| | B Mid 26 | -0.058 | -0.106 | -0.045 | 0.881** | -0.011* | Yes | 0.645 | 0.944** | 4.782 |
| | B Win 27 | -0.266** | -0.187** | -0.013 | 0.975** | -0.015** | Yes | 0.988 | 1.024** | 5.378 |
| Corr. with Ave.Ret. | | -0.407 | -0.705 | 0.237 | 0.081 | -0.685 | | | 0.068 | 0.201 |

Panel B. Sample Period 1963 to 1993, Replication Results

| B/MSize | Port. Mom. No. | Std. Skew. | Std. Cosk. | β to HS | β to HS ⁻ | β to MKT ² | Time-V. Cosk. | Av.E.Ret. (%/mo) | β to MKT | Stdev. (%/mo) |
|---------------------|----------------|------------|------------|---------------|----------------------------|-----------------------------|---------------|------------------|----------------|---------------|
| Low | S Los 1 | -0.193 | -0.161* | 0.454*** | 1.223*** | -0.022** | No | -0.443 | 1.362*** | 7.198 |
| | S Mid 2 | -0.663*** | -0.452*** | 0.573*** | 1.190*** | -0.029*** | No | 0.448 | 1.297*** | 6.492 |
| | S Win 3 | -0.710*** | -0.427*** | 0.615*** | 1.277*** | -0.033*** | Yes | 1.148 | 1.398*** | 7.204 |
| | M Los 4 | -0.130 | -0.004 | 0.299** | 1.075*** | -0.013* | No | -0.198 | 1.204*** | 5.996 |
| | M Mid 5 | -0.405*** | -0.191** | 0.374*** | 1.039*** | -0.017** | Yes | 0.379 | 1.150*** | 5.540 |
| | M Win 6 | -0.478*** | -0.195** | 0.474*** | 1.198*** | -0.021** | No | 1.170 | 1.319*** | 6.553 |
| | B Los 7 | 0.298** | 0.506*** | 0.283** | 0.929*** | 0.002 | No | -0.009 | 1.036*** | 5.132 |
| | B Mid 8 | -0.084 | 0.095 | 0.314*** | 0.883*** | -0.008 | No | 0.149 | 0.974*** | 4.824 |
| | B Win 9 | -0.388*** | -0.202** | 0.450*** | 1.012*** | -0.018** | No | 0.618 | 1.107*** | 5.643 |
| Med | S Los 10 | 0.194 | -0.094 | 0.466*** | 1.125*** | -0.018** | No | 0.058 | 1.243*** | 6.799 |
| | S Mid 11 | -0.520*** | -0.407*** | 0.490*** | 0.988*** | -0.025*** | Yes | 0.579 | 1.078*** | 5.604 |
| | S Win 12 | -0.869*** | -0.509*** | 0.503*** | 1.066*** | -0.030*** | No | 1.123 | 1.158*** | 5.994 |
| | M Los 13 | 0.438*** | 0.200** | 0.320** | 0.992*** | -0.005 | No | 0.264 | 1.105*** | 5.709 |
| | M Mid 14 | -0.357*** | -0.218** | 0.269** | 0.787*** | -0.015*** | No | 0.417 | 0.873*** | 4.463 |
| | M Win 15 | -0.936*** | -0.591*** | 0.365*** | 0.908*** | -0.027*** | No | 0.699 | 1.000*** | 5.090 |
| | B Los 16 | 0.539*** | 0.558*** | 0.231* | 0.854*** | 0.008 | No | 0.296 | 0.955*** | 5.088 |
| | B Mid 17 | 0.148 | 0.180** | 0.190* | 0.719*** | -0.004 | Yes | 0.190 | 0.802*** | 4.237 |
| | B Win 18 | -0.430*** | -0.150* | 0.224** | 0.836*** | -0.013** | No | 0.437 | 0.931*** | 4.670 |
| High | S Los 19 | 0.963*** | 0.014 | 0.652*** | 1.162*** | -0.013 | No | 0.650 | 1.261*** | 7.812 |
| | S Mid 20 | 0.877*** | -0.094 | 0.615*** | 1.013*** | -0.016** | No | 1.172 | 1.091*** | 6.427 |
| | S Win 21 | -0.009 | -0.281*** | 0.633*** | 1.033*** | -0.024*** | No | 1.424 | 1.109*** | 6.268 |
| | M Los 22 | 0.711*** | 0.210** | 0.577*** | 1.141*** | -0.003 | No | 0.542 | 1.240*** | 7.023 |
| | M Mid 23 | 0.713*** | 0.187** | 0.365*** | 0.926*** | -0.004 | No | 1.131 | 1.020*** | 5.563 |
| | M Win 24 | -0.136 | -0.221** | 0.464*** | 1.027*** | -0.020*** | No | 1.444 | 1.118*** | 5.940 |
| | B Los 25 | 1.147*** | 0.630*** | 0.331** | 0.919*** | 0.017** | No | 0.863 | 1.012*** | 5.899 |
| | B Mid 26 | 0.492*** | 0.329*** | 0.199* | 0.821*** | 0.001 | No | 0.646 | 0.915*** | 5.024 |
| | B Win 27 | 0.028 | 0.130 | 0.258** | 0.905*** | -0.007 | No | 0.957 | 1.003*** | 5.163 |
| Corr. with Ave.Ret. | | -0.013 | -0.265 | 0.428 | 0.094 | -0.236 | | | 0.038 | 0.150 |

(Continued)

Table IA.6: (Continued)

Panel C. Sample Period 1994 to 2019, Post-Sample Results

| B/MSize | Port. Mom. No. | Std. Skew. | Std. Cosk. | β to HS | β to HS ⁻ | β to MKT ² | Time-V. Cosk. | Av.E.Ret. (%/mo) | β to MKT | Stdev. (%/mo) |
|---------------------|----------------|------------|------------|---------------|----------------------------|-----------------------------|---------------|------------------|----------------|---------------|
| Low | S Los 1 | 0.244* | 0.188* | -0.618*** | 1.470*** | -0.041*** | Yes | 0.298 | 1.554*** | 8.027 |
| | S Mid 2 | -0.485*** | -0.075 | -0.423*** | 1.068*** | -0.045*** | No | 0.622 | 1.140*** | 5.803 |
| | S Win 3 | -0.022 | -0.078 | -0.762*** | 1.129*** | -0.052*** | No | 1.029 | 1.297*** | 7.120 |
| | M Los 4 | -0.401*** | 0.040 | -0.475*** | 1.238*** | -0.043*** | No | 0.271 | 1.278*** | 6.246 |
| | M Mid 5 | -0.731*** | -0.128 | -0.277** | 0.972*** | -0.040*** | No | 0.647 | 0.989*** | 4.777 |
| | M Win 6 | -0.049 | -0.077 | -0.667*** | 0.998*** | -0.046*** | No | 0.958 | 1.146*** | 6.210 |
| | B Los 7 | -0.319** | 0.142 | -0.318*** | 1.020*** | -0.030*** | Yes | 0.719 | 1.028*** | 5.158 |
| | B Mid 8 | -0.769*** | -0.188* | -0.286*** | 0.856*** | -0.037*** | No | 0.554 | 0.868*** | 4.236 |
| | B Win 9 | -0.396*** | 0.056 | -0.664*** | 0.877*** | -0.033*** | No | 0.988 | 0.997*** | 5.222 |
| Med | S Los 10 | 0.460*** | 0.151 | -0.457*** | 1.285*** | -0.037*** | No | 0.414 | 1.335*** | 6.983 |
| | S Mid 11 | -0.537*** | -0.020 | -0.089 | 0.956*** | -0.034*** | No | 0.762 | 0.932*** | 5.027 |
| | S Win 12 | -0.416*** | -0.004 | -0.201 | 1.017*** | -0.037*** | No | 1.007 | 1.024*** | 5.444 |
| | M Los 13 | 0.337** | 0.276*** | -0.223 | 1.273*** | -0.028** | No | 0.739 | 1.257*** | 6.483 |
| | M Mid 14 | -0.340** | 0.108 | -0.011 | 0.954*** | -0.027*** | No | 0.858 | 0.906*** | 4.711 |
| | M Win 15 | -0.476*** | 0.004 | 0.005 | 0.993*** | -0.034*** | No | 0.828 | 0.948*** | 5.127 |
| | B Los 16 | 0.006 | 0.137 | -0.208 | 1.110*** | -0.031*** | No | 0.669 | 1.081*** | 5.672 |
| | B Mid 17 | -0.382*** | 0.193** | 0.152 | 0.833*** | -0.018** | Yes | 0.735 | 0.749*** | 4.109 |
| | B Win 18 | -0.897*** | -0.218** | 0.032 | 0.890*** | -0.041*** | Yes | 0.832 | 0.851*** | 4.634 |
| High | S Los 19 | 1.958*** | 0.232** | -0.635** | 1.660*** | -0.030 | Yes | 1.232 | 1.731*** | 10.881 |
| | S Mid 20 | 0.847*** | 0.095 | -0.251 | 1.103*** | -0.032*** | Yes | 1.167 | 1.108*** | 6.521 |
| | S Win 21 | -0.579*** | -0.088 | -0.141 | 0.899*** | -0.037*** | Yes | 1.297 | 0.889*** | 5.039 |
| | M Los 22 | 1.227*** | 0.258*** | -0.501** | 1.650*** | -0.031* | Yes | 0.861 | 1.671*** | 9.643 |
| | M Mid 23 | 0.431*** | 0.125 | -0.098 | 1.125*** | -0.030*** | No | 1.076 | 1.092*** | 6.198 |
| | M Win 24 | -0.329** | 0.087 | -0.101 | 1.037*** | -0.031*** | Yes | 1.204 | 1.011*** | 5.658 |
| | B Los 25 | 0.244* | 0.161* | -0.314 | 1.568*** | -0.040*** | Yes | 0.360 | 1.530*** | 8.464 |
| | B Mid 26 | -0.660*** | 0.021 | 0.240* | 1.082*** | -0.032*** | No | 0.883 | 0.954*** | 5.831 |
| | B Win 27 | -0.557*** | 0.282*** | 0.092 | 0.927*** | -0.014* | No | 0.849 | 0.850*** | 4.964 |
| Corr. with Ave.Ret. | | 0.186 | -0.068 | 0.122 | -0.221 | 0.217 | | | -0.200 | 0.004 |

Panel D. Sample Period 1963 to 2019, Extended-Sample Results

| B/MSize | Port. Mom. No. | Std. Skew. | Std. Cosk. | β to HS | β to HS ⁻ | β to MKT ² | Time-V. Cosk. | Av.E.Ret. (%/mo) | β to MKT | Stdev. (%/mo) |
|---------------------|----------------|------------|------------|---------------|----------------------------|-----------------------------|---------------|------------------|----------------|---------------|
| Low | S Los 1 | 0.054 | -0.007 | -0.091 | 1.323*** | -0.029*** | No | -0.102 | 1.448*** | 7.594 |
| | S Mid 2 | -0.594*** | -0.262*** | 0.070 | 1.141*** | -0.035*** | No | 0.528 | 1.226*** | 6.180 |
| | S Win 3 | -0.396*** | -0.244*** | -0.079 | 1.217*** | -0.039*** | No | 1.093 | 1.350*** | 7.160 |
| | M Los 4 | -0.262*** | 0.009 | -0.094 | 1.141*** | -0.024*** | No | 0.018 | 1.236*** | 6.112 |
| | M Mid 5 | -0.521*** | -0.139** | 0.045 | 1.012*** | -0.025*** | No | 0.502 | 1.077*** | 5.201 |
| | M Win 6 | -0.290*** | -0.116* | -0.100 | 1.117*** | -0.029*** | No | 1.073 | 1.240*** | 6.393 |
| | B Los 7 | 0.012 | 0.324*** | -0.024 | 0.966*** | -0.009* | No | 0.326 | 1.033*** | 5.153 |
| | B Mid 8 | -0.340*** | -0.014 | 0.010 | 0.872*** | -0.018** | No | 0.335 | 0.926*** | 4.564 |
| | B Win 9 | -0.393*** | -0.071 | -0.114 | 0.957*** | -0.023*** | No | 0.788 | 1.058*** | 5.452 |
| Med | S Los 10 | 0.322*** | 0.009 | -0.001 | 1.189*** | -0.024*** | No | 0.222 | 1.283*** | 6.882 |
| | S Mid 11 | -0.524*** | -0.214*** | 0.198** | 0.974*** | -0.028*** | No | 0.663 | 1.012*** | 5.343 |
| | S Win 12 | -0.681*** | -0.262*** | 0.149 | 1.045*** | -0.032*** | No | 1.070 | 1.096*** | 5.743 |
| | M Los 13 | 0.388*** | 0.221*** | 0.044 | 1.105*** | -0.013* | No | 0.482 | 1.172*** | 6.077 |
| | M Mid 14 | -0.347*** | -0.060 | 0.127* | 0.854*** | -0.019** | No | 0.620 | 0.887*** | 4.580 |
| | M Win 15 | -0.721*** | -0.281*** | 0.184** | 0.942*** | -0.029** | No | 0.759 | 0.976*** | 5.104 |
| | B Los 16 | 0.252*** | 0.339*** | 0.008 | 0.957*** | -0.006 | No | 0.468 | 1.016*** | 5.364 |
| | B Mid 17 | -0.086 | 0.190*** | 0.170** | 0.765*** | -0.009** | No | 0.441 | 0.778*** | 4.184 |
| | B Win 18 | -0.649*** | -0.173*** | 0.126 | 0.857*** | -0.023*** | Yes | 0.619 | 0.895*** | 4.654 |
| High | S Los 19 | 1.737*** | 0.108 | -0.001 | 1.362*** | -0.019** | Yes | 0.917 | 1.470*** | 9.347 |
| | S Mid 20 | 0.860*** | -0.008 | 0.179* | 1.049*** | -0.022*** | No | 1.170 | 1.097*** | 6.466 |
| | S Win 21 | -0.162* | -0.183*** | 0.244** | 0.978*** | -0.028*** | No | 1.365 | 1.009*** | 5.732 |
| | M Los 22 | 1.105*** | 0.205*** | 0.031 | 1.345*** | -0.013 | No | 0.689 | 1.430*** | 8.327 |
| | M Mid 23 | 0.551*** | 0.149** | 0.133 | 1.005*** | -0.013** | No | 1.106 | 1.050*** | 5.860 |
| | M Win 24 | -0.211** | -0.065 | 0.181* | 1.030*** | -0.024*** | No | 1.334 | 1.068*** | 5.809 |
| | B Los 25 | 0.450*** | 0.334*** | 0.009 | 1.178*** | -0.003 | No | 0.631 | 1.239*** | 7.193 |
| | B Mid 26 | -0.173* | 0.159** | 0.221** | 0.925*** | -0.010* | No | 0.755 | 0.932*** | 5.407 |
| | B Win 27 | -0.220** | 0.218*** | 0.177** | 0.913*** | -0.009* | No | 0.908 | 0.933*** | 5.069 |
| Corr. with Ave.Ret. | | 0.062 | -0.268 | 0.464 | -0.084 | -0.193 | | | -0.114 | 0.060 |

(Continued)

Table IA.6: (Continued)

Panel E. Sample Period 1926 to 1963, Pre-Sample Results

| B/M | Size | Port. | Std. | Std. | β to | β to | β to | Time-V. | Av.E.Ret. | β to | Stdev. |
|---------------------|------|----------|-----------|-----------|------------|-----------------|------------------|---------|-----------|------------|--------|
| | | Mom. No. | Skew. | Cosk. | HS | HS ⁻ | MKT ² | Cosk. | (%/mo) | MKT | (%/mo) |
| Low | S | Los 1 | 0.082 | 0.255*** | 2.006*** | 0.784*** | 0.021 | No | -0.335 | 0.882*** | 5.502 |
| | S | Mid 2 | 0.239** | -0.178** | 2.124*** | 0.870*** | -0.009 | No | 0.288 | 0.969*** | 5.679 |
| | S | Win 3 | -0.323*** | -0.393*** | 2.179*** | 0.794*** | -0.029 | No | -0.298 | 0.881*** | 5.585 |
| | M | Los 4 | 0.169 | 0.212*** | 2.542*** | 1.092*** | 0.026 | No | -0.679 | 1.224*** | 7.745 |
| | M | Mid 5 | -0.808** | -0.262*** | 1.904** | 0.876*** | -0.020 | No | 0.783 | 0.991*** | 6.223 |
| | M | Win 6 | 0.006 | -0.198** | 2.004** | 0.715*** | -0.012 | No | -0.075 | 0.776*** | 4.979 |
| | B | Los 7 | -0.188 | -0.399*** | 2.270*** | 0.952*** | -0.022 | No | 0.525 | 1.075*** | 6.158 |
| | B | Mid 8 | -0.309*** | -0.482*** | 1.892** | 0.783*** | -0.031 | No | -0.143 | 0.868*** | 5.305 |
| | B | Win 9 | -0.596*** | -0.235*** | 1.693** | 0.807*** | -0.015 | No | 0.170 | 0.927*** | 5.710 |
| Med | S | Los 10 | -0.598*** | -0.094 | 1.498** | 0.616** | -0.007 | No | 1.126 | 0.692*** | 5.076 |
| | S | Mid 11 | -0.782*** | -0.206** | 1.385** | 0.657*** | -0.016 | No | -0.124 | 0.747*** | 5.196 |
| | S | Win 12 | -0.831*** | -0.272*** | 1.762*** | 0.660*** | -0.025 | No | 0.528 | 0.722*** | 5.410 |
| | M | Los 13 | -0.243** | 0.065 | 1.939*** | 0.724*** | 0.007 | Yes | 0.900 | 0.791*** | 4.996 |
| | M | Mid 14 | -0.691*** | -0.531*** | 1.891*** | 0.770*** | -0.027 | No | 0.373 | 0.860*** | 4.999 |
| | M | Win 15 | -1.102*** | -0.427*** | 1.611** | 0.652*** | -0.035 | No | 0.570 | 0.721*** | 5.081 |
| | B | Los 16 | -0.459*** | -0.421*** | 2.072*** | 0.860*** | -0.024 | No | 0.434 | 0.951*** | 5.617 |
| | B | Mid 17 | -0.853*** | -0.200** | 1.766*** | 0.715*** | -0.013 | No | 0.496 | 0.789*** | 5.121 |
| | B | Win 18 | -0.980*** | -0.611*** | 1.714** | 0.701*** | -0.033 | No | 0.153 | 0.788*** | 4.706 |
| High | S | Los 19 | 1.148*** | 0.665*** | 3.797*** | 1.334*** | 0.108 | No | 1.118 | 1.485*** | 9.993 |
| | S | Mid 20 | 0.046 | 0.003 | 2.184*** | 0.793*** | 0.002 | Yes | 0.710 | 0.889*** | 5.520 |
| | S | Win 21 | 0.116 | 0.165** | 2.562*** | 0.900*** | 0.015 | No | 0.639 | 0.982*** | 6.009 |
| | M | Los 22 | 0.904*** | 0.703*** | 2.769*** | 0.998*** | 0.071 | No | 0.511 | 1.119*** | 7.014 |
| | M | Mid 23 | -0.330*** | -0.141* | 1.642*** | 0.759*** | -0.005 | No | 0.761 | 0.874*** | 4.957 |
| | M | Win 24 | 0.276** | 0.387*** | 2.473*** | 0.891*** | 0.048 | No | 1.323 | 1.000*** | 7.007 |
| | B | Los 25 | 1.673*** | 0.845*** | 2.233** | 0.784*** | 0.067 | No | 0.440 | 0.876*** | 5.524 |
| | B | Mid 26 | 0.016 | 0.253*** | 2.201*** | 0.893*** | 0.018 | Yes | 1.210 | 1.002*** | 5.782 |
| | B | Win 27 | -0.610*** | -0.547*** | 1.427** | 0.709*** | -0.025 | No | 0.975 | 0.813*** | 4.673 |
| Corr. with Ave.Ret. | | | 0.090 | 0.226 | 0.139 | 0.080 | 0.275 | | | 0.085 | 0.130 |

Description: The table summarizes properties of 27 portfolios with dependent sorts on book-to-market, size, and momentum, using as cutoffs the stocks listed on NYSE. Standardized (unconditional) skewness is the third central moment about the mean. Standardized (unconditional) coskewness of the i^{th} asset is defined as $E[\varepsilon_{i,t}\varepsilon_{M,t}^2]/(\sqrt{E[\varepsilon_{i,t}^2]}E[\varepsilon_{M,t}^2])$, where $\varepsilon_{i,t}$ is the residual from regressing i 's excess return on the excess market return, and $\varepsilon_{M,t}$ is the market return minus its unconditional average. Time-variation in conditional coskewness is captured through the autoregression $E_t[\varepsilon_{i,t+1}\varepsilon_{M,t+1}^2] = \rho_0 + \rho_1\varepsilon_{i,t}\varepsilon_{M,t}^2 + \rho_2\varepsilon_{i,t-1}\varepsilon_{M,t-1}^2$ and whether it is significant at 10% level (i.e., the p-value of the joint test of zero coefficients is below 10%). The coskewness factors are the long-short portfolios $HS = S^- - S^+$ and $HS^- = S^- - r_f$, where S^- (S^+) is the portfolio of the 30% of stocks with the lowest (highest) past standardized coskewness, and r_f is the one-month Treasury bill rate. We also report cross-sectional correlations between the average excess return and other variables. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels. For the original results, 3-star significance is not available.

Interpretation: Theory predicts that a portfolio's average (excess) return should be negatively correlated to the portfolio's (i) standardized coskewness, (ii) beta on $HS = S^- - S^+$, and (iii) beta on $HS^- = S^- - r_f$. For the replication sample period (1963 to 1993), the replicated results in Panel B are qualitatively similar to Harvey and Siddique (2000)'s original results in Panel A: Only Result (i) holds, while Results (ii) and (iii) do not. In the post-sample period (1994 to 2019) and extended sample period (1963 to 2019) only Results (i) and (iii) hold, while none of Results (i) to (iii) holds for the pre-sample period (1926 to 1963).

Table IA.7: Properties of the 10 Fama-French Portfolios Sorted on Momentum

| Panel A. Sample Period 1963 to 1993 | | | | | | | | | | |
|-------------------------------------|-----------|------------|------------|---------------|----------------------------|-----------------------------|---------------|------------------|----------------|---------------|
| Perf. | Portfolio | Std. Skew. | Std. Cosk. | β to HS | β to HS ⁻ | β to MKT ² | Time-V. Cosk. | Av.E.Ret. (%/mo) | β to MKT | Stdev. (%/mo) |
| Losers | 1 | 0.341*** | 0.179** | 0.386** | 1.133*** | -0.006 | No | -0.397 | 1.262*** | 6.769 |
| | 2 | 0.193 | 0.389*** | 0.246* | 0.988*** | 0.001 | No | 0.181 | 1.105*** | 5.722 |
| | 3 | 0.309** | 0.457*** | 0.192 | 0.899*** | 0.002 | No | 0.340 | 1.007*** | 5.103 |
| | 4 | -0.028 | 0.271*** | 0.225** | 0.876*** | -0.005 | No | 0.306 | 0.980*** | 4.740 |
| | 5 | -0.306** | -0.041 | 0.224** | 0.852*** | -0.011* | Yes | 0.277 | 0.952*** | 4.506 |
| | 6 | -0.275** | -0.091 | 0.222** | 0.897*** | -0.012** | No | 0.427 | 1.002*** | 4.681 |
| | 7 | -0.360*** | -0.120 | 0.237** | 0.875*** | -0.012** | No | 0.421 | 0.978*** | 4.560 |
| | 8 | -0.233* | 0.053 | 0.405*** | 0.906*** | -0.009 | Yes | 0.589 | 0.990*** | 4.694 |
| | 9 | -0.508** | -0.313*** | 0.489*** | 0.975*** | -0.018*** | No | 0.809 | 1.060*** | 5.103 |
| | Winners | 10 | -0.445*** | -0.183** | 0.548*** | 1.096*** | -0.019** | No | 1.183 | 1.194*** |
| Corr. with Ave.Ret. | | -0.765 | -0.581 | 0.527 | -0.052 | -0.657 | | | -0.150 | -0.263 |

| Panel B. Sample Period 1994 to 2019 | | | | | | | | | | |
|-------------------------------------|-----------|------------|------------|---------------|----------------------------|-----------------------------|---------------|------------------|----------------|---------------|
| Perf. | Portfolio | Std. Skew. | Std. Cosk. | β to HS | β to HS ⁻ | β to MKT ² | Time-V. Cosk. | Av.E.Ret. (%/mo) | β to MKT | Stdev. (%/mo) |
| Losers | 1 | 0.824*** | 0.305*** | -0.778*** | 1.680*** | -0.030* | No | 0.369 | 1.749*** | 9.695 |
| | 2 | 0.232* | 0.183* | -0.294* | 1.350*** | -0.036*** | Yes | 0.583 | 1.335*** | 6.841 |
| | 3 | 0.239* | 0.236** | -0.072 | 1.131*** | -0.026*** | Yes | 0.712 | 1.080*** | 5.616 |
| | 4 | -0.301** | 0.100 | -0.077 | 1.021*** | -0.030*** | Yes | 0.781 | 0.970*** | 4.876 |
| | 5 | -0.301** | 0.182* | -0.087 | 0.918*** | -0.025*** | No | 0.760 | 0.887*** | 4.321 |
| | 6 | -0.596*** | -0.128 | -0.003 | 0.907*** | -0.035*** | No | 0.707 | 0.861*** | 4.163 |
| | 7 | -0.592*** | -0.022 | -0.088 | 0.837*** | -0.029*** | Yes | 0.718 | 0.805*** | 4.003 |
| | 8 | -0.549*** | -0.025 | -0.106 | 0.842*** | -0.030*** | Yes | 0.811 | 0.821*** | 3.968 |
| | 9 | -0.619*** | -0.117 | -0.208** | 0.862*** | -0.035*** | Yes | 0.674 | 0.863*** | 4.238 |
| | Winners | 10 | -0.469*** | -0.017 | -0.666*** | 0.996*** | -0.041** | No | 0.966 | 1.125*** |
| Corr. with Ave.Ret. | | -0.747 | -0.525 | 0.302 | -0.770 | -0.226 | | | -0.693 | -0.681 |

| Panel C. Sample Period 1963 to 2019 | | | | | | | | | | |
|-------------------------------------|-----------|------------|------------|---------------|----------------------------|-----------------------------|---------------|------------------|----------------|---------------|
| Perf. | Portfolio | Std. Skew. | Std. Cosk. | β to HS | β to HS ⁻ | β to MKT ² | Time-V. Cosk. | Av.E.Ret. (%/mo) | β to MKT | Stdev. (%/mo) |
| Losers | 1 | 0.746*** | 0.209*** | -0.205 | 1.353*** | -0.014* | No | -0.044 | 1.478*** | 8.248 |
| | 2 | 0.222** | 0.260*** | -0.027 | 1.133*** | -0.012* | Yes | 0.366 | 1.207*** | 6.260 |
| | 3 | 0.274*** | 0.332*** | 0.058 | 0.992*** | -0.008 | No | 0.511 | 1.039*** | 5.345 |
| | 4 | -0.158* | 0.179*** | 0.072 | 0.934*** | -0.014** | Yes | 0.524 | 0.975*** | 4.806 |
| | 5 | -0.306*** | 0.083 | 0.065 | 0.879*** | -0.016*** | Yes | 0.500 | 0.923*** | 4.425 |
| | 6 | -0.396*** | -0.083 | 0.109 | 0.901*** | -0.020*** | No | 0.556 | 0.938*** | 4.449 |
| | 7 | -0.446*** | -0.034 | 0.073 | 0.859*** | -0.018*** | No | 0.558 | 0.901*** | 4.312 |
| | 8 | -0.338*** | 0.043 | 0.147** | 0.880*** | -0.017*** | Yes | 0.691 | 0.914*** | 4.373 |
| | 9 | -0.522*** | -0.187*** | 0.139* | 0.929*** | -0.024*** | No | 0.747 | 0.970*** | 4.722 |
| | Winners | 10 | -0.453*** | -0.092 | -0.064 | 1.055*** | -0.026*** | No | 1.083 | 1.161*** |
| Corr. with Ave.Ret. | | -0.818 | -0.623 | 0.489 | -0.581 | -0.652 | | | -0.536 | -0.550 |

(Continued)

Table IA.7: (Continued)

Panel D. Sample Period 1926 to 1963

| Perf. | Portfolio | Std. Skew. | Std. Cosk. | β to HS | β to HS^- | β to MKT^2 | Time-V. Cosk. | Ave. Ret. (%/mo) | β to MKT | Stdev. (%/mo) |
|---------------------|-----------|------------|------------|-----------------|-------------------|--------------------|---------------|------------------|------------------|---------------|
| Losers | 1 | 2.103*** | 1.043*** | -2.025*** | 1.745*** | 0.031*** | Yes | 0.461 | 1.619*** | 11.880 |
| | 2 | 2.180*** | 0.969*** | -1.711*** | 1.595*** | 0.026*** | Yes | 0.678 | 1.454*** | 10.475 |
| | 3 | 1.719*** | 0.951*** | -1.482*** | 1.386*** | 0.021*** | Yes | 0.524 | 1.279*** | 8.952 |
| | 4 | 1.718*** | 1.233*** | -1.450*** | 1.270*** | 0.021*** | No | 0.779 | 1.182*** | 8.188 |
| | 5 | 1.531*** | 0.927*** | -1.310*** | 1.224*** | 0.017*** | Yes | 0.887 | 1.112*** | 7.670 |
| | 6 | 1.004*** | 0.815*** | -1.238*** | 1.177*** | 0.015*** | Yes | 0.866 | 1.083*** | 7.295 |
| | 7 | 0.261** | -0.248*** | -1.096*** | 1.084*** | 0.010*** | No | 1.060 | 1.003*** | 6.809 |
| | 8 | 0.145 | -0.575*** | -1.003*** | 1.008*** | 0.008*** | No | 1.100 | 0.937*** | 6.458 |
| | 9 | -0.164 | -0.914*** | -1.069*** | 1.000*** | 0.005** | Yes | 1.202 | 0.957*** | 6.705 |
| Winners | 10 | -0.521*** | -0.945*** | -0.971*** | 0.948*** | 0.003 | Yes | 1.490 | 0.929*** | 6.992 |
| Corr. with Ave.Ret. | | -0.935 | -0.881 | 0.881 | -0.893 | -0.947 | | | -0.870 | -0.800 |

Description: The table summarizes properties of the 10 Fama-French portfolios sorted on momentum, using as cutoffs the stocks listed on NYSE. Standardized (unconditional) skewness is the third central moment about the mean. Standardized (unconditional) coskewness of the i^{th} asset is defined as $E[\varepsilon_{i,t}\varepsilon_{M,t}^2]/(\sqrt{E[\varepsilon_{i,t}^2]}E[\varepsilon_{M,t}^2])$, where $\varepsilon_{i,t}$ is the residual from regressing i 's excess return on the excess market return, and $\varepsilon_{M,t}$ is the market return minus its unconditional average. Time-variation in conditional coskewness is captured through the autoregression $E_t[\varepsilon_{i,t+1}\varepsilon_{M,t+1}^2] = \rho_0 + \rho_1\varepsilon_{i,t}\varepsilon_{M,t}^2 + \rho_2\varepsilon_{i,t-1}\varepsilon_{M,t-1}^2$ and whether it is significant at 10% level (i.e., the p-value of the joint test of zero coefficients is below 10%). The coskewness factors are the long-short portfolios $HS = S^- - S^+$ and $HS^- = S^- - r_f$, where S^- (S^+) is the portfolio of the 30% of stocks with the lowest (highest) past standardized coskewness, and r_f is the one-month Treasury bill rate. We also report cross-sectional correlations between the average excess return and other variables. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: Theory predicts that a portfolio's average (excess) return should be negatively correlated to the portfolio's (i) standardized coskewness, (ii) beta on $HS = S^- - S^+$, and (iii) beta on $HS^- = S^- - r_f$. In all sample periods considered, Results (i) and (iii) hold, while Result (ii) does not.

Table IA.8: Properties of the 25 Fama-French Portfolios Sorted on Size and Momentum

Panel A. Sample Period 1963 to 1993

| Size Quin- Tile | Mom. Quin- Tile | Std. Skew. | Std. Cosk. | β to <i>HS</i> | β to <i>HS</i> ⁻ | β to <i>MKT</i> ² | Time- Var. Cosk. (%/mo) | Ave. Exc.Ret. (%/mo) | β to <i>MKT</i> | Std. Dev. (%/mo) |
|-----------------------|-----------------------|---------------|---------------|-------------------------|--------------------------------------|---------------------------------------|-------------------------------|----------------------------|--------------------------|------------------------|
| 1 | 1 | 0.647*** | -0.058 | 0.635*** | 1.153*** | -0.017* | No | -0.212 | 1.256*** | 7.295 |
| | 2 | 0.309** | -0.182** | 0.511*** | 0.978*** | -0.019** | No | 0.626 | 1.066*** | 5.952 |
| | 3 | -0.104 | -0.314*** | 0.530*** | 0.961*** | -0.023*** | No | 0.899 | 1.043*** | 5.694 |
| | 4 | -0.632*** | -0.493*** | 0.510*** | 0.995*** | -0.029*** | No | 0.961 | 1.083*** | 5.774 |
| | 5 | -0.653*** | -0.468*** | 0.612*** | 1.166*** | -0.034** | Yes | 1.361 | 1.270*** | 6.803 |
| 2 | 1 | 0.196 | 0.015 | 0.452*** | 1.188*** | -0.013 | No | -0.161 | 1.318*** | 6.936 |
| | 2 | -0.049 | -0.131 | 0.394*** | 1.004*** | -0.016** | No | 0.505 | 1.109*** | 5.691 |
| | 3 | -0.398*** | -0.330*** | 0.399*** | 0.979*** | -0.020*** | Yes | 0.737 | 1.077*** | 5.360 |
| | 4 | -0.674*** | -0.494*** | 0.446*** | 1.024*** | -0.026*** | No | 0.990 | 1.121*** | 5.581 |
| | 5 | -0.770*** | -0.485*** | 0.551*** | 1.205*** | -0.031** | Yes | 1.254 | 1.315*** | 6.595 |
| 3 | 1 | 0.174 | 0.202** | 0.284* | 1.088*** | -0.005 | No | 0.001 | 1.221*** | 6.439 |
| | 2 | 0.073 | 0.100 | 0.290** | 0.969*** | -0.009 | No | 0.466 | 1.080*** | 5.391 |
| | 3 | -0.391*** | -0.260** | 0.319*** | 0.955*** | -0.017*** | Yes | 0.623 | 1.058*** | 5.139 |
| | 4 | -0.927*** | -0.587*** | 0.377*** | 0.967*** | -0.024*** | No | 0.767 | 1.067*** | 5.142 |
| | 5 | -0.711*** | -0.422*** | 0.522*** | 1.166*** | -0.027*** | Yes | 1.328 | 1.275*** | 6.302 |
| 4 | 1 | 0.328** | 0.475*** | 0.376** | 1.054*** | 0.006 | No | 0.086 | 1.163*** | 6.148 |
| | 2 | 0.013 | 0.232** | 0.238* | 0.996*** | -0.006 | No | 0.442 | 1.117*** | 5.452 |
| | 3 | -0.210* | -0.022 | 0.262** | 0.942*** | -0.012* | Yes | 0.472 | 1.050*** | 4.978 |
| | 4 | -0.418*** | -0.146 | 0.336*** | 0.980*** | -0.014** | Yes | 0.748 | 1.085*** | 5.062 |
| | 5 | -0.631*** | -0.352*** | 0.487*** | 1.111*** | -0.023*** | Yes | 1.122 | 1.214*** | 5.927 |
| 5 | 1 | 0.198 | 0.444*** | 0.225 | 1.001*** | 0.005 | No | 0.067 | 1.121*** | 6.047 |
| | 2 | 0.251** | 0.540*** | 0.178 | 0.811*** | 0.004 | No | 0.316 | 0.908*** | 4.626 |
| | 3 | -0.250* | 0.003 | 0.194* | 0.839*** | -0.010* | Yes | 0.248 | 0.939*** | 4.465 |
| | 4 | 0.013 | 0.148 | 0.289*** | 0.855*** | -0.007 | No | 0.406 | 0.948*** | 4.518 |
| | 5 | -0.295** | -0.159* | 0.489*** | 0.989*** | -0.016** | No | 0.782 | 1.077*** | 5.422 |
| Corr. with Ave.Ret. | | -0.844 | -0.765 | 0.466 | 0.199 | -0.776 | | | 0.140 | -0.035 |

Panel B. Sample Period 1994 to 2019

| Size Quin- Tile | Mom. Quin- Tile | Std. Skew. | Std. Cosk. | β to <i>HS</i> | β to <i>HS</i> ⁻ | β to <i>MKT</i> ² | Time- Var. Cosk. (%/mo) | Ave. Exc.Ret. (%/mo) | β to <i>MKT</i> | Std. Dev. (%/mo) |
|-----------------------|-----------------------|---------------|---------------|-------------------------|--------------------------------------|---------------------------------------|-------------------------------|----------------------------|--------------------------|------------------------|
| 1 | 1 | 0.863*** | 0.116 | -0.641*** | 1.478*** | -0.045*** | Yes | 0.341 | 1.562*** | 8.708 |
| | 2 | -0.291** | -0.057 | -0.236* | 1.043*** | -0.041** | Yes | 0.692 | 1.054*** | 5.654 |
| | 3 | -0.408*** | -0.067 | -0.138 | 0.952*** | -0.037*** | No | 0.970 | 0.949*** | 5.084 |
| | 4 | -0.424*** | -0.091 | -0.288** | 0.862*** | -0.037*** | No | 1.133 | 0.900*** | 4.926 |
| | 5 | -0.085 | -0.083 | -0.633*** | 1.019*** | -0.047*** | Yes | 1.246 | 1.149*** | 6.498 |
| 2 | 1 | 0.665*** | 0.235** | -0.591*** | 1.600*** | -0.039*** | Yes | 0.551 | 1.661*** | 8.657 |
| | 2 | 0.004 | 0.097 | -0.217 | 1.165*** | -0.036*** | No | 0.915 | 1.166*** | 6.011 |
| | 3 | -0.509*** | 0.023 | -0.156 | 0.991*** | -0.034*** | No | 0.927 | 0.984*** | 5.053 |
| | 4 | -0.470*** | 0.001 | -0.204* | 0.952*** | -0.034*** | Yes | 0.970 | 0.966*** | 5.006 |
| | 5 | 0.021 | -0.038 | -0.624*** | 1.111*** | -0.047*** | No | 1.094 | 1.240*** | 6.627 |
| 3 | 1 | 0.417*** | 0.295*** | -0.586*** | 1.544*** | -0.033** | Yes | 0.570 | 1.591*** | 8.315 |
| | 2 | -0.294** | 0.093 | -0.231* | 1.160*** | -0.037*** | Yes | 0.804 | 1.151*** | 5.623 |
| | 3 | -0.322** | 0.109 | -0.075 | 1.002*** | -0.030*** | No | 0.831 | 0.975*** | 4.858 |
| | 4 | -0.464*** | 0.012 | -0.117 | 0.953*** | -0.033** | No | 0.759 | 0.941*** | 4.684 |
| | 5 | -0.255* | -0.069 | -0.593*** | 1.035*** | -0.045*** | No | 0.940 | 1.158*** | 6.061 |
| 4 | 1 | 0.320** | 0.180* | -0.451** | 1.569*** | -0.042*** | No | 0.381 | 1.588*** | 8.329 |
| | 2 | -0.155 | 0.119 | -0.078 | 1.159*** | -0.034*** | Yes | 0.796 | 1.111*** | 5.519 |
| | 3 | -0.507*** | 0.036 | -0.054 | 0.992*** | -0.032*** | No | 0.915 | 0.947*** | 4.594 |
| | 4 | -0.703*** | -0.039 | -0.098 | 0.903*** | -0.033*** | No | 0.856 | 0.882*** | 4.246 |
| | 5 | -0.382*** | -0.184* | -0.526*** | 0.955*** | -0.048*** | Yes | 0.931 | 1.067*** | 5.576 |
| 5 | 1 | 0.153 | 0.209** | -0.427** | 1.399*** | -0.034*** | No | 0.382 | 1.397*** | 7.460 |
| | 2 | -0.108 | 0.169* | -0.041 | 1.036*** | -0.026*** | Yes | 0.720 | 0.976*** | 5.084 |
| | 3 | -0.426*** | 0.051 | -0.023 | 0.901*** | -0.029*** | Yes | 0.699 | 0.856*** | 4.155 |
| | 4 | -0.504*** | -0.013 | -0.100 | 0.824*** | -0.029*** | No | 0.755 | 0.797*** | 3.884 |
| | 5 | -0.558*** | -0.005 | -0.493*** | 0.863*** | -0.034*** | No | 0.815 | 0.944*** | 4.802 |
| Corr. with Ave.Ret. | | -0.609 | -0.721 | 0.117 | -0.702 | -0.173 | | | -0.600 | -0.549 |

(Continued)

Table IA.8: (Continued)

Panel C. Sample Period 1963 to 2019

| Size | Mom. | Std. | Std. | β to | β to | β to | Time- | Ave. | β to | Std. |
|---------------------|-------|-----------|-----------|------------|------------|------------|--------------|----------|------------|--------|
| Quin- | Quin- | Skew. | Cosk. | HS | HS^- | MKT^2 | Var. | Exc.Ret. | MKT | Dev. |
| Tile | Tile | | | | | | Cosk. (%/mo) | | | (%/mo) |
| 1 | 1 | 0.791*** | 0.010 | -0.012 | 1.284*** | -0.026*** | No | 0.042 | 1.392*** | 7.975 |
| | 2 | 0.058 | -0.126* | 0.134 | 1.003*** | -0.026*** | No | 0.656 | 1.059*** | 5.813 |
| | 3 | -0.212** | -0.200*** | 0.193** | 0.957*** | -0.028*** | No | 0.932 | 0.999*** | 5.418 |
| | 4 | -0.557*** | -0.298*** | 0.107 | 0.941*** | -0.032*** | No | 1.040 | 1.001*** | 5.397 |
| | 5 | -0.405*** | -0.275*** | -0.016 | 1.106*** | -0.038*** | No | 1.308 | 1.214*** | 6.660 |
| 2 | 1 | 0.514*** | 0.102 | -0.078 | 1.354*** | -0.023*** | No | 0.167 | 1.470*** | 7.778 |
| | 2 | -0.021 | -0.025 | 0.085 | 1.069*** | -0.023*** | No | 0.694 | 1.134*** | 5.840 |
| | 3 | -0.442*** | -0.148** | 0.119 | 0.983*** | -0.025*** | Yes | 0.824 | 1.035*** | 5.218 |
| | 4 | -0.587*** | -0.238*** | 0.119 | 0.994*** | -0.029*** | No | 0.981 | 1.050*** | 5.320 |
| | 5 | -0.401*** | -0.245*** | -0.041 | 1.166*** | -0.036*** | Yes | 1.180 | 1.279*** | 6.605 |
| 3 | 1 | 0.352*** | 0.217*** | -0.158 | 1.271*** | -0.015** | No | 0.263 | 1.385*** | 7.362 |
| | 2 | -0.108 | 0.089 | 0.026 | 1.046*** | -0.018*** | No | 0.622 | 1.111*** | 5.498 |
| | 3 | -0.360*** | -0.067 | 0.120 | 0.973*** | -0.022*** | No | 0.718 | 1.020*** | 5.009 |
| | 4 | -0.736*** | -0.269*** | 0.129 | 0.961*** | -0.027*** | No | 0.763 | 1.009*** | 4.933 |
| | 5 | -0.505*** | -0.226*** | -0.038 | 1.112*** | -0.033*** | No | 1.150 | 1.220*** | 6.190 |
| 4 | 1 | 0.331*** | 0.275*** | -0.042 | 1.260*** | -0.011 | No | 0.222 | 1.350*** | 7.230 |
| | 2 | -0.066 | 0.175** | 0.078 | 1.061*** | -0.016*** | Yes | 0.605 | 1.113*** | 5.481 |
| | 3 | -0.332*** | 0.022 | 0.101 | 0.962*** | -0.019*** | Yes | 0.676 | 1.004*** | 4.807 |
| | 4 | -0.507*** | -0.054 | 0.117 | 0.949*** | -0.020*** | No | 0.798 | 0.993*** | 4.701 |
| | 5 | -0.518*** | -0.243*** | -0.023 | 1.048*** | -0.031*** | No | 1.034 | 1.146*** | 5.765 |
| 5 | 1 | 0.172* | 0.298*** | -0.105 | 1.161*** | -0.008 | No | 0.212 | 1.243*** | 6.731 |
| | 2 | 0.062 | 0.339*** | 0.067 | 0.901*** | -0.007 | No | 0.502 | 0.938*** | 4.843 |
| | 3 | -0.325*** | 0.039 | 0.083 | 0.864*** | -0.016*** | Yes | 0.455 | 0.902*** | 4.328 |
| | 4 | -0.172* | 0.093 | 0.092 | 0.842*** | -0.015*** | No | 0.566 | 0.880*** | 4.239 |
| | 5 | -0.385*** | -0.074 | -0.007 | 0.938*** | -0.022*** | No | 0.797 | 1.016*** | 5.143 |
| Corr. with Ave.Ret. | | -0.837 | -0.815 | 0.330 | -0.413 | -0.748 | | | -0.359 | -0.366 |

Panel D. Sample Period 1926 to 1963

| Size | Mom. | Std. | Std. | β to | β to | β to | Time- | Ave. | β to | Std. |
|---------------------|-------|-----------|-----------|------------|------------|------------|--------------|----------|------------|--------|
| Quin- | Quin- | Skew. | Cosk. | HS | HS^- | MKT^2 | Var. | Exc.Ret. | MKT | Dev. |
| Tile | Tile | | | | | | Cosk. (%/mo) | | | (%/mo) |
| 1 | 1 | 3.084*** | 0.884*** | -2.454*** | 1.781*** | 0.036*** | Yes | 1.507 | 1.689*** | 13.892 |
| | 2 | 3.217*** | 0.959*** | -2.484*** | 1.708*** | 0.035*** | No | 1.812 | 1.627*** | 13.176 |
| | 3 | 3.541*** | 0.817*** | -2.335*** | 1.571*** | 0.031*** | Yes | 2.005 | 1.498*** | 12.363 |
| | 4 | 3.453*** | 0.735** | -2.400*** | 1.538*** | 0.029*** | No | 1.830 | 1.495*** | 12.333 |
| | 5 | 1.798*** | 0.149* | -2.039*** | 1.323*** | 0.017*** | Yes | 1.984 | 1.313*** | 11.170 |
| 2 | 1 | 2.505*** | 1.068*** | -2.157*** | 1.771*** | 0.032*** | Yes | 0.740 | 1.640*** | 12.183 |
| | 2 | 2.404*** | 0.850** | -1.973*** | 1.548*** | 0.026*** | Yes | 1.183 | 1.443*** | 10.685 |
| | 3 | 1.435*** | 0.346*** | -1.799*** | 1.354*** | 0.018*** | Yes | 1.197 | 1.283*** | 9.440 |
| | 4 | 2.285*** | 0.403*** | -1.829*** | 1.305*** | 0.018*** | Yes | 1.444 | 1.234*** | 9.314 |
| | 5 | 1.204*** | -0.046 | -1.719*** | 1.248*** | 0.013*** | Yes | 1.687 | 1.217*** | 9.155 |
| 3 | 1 | 2.405*** | 1.173*** | -2.161*** | 1.750*** | 0.032*** | Yes | 0.501 | 1.630*** | 11.819 |
| | 2 | 2.071*** | 1.319*** | -1.875*** | 1.517*** | 0.027*** | Yes | 1.062 | 1.405*** | 9.895 |
| | 3 | 1.616*** | 0.893*** | -1.710*** | 1.352*** | 0.020*** | Yes | 1.056 | 1.261*** | 8.812 |
| | 4 | 0.418** | -0.282*** | -1.443*** | 1.158*** | 0.010** | No | 1.200 | 1.092*** | 7.675 |
| | 5 | -0.116 | -0.775*** | -1.280*** | 1.089*** | 0.005* | Yes | 1.477 | 1.045*** | 7.678 |
| 4 | 1 | 2.771*** | 1.224*** | -2.101*** | 1.780*** | 0.033*** | Yes | 0.606 | 1.643*** | 11.958 |
| | 2 | 1.624*** | 1.069*** | -1.721*** | 1.440*** | 0.022*** | No | 0.717 | 1.331*** | 9.205 |
| | 3 | 1.390*** | 0.890** | -1.490*** | 1.254*** | 0.018*** | Yes | 1.018 | 1.164*** | 8.005 |
| | 4 | 1.147*** | 0.456*** | -1.388*** | 1.179*** | 0.015*** | Yes | 1.120 | 1.113*** | 7.646 |
| | 5 | -0.107 | -0.580*** | -1.172*** | 1.022*** | 0.007*** | Yes | 1.591 | 0.995*** | 7.235 |
| 5 | 1 | -2.397*** | 0.317*** | -1.590*** | 1.524*** | 0.023*** | Yes | -0.426 | 1.309*** | 14.186 |
| | 2 | 1.688*** | 1.042*** | -1.392*** | 1.264*** | 0.020*** | Yes | 0.512 | 1.182*** | 8.258 |
| | 3 | 1.432*** | 1.080*** | -1.233*** | 1.187*** | 0.017*** | Yes | 0.856 | 1.082*** | 7.346 |
| | 4 | 0.180 | -0.455*** | -0.995*** | 1.021*** | 0.009*** | No | 1.039 | 0.944*** | 6.428 |
| | 5 | -0.361*** | -1.059*** | -0.946*** | 0.934*** | 0.003 | Yes | 1.183 | 0.909*** | 6.582 |
| Corr. with Ave.Ret. | | 0.449 | -0.258 | -0.273 | -0.140 | -0.080 | | | -0.001 | -0.046 |

(Continued)

Table IA.8: (Continued)

Description: The table summarizes properties of the 25 Fama-French portfolios with independent sorts on size and momentum, using as cutoffs the stocks listed on NYSE. Standardized (unconditional) skewness is the third central moment about the mean. Standardized (unconditional) coskewness of the i^{th} asset is defined as $E[\varepsilon_{i,t}\varepsilon_{M,t}^2]/(\sqrt{E[\varepsilon_{i,t}^2]}E[\varepsilon_{M,t}^2])$, where $\varepsilon_{i,t}$ is the residual from regressing i 's excess return on the excess market return, and $\varepsilon_{M,t}$ is the market return minus its unconditional average. Time-variation in conditional coskewness is captured through the autoregression $E_t[\varepsilon_{i,t+1}\varepsilon_{M,t+1}^2] = \rho_0 + \rho_1\varepsilon_{i,t}\varepsilon_{M,t}^2 + \rho_2\varepsilon_{i,t-1}\varepsilon_{M,t-1}^2$ and whether it is significant at 10% level (i.e., the p-value of the joint test of zero coefficients is below 10%). The coskewness factors are the long-short portfolios $HS = S^- - S^+$ and $HS^- = S^- - r_f$, where S^- (S^+) is the portfolio of the 30% of stocks with the lowest (highest) past standardized coskewness, and r_f is the one-month Treasury bill rate. We also report cross-sectional correlations between the average excess return and other variables. The stars indicate significance at 1% (***) , 5% (**), and 10% (*) levels.

Interpretation: Theory predicts that a portfolio's average (excess) return should be negatively correlated to the portfolio's (i) standardized coskewness, (ii) beta on $HS = S^- - S^+$, and (iii) beta on $HS^- = S^- - r_f$. In all sample periods, Results (i) and (iii) hold while Result (ii) does not, except for the replication sample period (1963 to 1993), where only Result (i) holds.

Table IA.9: Properties of 25 Portfolios Sorted on Size and Coskewness

Panel A. Sample Period 1963 to 1993

| Size | Cosk. | Std. | Std. | β to | β to | β to | Time- | Ave. | β to | Std. |
|---------------------|-------|-----------|-----------|------------|------------|------------|--------------|----------|------------|--------|
| Quin- | Quin- | Skew. | Cosk. | HS | HS^- | MKT^2 | Var. | Exc.Ret. | MKT | Dev. |
| Tile | Tile | | | | | | Cosk. (%/mo) | | | (%/mo) |
| 1 | 1 | 0.287** | -0.175* | 0.644*** | 1.068*** | -0.020** | No | 0.905 | 1.154*** | 6.480 |
| | 2 | 0.231* | -0.193** | 0.647*** | 1.117*** | -0.022*** | No | 0.875 | 1.209*** | 6.688 |
| | 3 | 0.193 | -0.186** | 0.633*** | 1.108*** | -0.021** | No | 0.893 | 1.201*** | 6.669 |
| | 4 | 0.042 | -0.227** | 0.604*** | 1.112*** | -0.023*** | No | 0.796 | 1.209*** | 6.647 |
| | 5 | 0.227* | -0.116 | 0.578*** | 1.130*** | -0.018** | No | 0.747 | 1.232*** | 6.710 |
| 2 | 1 | -0.059 | -0.139 | 0.580*** | 1.099*** | -0.017** | No | 0.764 | 1.192*** | 6.077 |
| | 2 | -0.138 | -0.164* | 0.509*** | 1.096*** | -0.018** | Yes | 0.903 | 1.196*** | 6.080 |
| | 3 | -0.312** | -0.237*** | 0.488*** | 1.109*** | -0.020*** | No | 0.770 | 1.216*** | 6.035 |
| | 4 | -0.310** | -0.261*** | 0.413*** | 1.083*** | -0.021*** | Yes | 0.726 | 1.195*** | 6.069 |
| | 5 | -0.425*** | -0.226** | 0.345** | 1.104*** | -0.020*** | No | 0.807 | 1.228*** | 6.116 |
| 3 | 1 | -0.204 | -0.126 | 0.543*** | 1.047*** | -0.015** | No | 0.875 | 1.137*** | 5.535 |
| | 2 | -0.309** | -0.154* | 0.447*** | 1.059*** | -0.016** | No | 0.733 | 1.160*** | 5.636 |
| | 3 | -0.349*** | -0.151* | 0.357*** | 1.012*** | -0.016** | Yes | 0.815 | 1.121*** | 5.441 |
| | 4 | -0.352*** | -0.207** | 0.318** | 1.040*** | -0.018** | No | 0.756 | 1.157*** | 5.610 |
| | 5 | -0.486*** | -0.231** | 0.204 | 1.006*** | -0.018*** | Yes | 0.733 | 1.134*** | 5.545 |
| 4 | 1 | 0.039 | 0.146 | 0.568*** | 1.038*** | -0.009 | No | 0.685 | 1.118*** | 5.352 |
| | 2 | -0.040 | 0.240*** | 0.419*** | 0.994*** | -0.007 | No | 0.622 | 1.087*** | 5.149 |
| | 3 | -0.129 | 0.112 | 0.377*** | 1.011*** | -0.010 | Yes | 0.739 | 1.113*** | 5.251 |
| | 4 | -0.143 | 0.125 | 0.283** | 0.995*** | -0.009 | No | 0.721 | 1.109*** | 5.219 |
| | 5 | -0.321** | -0.026 | 0.105 | 0.972*** | -0.012* | No | 0.604 | 1.105*** | 5.240 |
| 5 | 1 | 0.157 | 0.257*** | 0.778*** | 0.944*** | -0.004 | No | 0.509 | 0.977*** | 4.830 |
| | 2 | 0.459*** | 0.559*** | 0.648*** | 0.941*** | 0.001 | No | 0.476 | 0.998*** | 4.825 |
| | 3 | -0.079 | 0.207** | 0.303*** | 0.852*** | -0.007 | No | 0.445 | 0.945*** | 4.451 |
| | 4 | -0.310** | 0.003 | 0.162 | 0.818*** | -0.010* | No | 0.325 | 0.924*** | 4.355 |
| | 5 | -0.161 | 0.009 | -0.123 | 0.788*** | -0.009* | No | 0.317 | 0.919*** | 4.385 |
| Corr. with Ave.Ret. | | 0.017 | -0.628 | 0.498 | 0.904 | -0.739 | | | 0.898 | 0.850 |

Panel B. Sample Period 1994 to 2019

| Size | Cosk. | Std. | Std. | β to | β to | β to | Time- | Ave. | β to | Std. |
|---------------------|-------|-----------|---------|------------|------------|------------|--------------|----------|------------|--------|
| Quin- | Quin- | Skew. | Cosk. | HS | HS^- | MKT^2 | Var. | Exc.Ret. | MKT | Dev. |
| Tile | Tile | | | | | | Cosk. (%/mo) | | | (%/mo) |
| 1 | 1 | -0.142 | 0.029 | -0.174 | 1.075*** | -0.037*** | No | 1.007 | 1.082*** | 5.845 |
| | 2 | 0.359** | 0.017 | -0.367** | 1.140*** | -0.041*** | Yes | 0.979 | 1.184*** | 6.464 |
| | 3 | -0.037 | -0.031 | -0.478*** | 1.096*** | -0.043*** | No | 0.860 | 1.163*** | 6.233 |
| | 4 | -0.005 | -0.047 | -0.503*** | 1.142*** | -0.046*** | Yes | 0.854 | 1.211*** | 6.443 |
| | 5 | 0.033 | -0.040 | -0.672*** | 1.137*** | -0.047*** | No | 0.903 | 1.236*** | 6.765 |
| 2 | 1 | -0.132 | 0.072 | -0.172 | 1.086*** | -0.035*** | No | 1.014 | 1.095*** | 5.673 |
| | 2 | -0.336** | 0.041 | -0.261* | 1.146*** | -0.040*** | No | 0.954 | 1.170*** | 5.860 |
| | 3 | -0.285** | 0.044 | -0.452*** | 1.162*** | -0.041*** | No | 0.908 | 1.217*** | 6.086 |
| | 4 | -0.213 | 0.110 | -0.484*** | 1.146*** | -0.037*** | Yes | 0.924 | 1.211*** | 6.088 |
| | 5 | -0.284** | 0.047 | -0.613*** | 1.218*** | -0.043*** | No | 0.934 | 1.294*** | 6.496 |
| 3 | 1 | -0.263* | 0.250** | -0.100 | 1.049*** | -0.026*** | No | 0.934 | 1.036*** | 5.103 |
| | 2 | -0.257* | 0.136 | -0.229* | 1.107*** | -0.034*** | No | 0.947 | 1.120*** | 5.409 |
| | 3 | -0.446*** | 0.102 | -0.337*** | 1.089*** | -0.036*** | Yes | 0.696 | 1.126*** | 5.354 |
| | 4 | -0.450*** | 0.129 | -0.455*** | 1.093*** | -0.035** | No | 0.842 | 1.140*** | 5.458 |
| | 5 | -0.530*** | 0.023 | -0.512*** | 1.161*** | -0.042*** | No | 0.789 | 1.216*** | 5.868 |
| 4 | 1 | -0.344** | 0.065 | -0.032 | 1.029*** | -0.033*** | Yes | 0.907 | 0.994*** | 4.889 |
| | 2 | -0.513*** | 0.097 | -0.198* | 1.039*** | -0.034*** | No | 0.841 | 1.041*** | 4.852 |
| | 3 | -0.493*** | 0.132 | -0.340*** | 1.092*** | -0.035*** | No | 0.861 | 1.116*** | 5.180 |
| | 4 | -0.787*** | -0.099 | -0.240** | 1.076*** | -0.042*** | No | 0.804 | 1.074*** | 5.064 |
| | 5 | -0.926*** | -0.169* | -0.440*** | 1.059*** | -0.046*** | Yes | 0.745 | 1.105*** | 5.239 |
| 5 | 1 | -0.549*** | 0.058 | 0.119 | 0.989*** | -0.030*** | No | 0.802 | 0.912*** | 4.516 |
| | 2 | -0.539*** | 0.047 | -0.080 | 0.904*** | -0.030*** | Yes | 0.713 | 0.881*** | 4.133 |
| | 3 | -0.655*** | 0.046 | -0.452*** | 0.898*** | -0.033*** | No | 0.682 | 0.950*** | 4.364 |
| | 4 | -0.463*** | 0.174* | -0.489*** | 0.936*** | -0.030*** | Yes | 0.675 | 0.982*** | 4.487 |
| | 5 | -0.625*** | -0.059 | -0.645*** | 0.892*** | -0.036*** | No | 0.689 | 0.966*** | 4.481 |
| Corr. with Ave.Ret. | | 0.682 | 0.172 | 0.194 | 0.669 | -0.174 | | | 0.515 | 0.649 |

(Continued)

Table IA.9: (Continued)

Panel C. Sample Period 1963 to 2019

| Size Quin- Tile | Cosk. Quin- Tile | Std. Skew. | Std. Cosk. | β to <i>HS</i> | β to <i>HS</i> ⁻ | β to <i>MKT</i> ² | Time- Var. Cosk. (%/mo) | Ave. Exc.Ret. | β to <i>MKT</i> | Std. Dev. (%/mo) |
|-----------------------|------------------------|---------------|---------------|-------------------------|--------------------------------------|---------------------------------------|-------------------------------|------------------|--------------------------|------------------------|
| 1 | 1 | 0.127 | -0.084 | 0.231** | 1.070*** | -0.026*** | No | 0.952 | 1.120*** | 6.192 |
| | 2 | 0.288*** | -0.097 | 0.135 | 1.126*** | -0.028*** | No | 0.923 | 1.196*** | 6.581 |
| | 3 | 0.104 | -0.116* | 0.073 | 1.103*** | -0.029*** | No | 0.878 | 1.182*** | 6.467 |
| | 4 | 0.023 | -0.147** | 0.045 | 1.123*** | -0.031*** | No | 0.823 | 1.208*** | 6.549 |
| 2 | 5 | 0.135 | -0.080 | -0.054 | 1.132*** | -0.028*** | No | 0.819 | 1.232*** | 6.731 |
| | 1 | -0.088 | -0.032 | 0.200** | 1.094*** | -0.024*** | No | 0.879 | 1.148*** | 5.891 |
| | 2 | -0.222** | -0.068 | 0.121 | 1.115*** | -0.026*** | Yes | 0.927 | 1.183*** | 5.975 |
| | 3 | -0.300*** | -0.100 | 0.014 | 1.130*** | -0.027*** | No | 0.834 | 1.215*** | 6.054 |
| | 4 | -0.265*** | -0.089 | -0.040 | 1.108*** | -0.027*** | Yes | 0.817 | 1.201*** | 6.074 |
| 3 | 5 | -0.357*** | -0.095 | -0.138 | 1.149*** | -0.028*** | Yes | 0.865 | 1.256*** | 6.290 |
| | 1 | -0.222** | 0.064 | 0.219** | 1.047*** | -0.019*** | No | 0.902 | 1.090*** | 5.337 |
| | 2 | -0.285*** | -0.013 | 0.106 | 1.078*** | -0.023*** | No | 0.831 | 1.141*** | 5.530 |
| | 3 | -0.390*** | -0.033 | 0.008 | 1.042*** | -0.023*** | Yes | 0.760 | 1.121*** | 5.397 |
| | 4 | -0.394*** | -0.047 | -0.072 | 1.061*** | -0.024*** | No | 0.796 | 1.148*** | 5.537 |
| 4 | 5 | -0.513*** | -0.115* | -0.157* | 1.068*** | -0.026*** | Yes | 0.759 | 1.169*** | 5.692 |
| | 1 | -0.110 | 0.121* | 0.265*** | 1.034*** | -0.017*** | No | 0.787 | 1.062*** | 5.142 |
| | 2 | -0.236** | 0.181*** | 0.107 | 1.012*** | -0.016*** | No | 0.723 | 1.065*** | 5.012 |
| | 3 | -0.293*** | 0.122* | 0.015 | 1.043*** | -0.019*** | Yes | 0.795 | 1.113*** | 5.215 |
| | 4 | -0.423*** | 0.020 | 0.020 | 1.027*** | -0.021*** | No | 0.759 | 1.091*** | 5.145 |
| 5 | 5 | -0.601*** | -0.095 | -0.170* | 1.007*** | -0.024*** | Yes | 0.669 | 1.104*** | 5.237 |
| | 1 | -0.134 | 0.173*** | 0.444*** | 0.962*** | -0.013*** | No | 0.644 | 0.947*** | 4.687 |
| | 2 | 0.115 | 0.361*** | 0.280*** | 0.926*** | -0.010*** | No | 0.585 | 0.945*** | 4.518 |
| | 3 | -0.336*** | 0.132** | -0.079 | 0.870*** | -0.016*** | No | 0.554 | 0.946*** | 4.409 |
| | 4 | -0.384*** | 0.071 | -0.167** | 0.865*** | -0.017*** | No | 0.486 | 0.949*** | 4.416 |
| 5 | -0.383*** | -0.030 | -0.387*** | 0.829*** | -0.019*** | No | 0.488 | 0.939*** | 4.430 | |
| Corr. with Ave.Ret. | | 0.391 | -0.518 | 0.376 | 0.913 | -0.670 | | | 0.825 | 0.833 |

Panel D. Sample Period 1926 to 1963

| Size Quin- Tile | Cosk. Quin- Tile | Std. Skew. | Std. Cosk. | β to <i>HS</i> | β to <i>HS</i> ⁻ | β to <i>MKT</i> ² | Time- Var. Cosk. (%/mo) | Ave. Exc.Ret. | β to <i>MKT</i> | Std. Dev. (%/mo) |
|-----------------------|------------------------|---------------|---------------|-------------------------|--------------------------------------|---------------------------------------|-------------------------------|------------------|--------------------------|------------------------|
| 1 | 1 | 1.794*** | 0.844*** | -1.840*** | 1.454*** | 0.029*** | No | 1.823 | 1.406*** | 11.872 |
| | 2 | 3.211*** | 0.781*** | -2.374*** | 1.704*** | 0.032*** | Yes | 1.843 | 1.623*** | 13.428 |
| | 3 | 3.254*** | 1.033*** | -2.532*** | 1.765*** | 0.038*** | Yes | 2.238 | 1.704*** | 14.137 |
| | 4 | 4.083*** | 0.835*** | -2.809*** | 1.787*** | 0.037*** | Yes | 2.184 | 1.748*** | 14.984 |
| | 5 | 3.296*** | 1.004*** | -2.604*** | 1.819*** | 0.039*** | No | 1.970 | 1.747*** | 14.480 |
| 2 | 1 | 5.114*** | 1.210*** | -2.065*** | 1.564*** | 0.033*** | Yes | 1.468 | 1.473*** | 11.576 |
| | 2 | 2.489*** | 1.037*** | -2.006*** | 1.484*** | 0.027*** | Yes | 1.356 | 1.410*** | 10.692 |
| | 3 | 2.222*** | 0.645*** | -2.061*** | 1.559*** | 0.024*** | No | 1.370 | 1.482*** | 11.194 |
| | 4 | 2.116*** | 0.484*** | -2.139*** | 1.645*** | 0.023*** | No | 1.205 | 1.557*** | 11.773 |
| | 5 | 2.317*** | 1.217*** | -2.297*** | 1.632*** | 0.032*** | Yes | 1.345 | 1.566*** | 11.704 |
| 3 | 1 | 1.028*** | 0.165** | -1.401*** | 1.314*** | 0.015*** | Yes | 1.147 | 1.230*** | 8.783 |
| | 2 | 1.289*** | 0.476** | -1.640*** | 1.381*** | 0.018*** | No | 1.148 | 1.293*** | 9.295 |
| | 3 | 0.966*** | 0.396*** | -1.624*** | 1.390*** | 0.017*** | Yes | 1.006 | 1.313*** | 9.281 |
| | 4 | 1.380*** | 0.850*** | -1.913*** | 1.497*** | 0.022*** | Yes | 1.077 | 1.406*** | 10.007 |
| | 5 | 2.677*** | 1.684*** | -2.247*** | 1.681*** | 0.034*** | Yes | 1.362 | 1.563*** | 11.311 |
| 4 | 1 | 0.327*** | -0.113 | -1.104*** | 1.145*** | 0.011*** | Yes | 1.012 | 1.068*** | 7.420 |
| | 2 | 1.189*** | 0.786*** | -1.398*** | 1.284*** | 0.018*** | No | 1.151 | 1.202*** | 8.425 |
| | 3 | 0.537*** | -0.035 | -1.462*** | 1.275*** | 0.013*** | Yes | 0.938 | 1.207*** | 8.389 |
| | 4 | 1.838*** | 1.375*** | -1.743*** | 1.382*** | 0.023*** | Yes | 0.803 | 1.301*** | 9.078 |
| | 5 | 2.102*** | 1.257*** | -2.000*** | 1.481*** | 0.025*** | Yes | 1.007 | 1.385*** | 9.892 |
| 5 | 1 | -0.017 | -0.682*** | -0.744*** | 0.987*** | 0.007*** | Yes | 0.703 | 0.911*** | 6.343 |
| | 2 | 0.400** | -0.074 | -0.896*** | 0.998*** | 0.010*** | Yes | 0.717 | 0.926*** | 6.390 |
| | 3 | 0.560*** | 0.005 | -1.137*** | 1.041*** | 0.011*** | No | 0.755 | 0.985*** | 6.759 |
| | 4 | 0.298** | -0.268** | -1.216** | 1.093*** | 0.010*** | Yes | 0.812 | 1.031*** | 7.077 |
| | 5 | 1.095*** | 0.765*** | -1.593*** | 1.154*** | 0.016*** | Yes | 0.831 | 1.097*** | 7.682 |
| Corr. with Ave.Ret. | | 0.781 | 0.497 | -0.835 | 0.840 | 0.875 | | | 0.861 | 0.935 |

(Continued)

Table IA.9: (Continued)

Description: The table summarizes properties of 25 portfolios with independent sorts on size and coskewness, using as cutoffs the stocks listed on NYSE. Standardized (unconditional) skewness is the third central moment about the mean. Standardized (unconditional) coskewness of the i^{th} asset is defined as $E[\varepsilon_{i,t}\varepsilon_{M,t}^2]/(\sqrt{E[\varepsilon_{i,t}^2]}E[\varepsilon_{M,t}^2])$, where $\varepsilon_{i,t}$ is the residual from regressing i 's excess return on the excess market return, and $\varepsilon_{M,t}$ is the market return minus its unconditional average. Time-variation in conditional coskewness is captured through the autoregression $E_t[\varepsilon_{i,t+1}\varepsilon_{M,t+1}^2] = \rho_0 + \rho_1\varepsilon_{i,t}\varepsilon_{M,t}^2 + \rho_2\varepsilon_{i,t-1}\varepsilon_{M,t-1}^2$ and whether it is significant at 10% level (i.e., the p-value of the joint test of zero coefficients is below 10%). The coskewness factors are the long-short portfolios $HS = S^- - S^+$ and $HS^- = S^- - r_f$, where S^- (S^+) is the portfolio of the 30% of stocks with the lowest (highest) past standardized coskewness, and r_f is the one-month Treasury bill rate. We also report cross-sectional correlations between the average excess return and other variables. The stars indicate significance at 1% (***) , 5% (**), and 10% (*) levels.

Interpretation: Theory predicts that a portfolio's average (excess) return should be negatively correlated to the portfolio's (i) standardized coskewness, (ii) beta on $HS = S^- - S^+$, and (iii) beta on $HS^- = S^- - r_f$. In the replication sample period (1963 to 1993) and the extended sample period (1963 to 2019) only Result (i) holds, in the pre-sample period (1926 to 1963) only Result (ii) holds, and in the post-sample period (1994 to 2019) none of the Results (i) to (iii) holds.

Table IA.10: Risk Premia for FF3 + HS from Individual Stocks in CRSP – NASDAQ

| Stock Selection | No. of Stocks | λ_{MKT} | λ_{SMB} | λ_{HML} | λ_{HS} | Time Period/ Source |
|------------------------------|---------------|---------------------|---------------------|----------------------|----------------------|---|
| All stocks | 9,268 | 0.278** (0.023) | 0.022* (0.012) | -0.051** (0.012) | 0.058** (0.011) | 1963.07-1993.12/ Original |
| T < 24 | 1,707 | 0.294** (0.026) | 0.109* (0.013) | -0.049** (0.013) | 0.074** (0.011) | |
| 24 ≤ T < 60 | 2,283 | 0.343** (0.066) | 0.144** (0.046) | -0.012 (0.052) | -0.232** (0.048) | |
| 60 ≤ T < 90 | 1,240 | 0.349** (0.116) | -0.051 (0.087) | -0.136 (0.097) | -0.054 (0.099) | |
| T ≥ 90 | 4,038 | 0.122* (0.077) | 0.075 (0.062) | -0.271** (0.088) | -0.027 (0.173) | |
| All stocks | 14,988 | 0.289*** (0.017) | 0.135*** (0.011) | -0.083*** (0.010) | 0.047*** (0.011) | 1963.07-1993.12/ Replicated |
| T < 24 | 2,539 | 0.255*** (0.038) | 0.127*** (0.024) | -0.056** (0.024) | 0.073*** (0.025) | |
| 24 ≤ T < 60 | 3,609 | 0.285*** (0.057) | 0.116*** (0.035) | -0.197*** (0.033) | -0.022 (0.029) | |
| 60 ≤ T < 90 | 2,443 | 0.296*** (0.057) | 0.103*** (0.033) | -0.224*** (0.033) | -0.183*** (0.033) | |
| T ≥ 90 | 6,397 | 0.419*** (0.027) | 0.086*** (0.014) | -0.277*** (0.017) | -0.067*** (0.019) | |
| All stocks CRSP – NASDAQ | 5,444 | 0.186*** (0.031) | -0.002 (0.011) | -0.007 (0.013) | 0.000 (0.016) | 1963.07-1993.12/ Replicated CRSP – NASDAQ |
| T < 24 CRSP – NASDAQ | 590 | 0.255*** (0.084) | 0.025 (0.029) | 0.071** (0.034) | 0.112** (0.046) | |
| 24 ≤ T < 60 CRSP – NASDAQ | 1,077 | -0.046 (0.096) | -0.029 (0.064) | -0.262*** (0.057) | -0.228*** (0.054) | |
| 60 ≤ T < 90 CRSP – NASDAQ | 756 | 0.180* (0.101) | -0.010 (0.058) | -0.236*** (0.059) | -0.307*** (0.062) | |
| T ≥ 90 CRSP – NASDAQ | 3,021 | 0.413*** (0.038) | 0.006 (0.016) | -0.320*** (0.025) | 0.001 (0.028) | |

Description: This table presents risk premia for the individual stocks in CRSP over the extended sample period (1963 to 2019). As risk factors, we use the factors from the Fama-French three-factor model (FF3), to which we add the long-short portfolio $HS = S^- - S^+$, where S^- (S^+) is the portfolio of the 30% of stocks with the lowest (highest) past standardized coskewness. For each stock, we run a time-series regression of its excess returns on a constant and the factor returns. Then we run a cross-sectional regression of the average stock excess returns on a constant and the betas obtained from the time-series regression, and we obtain the factor premia. We weight each stock i by $1/\sigma(\hat{\epsilon}_i)$, where $\sigma(\hat{\epsilon}_i)$ is the standard deviation of residuals from the beta estimation. The first line reports the estimated premia and the second line the weighted least squares (WLS) standard errors in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels. For the original results, 3-star significance is not available.

Interpretation: As theory predicts a negative risk premium associated to coskewness, we should observe a positive premium on $HS = S^- - S^+$. For the replication sample period (1963 to 1993), this result is true for the first two stock groups (“All stocks” and “T < 24”) in the original study and in the replication, but when NASDAQ stocks are removed the result is true only for the second stock group (“T < 24”).

Table IA.11: Summary Statistics on Momentum Strategies

| Panel A. Sample Period 1926 to 1963 | | | | | | |
|-------------------------------------|----------|--------|----------------|-------------------|----------|----------|
| Holding Period | Momentum | Decile | Average (%/yr) | Volatility (%/yr) | Skewness | Kurtosis |
| 1 | 6 | 1 | 17.10 | 45.15 | 3.04 | 21.72 |
| 1 | 6 | 10 | 17.49 | 28.39 | 0.08 | 7.25 |
| 3 | 6 | 1 | 15.74 | 44.32 | 2.96 | 21.07 |
| 3 | 6 | 10 | 18.47 | 29.42 | 0.31 | 8.84 |
| 1 | 12 | 1 | 13.63 | 46.55 | 3.06 | 23.15 |
| 1 | 12 | 10 | 22.37 | 28.40 | 0.58 | 10.40 |
| 3 | 12 | 1 | 12.95 | 45.93 | 3.37 | 25.69 |
| 3 | 12 | 10 | 22.16 | 29.23 | 0.57 | 9.11 |
| 6 | 12 | 1 | 13.13 | 45.01 | 3.06 | 23.19 |
| 6 | 12 | 10 | 21.87 | 30.46 | 1.44 | 15.58 |
| 1 | 24 | 1 | 20.82 | 51.23 | 3.56 | 26.21 |
| 1 | 24 | 10 | 16.17 | 26.70 | -0.22 | 6.01 |
| 3 | 24 | 1 | 20.83 | 50.09 | 3.48 | 25.20 |
| 3 | 24 | 10 | 15.41 | 26.96 | -0.29 | 6.06 |
| 6 | 24 | 1 | 21.81 | 49.24 | 3.31 | 23.79 |
| 6 | 24 | 10 | 15.13 | 27.59 | 0.12 | 7.38 |
| 12 | 24 | 1 | 22.27 | 48.43 | 3.53 | 26.80 |
| 12 | 24 | 10 | 14.18 | 28.13 | 0.15 | 7.29 |

| Panel B. Sample Period 1963 to 1993 | | | | | | |
|-------------------------------------|----------|--------|----------------|-------------------|----------|----------|
| Holding Period | Momentum | Decile | Average (%/yr) | Volatility (%/yr) | Skewness | Kurtosis |
| 1 | 6 | 1 | 10.29 | 26.43 | 0.80 | 7.13 |
| 1 | 6 | 10 | 18.02 | 21.38 | -0.83 | 5.93 |
| 3 | 6 | 1 | 9.52 | 26.37 | 0.81 | 7.33 |
| 3 | 6 | 10 | 17.77 | 21.12 | -0.77 | 5.70 |
| 1 | 12 | 1 | 8.45 | 27.03 | 0.91 | 7.32 |
| 1 | 12 | 10 | 23.12 | 22.51 | -0.69 | 5.77 |
| 3 | 12 | 1 | 8.75 | 26.72 | 0.91 | 7.56 |
| 3 | 12 | 10 | 21.40 | 22.39 | -0.66 | 5.70 |
| 6 | 12 | 1 | 9.89 | 26.30 | 0.93 | 7.91 |
| 6 | 12 | 10 | 19.12 | 22.01 | -0.57 | 5.15 |
| 1 | 24 | 1 | 13.52 | 28.63 | 1.27 | 8.87 |
| 1 | 24 | 10 | 19.39 | 22.92 | -0.67 | 5.26 |
| 3 | 24 | 1 | 13.61 | 28.48 | 1.28 | 9.04 |
| 3 | 24 | 10 | 17.90 | 22.81 | -0.63 | 5.14 |
| 6 | 24 | 1 | 14.53 | 28.21 | 1.31 | 9.28 |
| 6 | 24 | 10 | 16.26 | 22.33 | -0.56 | 4.78 |
| 12 | 24 | 1 | 14.73 | 27.05 | 1.24 | 10.06 |
| 12 | 24 | 10 | 13.69 | 21.90 | -0.55 | 4.84 |

| Panel C. Sample Period 1994 to 2019 | | | | | | |
|-------------------------------------|----------|--------|----------------|-------------------|----------|----------|
| Holding Period | Momentum | Decile | Average (%/yr) | Volatility (%/yr) | Skewness | Kurtosis |
| 1 | 6 | 1 | 8.12 | 32.35 | 1.12 | 9.22 |
| 1 | 6 | 10 | 15.65 | 21.63 | -0.18 | 5.61 |
| 3 | 6 | 1 | 7.68 | 31.64 | 1.19 | 9.72 |
| 3 | 6 | 10 | 14.29 | 21.62 | -0.37 | 4.77 |
| 1 | 12 | 1 | 8.06 | 33.14 | 1.17 | 9.05 |
| 1 | 12 | 10 | 16.14 | 22.08 | -0.20 | 5.28 |
| 3 | 12 | 1 | 7.80 | 31.78 | 1.24 | 9.93 |
| 3 | 12 | 10 | 12.95 | 22.17 | -0.32 | 4.78 |
| 6 | 12 | 1 | 8.19 | 30.75 | 1.24 | 10.47 |
| 6 | 12 | 10 | 11.74 | 21.51 | -0.35 | 4.99 |
| 1 | 24 | 1 | 10.69 | 32.90 | 1.20 | 8.53 |
| 1 | 24 | 10 | 12.02 | 22.08 | -0.44 | 5.01 |
| 3 | 24 | 1 | 10.93 | 32.08 | 1.26 | 8.96 |
| 3 | 24 | 10 | 9.88 | 21.76 | -0.58 | 4.66 |
| 6 | 24 | 1 | 10.89 | 30.91 | 1.24 | 9.26 |
| 6 | 24 | 10 | 9.67 | 21.34 | -0.53 | 4.57 |
| 12 | 24 | 1 | 11.53 | 29.26 | 1.45 | 10.68 |
| 12 | 24 | 10 | 7.97 | 20.27 | -0.57 | 4.57 |

(Continued)

Table IA.11: (Continued)

Panel D. Sample Period 1963 to 2019

| Holding Period | Momentum | Decile | Average (%/yr) | Volatility (%/yr) | Skewness | Kurtosis |
|----------------|----------|--------|----------------|-------------------|----------|----------|
| 1 | 6 | 1 | 9.04 | 29.20 | 1.01 | 8.86 |
| 1 | 6 | 10 | 16.66 | 21.43 | -0.52 | 5.76 |
| 3 | 6 | 1 | 8.44 | 28.81 | 1.05 | 9.16 |
| 3 | 6 | 10 | 15.89 | 21.29 | -0.57 | 5.23 |
| 1 | 12 | 1 | 7.87 | 29.77 | 1.09 | 8.90 |
| 1 | 12 | 10 | 19.56 | 22.18 | -0.46 | 5.53 |
| 3 | 12 | 1 | 7.91 | 28.94 | 1.13 | 9.41 |
| 3 | 12 | 10 | 17.17 | 22.16 | -0.50 | 5.27 |
| 6 | 12 | 1 | 8.74 | 28.22 | 1.12 | 9.80 |
| 6 | 12 | 10 | 15.42 | 21.65 | -0.46 | 5.08 |
| 1 | 24 | 1 | 12.03 | 30.22 | 1.24 | 8.98 |
| 1 | 24 | 10 | 16.14 | 22.25 | -0.57 | 5.22 |
| 3 | 24 | 1 | 12.22 | 29.75 | 1.28 | 9.27 |
| 3 | 24 | 10 | 14.36 | 22.05 | -0.61 | 5.03 |
| 6 | 24 | 1 | 12.72 | 29.06 | 1.28 | 9.50 |
| 6 | 24 | 10 | 13.35 | 21.58 | -0.55 | 4.78 |
| 12 | 24 | 1 | 12.24 | 26.79 | 0.88 | 7.99 |
| 12 | 24 | 10 | 11.41 | 21.55 | -0.46 | 4.87 |

Panel E. Sample Period 1926 to 2019

| Holding Period | Momentum | Decile | Average (%/yr) | Volatility (%/yr) | Skewness | Kurtosis |
|----------------|----------|--------|----------------|-------------------|----------|----------|
| 1 | 6 | 1 | 12.12 | 36.30 | 2.67 | 23.08 |
| 1 | 6 | 10 | 16.96 | 24.37 | -0.15 | 7.33 |
| 3 | 6 | 1 | 11.23 | 35.70 | 2.61 | 22.38 |
| 3 | 6 | 10 | 16.90 | 24.78 | 0.01 | 8.67 |
| 1 | 12 | 1 | 10.05 | 37.14 | 2.73 | 24.79 |
| 1 | 12 | 10 | 20.68 | 24.71 | 0.16 | 9.28 |
| 3 | 12 | 1 | 9.82 | 36.44 | 3.01 | 27.85 |
| 3 | 12 | 10 | 19.19 | 25.09 | 0.17 | 8.56 |
| 6 | 12 | 1 | 10.46 | 35.64 | 2.77 | 25.58 |
| 6 | 12 | 10 | 18.03 | 25.39 | 0.84 | 14.42 |
| 1 | 24 | 1 | 15.39 | 39.47 | 3.38 | 30.90 |
| 1 | 24 | 10 | 16.29 | 23.92 | -0.40 | 5.92 |
| 3 | 24 | 1 | 15.50 | 38.69 | 3.30 | 29.61 |
| 3 | 24 | 10 | 14.89 | 23.91 | -0.45 | 5.93 |
| 6 | 24 | 1 | 16.21 | 37.95 | 3.18 | 28.32 |
| 6 | 24 | 10 | 14.13 | 23.94 | -0.16 | 6.91 |
| 12 | 24 | 1 | 17.20 | 37.01 | 3.47 | 32.69 |
| 12 | 24 | 10 | 12.46 | 23.92 | -0.09 | 7.13 |

Description: This table presents summary statistics for selected momentum portfolios. Among the U.S. stocks listed on NYSE, AMEX, and NASDAQ, we form equally weighted portfolios by sorting on performance over the past (monthly) return history of 24 months ($t - 24$ to $t - 2$), 12 months ($t - 12$ to $t - 2$), or 6 months ($t - 6$ to $t - 2$). The holding period refers to the period over which test portfolio returns are computed: 1 month, 3 months, 6 months, or 12 months. The summary statistics are the average return, volatility, skewness, and kurtosis, and are reported for decile 1 (the “loser” portfolio) and decile 10 (the “winner” portfolio).

Interpretation: Buying the winner portfolio 10 and selling the loser portfolio 1 requires acceptance of significant negative skewness, as a decrease in skewness between portfolios 1 and 10 is shown in all sample periods. The average return of the winner portfolio 10 is larger than the average return of the loser portfolio 1 in all sample periods for the 6-month and 12-month momentum portfolios, but not for the 24-month momentum portfolios.

3 Persistent Coskewness Factors – Different Sample Periods

In this section, we reproduce Tables 6 and 7 in the paper for different sample periods: the pre-sample period (1926 to 1963), the replication sample period (1963 to 1993), the post-sample period (1994 to 2019), and the maximum sample period (1926 to 2019). We also reproduce Table 8 in the paper for different sample periods and different asset pricing models: the CAPM and the Carhart-Fama-French four-factor model (FF4).

Table IA.12: Coskewness and Risk Factors

| Factor | Av.Ret. (%/yr) | Volat. (%/yr) | Sharpe Ratio | β_{MKT} | Std. Skew. | Std. Cosk. | CAPM α (%/yr) | FF4 α (%/yr) | FF5 α (%/yr) |
|--------------------------|-------------------|------------------|-----------------|---------------|---------------|---------------|-------------------------|------------------------|------------------------|
| Panel A. 1926.07-1963.06 | | | | | | | | | |
| <i>HS</i> | -3.152 | 12.173 | -0.26 | -0.288*** | -0.472*** | -1.036*** | 0.086 | 1.609 | |
| <i>mPSS</i> | 0.363 | 15.705 | 0.02 | 0.281*** | 0.859*** | -0.548*** | -2.413 | -6.296*** | |
| <i>MKT</i> | 9.935*** | 22.802 | 0.44 | 1.000 | 0.041 | | | | |
| <i>SMB</i> | 2.753** | 11.872 | 0.23 | 0.184*** | 1.512*** | 0.324*** | 0.922 | | |
| <i>HML</i> | 5.187*** | 15.070 | 0.34 | 0.373*** | 1.032*** | 1.169*** | 1.483 | | |
| <i>MOM</i> | 7.677*** | 18.835 | 0.41 | -0.416*** | -1.922*** | -1.228*** | 11.813*** | | |
| Panel B. 1963.07-1993.12 | | | | | | | | | |
| <i>HS</i> | 2.578 | 7.626 | 0.34 | 0.084*** | -2.988*** | 0.265*** | 2.152 | 0.746 | 0.907 |
| <i>mPSS</i> | 1.913 | 13.004 | 0.15 | 0.312*** | 1.354** | -0.408*** | 0.338 | -5.356*** | 0.934 |
| <i>PSS</i> | 6.830*** | 11.387 | 0.60 | 0.150*** | 2.303*** | -0.528*** | 6.072*** | -1.175 | 4.160*** |
| <i>MKT</i> | 5.042*** | 15.480 | 0.33 | 1.000 | 0.522*** | | | | |
| <i>SMB</i> | 3.371** | 9.931 | 0.34 | 0.233*** | 2.516*** | -0.386*** | 2.198 | | |
| <i>HML</i> | 5.586*** | 8.984 | 0.62 | -0.208*** | 4.800*** | -0.038 | 6.636*** | | |
| <i>RMW</i> | 2.257*** | 5.392 | 0.42 | 0.029 | -0.672*** | 0.012 | 2.112** | 4.207*** | |
| <i>CMA</i> | 3.962*** | 6.628 | 0.60 | -0.179*** | 0.234* | -0.062 | 4.867*** | 1.436* | |
| <i>MOM</i> | 10.237*** | 11.863 | 0.86 | 0.018 | -8.045*** | -0.422*** | 10.149*** | | 10.235*** |
| Panel C. 1994.01-2019.12 | | | | | | | | | |
| <i>HS</i> | 1.638 | 8.465 | 0.19 | -0.123*** | -2.056*** | -0.047 | 2.650 | 2.024 | 1.378 |
| <i>mPSS</i> | 1.220 | 19.674 | 0.06 | 0.642*** | 0.412*** | 0.018 | -4.045 | -4.889* | 2.168 |
| <i>PSS</i> | 3.505*** | 17.110 | 0.20 | 0.299*** | 0.795*** | -0.039 | 1.091 | -1.357 | 4.381* |
| <i>MKT</i> | 8.201*** | 14.860 | 0.55 | 1.000 | 0.304** | | | | |
| <i>SMB</i> | 1.128** | 11.211 | 0.10 | 0.170*** | 1.916*** | -0.055 | -0.265 | | |
| <i>HML</i> | 1.378*** | 10.513 | 0.13 | -0.098** | 3.460*** | -0.011 | 2.178 | | |
| <i>RMW</i> | 4.067*** | 9.419 | 0.43 | -0.288*** | -0.231* | 0.038 | 6.430*** | 5.396*** | |
| <i>CMA</i> | 2.507*** | 7.208 | 0.35 | -0.169*** | 0.342** | 0.160 | 3.895*** | 2.690*** | |
| <i>MOM</i> | 4.833*** | 17.056 | 0.28 | -0.326*** | -2.458*** | -0.159 | 7.507** | | 5.739* |
| Panel D. 1926.07-2019.12 | | | | | | | | | |
| <i>HS</i> | 0.211 | 9.765 | 0.02 | -0.166*** | -1.213*** | -0.794*** | 1.576 | 2.089** | |
| <i>mPSS</i> | 1.120 | 16.131 | 0.07 | 0.353*** | 0.752*** | -0.461*** | -1.633 | -4.703*** | |
| <i>MKT</i> | 7.830*** | 18.518 | 0.42 | 1.000 | 0.174** | | | | |
| <i>SMB</i> | 2.500** | 11.068 | 0.23 | 0.192*** | 1.885*** | 0.104** | 0.993 | | |
| <i>HML</i> | 4.246*** | 12.081 | 0.35 | 0.153*** | 2.071*** | 0.951*** | 3.046** | | |
| <i>MOM</i> | 7.722*** | 16.309 | 0.47 | -0.300*** | -2.964*** | -0.953*** | 10.073*** | | |

Description: This table presents statistics for the skewness factors and for some common factors used in asset pricing tests. We include alphas from several models: the CAPM with the market factor (*MKT*); the Carhart-Fama-French four-factor model (FF4) with *MKT*, size (*SMB*), value (*HML*), and momentum (*MOM*) factors; and the Fama-French five-factor model (FF5) with *MKT*, *SMB*, *HML*, profitability (*RMW*), and investment (*CMA*) factors. $HS = S^- - S^+$ is the Harvey and Siddique (2000) factor, *PSS* is the Langlois (2020) factor, and *mPSS* is our modified *PSS* factor. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: All three coskewness factors have in general positive risk premia (except *HS* during the pre-sample period). During the replication sample (1963 to 1993), the factors *mPSS* and *PSS* have negative coskewness while *HS* has positive coskewness, while the results are mixed for the other sample periods. With respect to FF5, *PSS* has the usually largest and most significant annualized alpha, followed by *mPSS* and *HS*.

Table IA.13: Factor Correlations

| Panel A. 1926.07-1963.06 | | | | | | |
|--------------------------|-----------|-------------|------------|------------|------------|------------|
| | <i>HS</i> | <i>mPSS</i> | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>MOM</i> |
| <i>HS</i> | 1.00 | | | | | |
| <i>mPSS</i> | -0.13 | 1.00 | | | | |
| <i>MKT</i> | -0.56 | 0.36 | 1.00 | | | |
| <i>SMB</i> | -0.39 | 0.41 | 0.37 | 1.00 | | |
| <i>HML</i> | -0.60 | 0.45 | 0.61 | 0.43 | 1.00 | |
| <i>MOM</i> | 0.33 | -0.08 | -0.52 | -0.28 | -0.60 | 1.00 |

| Panel B. 1963.07-1993.12 | | | | | | | | | |
|--------------------------|-----------|-------------|------------|------------|------------|------------|------------|------------|------------|
| | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>RMW</i> | <i>CMA</i> | <i>MOM</i> |
| <i>HS</i> | 1.00 | | | | | | | | |
| <i>mPSS</i> | 0.13 | 1.00 | | | | | | | |
| <i>PSS</i> | 0.12 | 0.83 | 1.00 | | | | | | |
| <i>MKT</i> | 0.16 | 0.37 | 0.20 | 1.00 | | | | | |
| <i>SMB</i> | 0.15 | 0.77 | 0.80 | 0.34 | 1.00 | | | | |
| <i>HML</i> | -0.02 | -0.18 | 0.08 | -0.36 | -0.03 | 1.00 | | | |
| <i>RMW</i> | 0.15 | -0.11 | -0.22 | 0.08 | -0.17 | -0.54 | 1.00 | | |
| <i>CMA</i> | -0.17 | -0.30 | -0.10 | -0.41 | -0.17 | 0.75 | -0.55 | 1.00 | |
| <i>MOM</i> | 0.11 | 0.24 | 0.21 | 0.02 | -0.11 | -0.16 | 0.18 | -0.08 | 1.00 |

| Panel C. 1994.01-2019.12 | | | | | | | | | |
|--------------------------|-----------|-------------|------------|------------|------------|------------|------------|------------|------------|
| | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>RMW</i> | <i>CMA</i> | <i>MOM</i> |
| <i>HS</i> | 1.00 | | | | | | | | |
| <i>mPSS</i> | -0.32 | 1.00 | | | | | | | |
| <i>PSS</i> | -0.29 | 0.87 | 1.00 | | | | | | |
| <i>MKT</i> | -0.21 | 0.50 | 0.27 | 1.00 | | | | | |
| <i>SMB</i> | -0.11 | 0.58 | 0.65 | 0.22 | 1.00 | | | | |
| <i>HML</i> | 0.39 | -0.40 | -0.37 | -0.15 | -0.10 | 1.00 | | | |
| <i>RMW</i> | 0.35 | -0.69 | -0.56 | -0.46 | -0.48 | 0.44 | 1.00 | | |
| <i>CMA</i> | 0.24 | -0.38 | -0.27 | -0.35 | -0.04 | 0.65 | 0.30 | 1.00 | |
| <i>MOM</i> | -0.05 | 0.15 | 0.37 | -0.29 | 0.02 | -0.21 | 0.07 | 0.01 | 1.00 |

| Panel D. 1926.07-2019.12 | | | | | | |
|--------------------------|-----------|-------------|------------|------------|------------|------------|
| | <i>HS</i> | <i>mPSS</i> | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>MOM</i> |
| <i>HS</i> | 1.00 | | | | | |
| <i>mPSS</i> | -0.13 | 1.00 | | | | |
| <i>MKT</i> | -0.32 | 0.39 | 1.00 | | | |
| <i>SMB</i> | -0.20 | 0.58 | 0.33 | 1.00 | | |
| <i>HML</i> | -0.26 | 0.04 | 0.25 | 0.13 | 1.00 | |
| <i>MOM</i> | 0.18 | 0.07 | -0.34 | -0.14 | -0.41 | 1.00 |

Description: This table presents correlations between the market (*MKT*), size (*SMB*), value (*HML*), momentum (*MOM*), profitability (*RMW*), and investment (*CMA*) factors, as well as the Harvey and Siddique (2000) factor ($HS = S^- - S^+$), the Langlois (2020) factor (*PSS*), and our modified predicted coskewness (*mPSS*).

Interpretation: The persistent coskewness factors *mPSS* and *PSS* are highly correlated with each other (83% or 87%, depending on the sample period) but not with *HS*. Size is very correlated with *mPSS* and *PSS* (over 55%) in the sample periods after 1963 (when both factors are defined), and fairly correlated (41%) with *mPSS* in the pre-sample period.

Table IA.14: Risk Premia from the 5-Factor Model and Coskewness, 1963 to 1993

| Panel A. the 25 portfolios Sorted by Size and B/M | | | | | | | | |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|----------------------|---------------------|
| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>RMW</i> | <i>CMA</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
| FF5 | 0.181 (0.333) | 0.291*** (0.040) | 0.527*** (0.048) | 0.450*** (0.141) | 0.029 (0.176) | | | |
| FF5 + <i>HS</i> | 0.156 (0.368) | 0.293*** (0.042) | 0.525*** (0.050) | 0.438*** (0.158) | 0.059 (0.231) | 0.201 (0.437) | | |
| FF5 – <i>SMB</i> + <i>HS</i> | 0.651 (0.401) | | 0.511*** (0.056) | 0.399** (0.183) | –0.361** (0.153) | 1.042*** (0.348) | | |
| FF5 + <i>mPSS</i> | 0.555* (0.286) | 0.315*** (0.033) | 0.507*** (0.039) | 0.314*** (0.119) | –0.110 (0.146) | | –0.650*** (0.213) | |
| FF5 – <i>SMB</i> + <i>mPSS</i> | 0.240 (0.436) | | 0.516*** (0.057) | 0.335* (0.179) | –0.086 (0.214) | | 0.347*** (0.093) | |
| FF5 + <i>PSS</i> | –0.086 (0.296) | 0.315*** (0.035) | 0.494*** (0.042) | 0.477*** (0.120) | 0.344* (0.184) | | | 1.161*** (0.317) |
| FF5 – <i>SMB</i> + <i>PSS</i> | 0.093 (0.330) | | 0.504*** (0.045) | 0.458*** (0.135) | 0.165 (0.174) | | | 0.556*** (0.076) |
| Panel B. 25 Portfolios Sorted on Size and Momentum | | | | | | | | |
| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>RMW</i> | <i>CMA</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
| FF5 | 0.785 (1.098) | 0.434*** (0.137) | –1.173* (0.684) | 0.680 (0.646) | 1.194* (0.714) | | | |
| FF5 + <i>HS</i> | 0.837 (1.243) | 0.424** (0.168) | –1.124 (0.858) | 0.659 (0.683) | 1.210 (0.738) | –0.185 (1.113) | | |
| FF5 – <i>SMB</i> + <i>HS</i> | 3.015** (1.212) | | 0.565 (0.749) | 0.078 (0.678) | 1.487* (0.781) | 2.230*** (0.723) | | |
| FF5 + <i>mPSS</i> | 0.694 (1.056) | 0.272* (0.161) | 0.284 (1.078) | 0.061 (0.709) | 1.214* (0.677) | | 0.646 (0.432) | |
| FF5 – <i>SMB</i> + <i>mPSS</i> | 1.018 (1.025) | | 0.093 (0.574) | 0.191 (0.535) | 1.142* (0.623) | | 0.591*** (0.217) | |
| FF5 + <i>PSS</i> | –0.397 (0.939) | 0.192 (0.127) | 0.425 (0.717) | –0.249 (0.576) | 0.621 (0.590) | | | 1.166*** (0.448) |
| FF5 – <i>SMB</i> + <i>PSS</i> | 0.265 (0.929) | | –0.365 (0.501) | 0.246 (0.472) | 0.767 (0.554) | | | 0.527*** (0.188) |
| Panel C. 25 Portfolios Sorted on Size and Coskewness | | | | | | | | |
| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>RMW</i> | <i>CMA</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
| FF5 | 1.169** (0.497) | 0.325*** (0.078) | –0.011 (0.457) | 0.137 (0.163) | –0.172 (0.356) | | | |
| FF5 + <i>HS</i> | 1.236** (0.518) | 0.338*** (0.082) | –0.106 (0.495) | 0.081 (0.192) | –0.159 (0.365) | 0.209** (0.092) | | |
| FF5 – <i>SMB</i> + <i>HS</i> | 1.348*** (0.464) | | –0.112 (0.435) | 0.049 (0.152) | –0.250 (0.344) | 0.219*** (0.072) | | |
| FF5 + <i>mPSS</i> | 1.168** (0.498) | 0.332*** (0.079) | –0.233 (0.513) | 0.204 (0.178) | –0.274 (0.373) | | –0.174 (0.585) | |
| FF5 – <i>SMB</i> + <i>mPSS</i> | 1.280*** (0.486) | | –0.033 (0.435) | 0.121 (0.148) | –0.240 (0.350) | | 0.434* (0.227) | |
| FF5 + <i>PSS</i> | 0.497 (0.533) | 0.323*** (0.071) | 0.431 (0.456) | 0.171 (0.148) | –0.100 (0.324) | | | 1.004*** (0.335) |
| FF5 – <i>SMB</i> + <i>PSS</i> | 1.118** (0.499) | | –0.107 (0.417) | 0.183 (0.153) | –0.250 (0.340) | | | 0.358*** (0.116) |

Description: This table presents risk premia for the Fama-French five-factor model and an additional coskewness factor: the Harvey and Siddique (2000) factor ($HS = S^- - S^+$), the Langlois (2020) factor (*PSS*), or the modified predicted coskewness factor (*mPSS*). The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and the 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market (*MKT*), size (*SMB*), value (*HML*), profitability (*RMW*), and investment (*CMA*) factors. The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding a coskewness factor to the five-factor model, its risk premium should be positive and significant. This is generally true for *HS*, *mPSS*, and *PSS* as long as we remove the size factor *SMB*, which is highly correlated with the persistent coskewness factors.

Table IA.15: Risk Premia from the 5-Factor Model and Coskewness, 1994 to 2019

| Panel A. the 25 portfolios Sorted by Size and B/M | | | | | | | | |
|--|----------------------|---------------------|---------------------|---------------------|---------------------|--------------------|--------------------|---------------------|
| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>RMW</i> | <i>CMA</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
| FF5 | -0.802** (0.370) | 0.113** (0.057) | 0.037 (0.066) | 0.384** (0.155) | -0.003 (0.210) | | | |
| FF5 + <i>HS</i> | -0.597* (0.355) | 0.104** (0.053) | 0.033 (0.061) | 0.442*** (0.146) | 0.013 (0.195) | -0.391 (0.255) | | |
| FF5 - <i>SMB</i> + <i>HS</i> | -0.247 (0.399) | | 0.049 (0.070) | 0.022 (0.068) | 0.417*** (0.159) | -0.473* (0.286) | | |
| FF5 + <i>mPSS</i> | -0.943*** (0.352) | 0.141** (0.055) | 0.062 (0.063) | 0.546*** (0.166) | -0.111 (0.203) | | 0.677 (0.565) | |
| FF5 - <i>SMB</i> + <i>mPSS</i> | -0.913** (0.363) | | 0.060 (0.060) | 0.557*** (0.171) | -0.135 (0.194) | | 0.727** (0.305) | |
| FF5 + <i>PSS</i> | -0.807** (0.322) | 0.117** (0.051) | 0.079 (0.061) | 0.442*** (0.143) | -0.109 (0.198) | | | 1.092** (0.495) |
| FF5 - <i>SMB</i> + <i>PSS</i> | -0.795** (0.332) | | 0.060 (0.058) | 0.473*** (0.148) | -0.140 (0.199) | | | 0.721*** (0.244) |
| Panel B. 25 Portfolios Sorted on Size and Momentum | | | | | | | | |
| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>RMW</i> | <i>CMA</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
| FF5 | -0.302 (0.205) | 0.266*** (0.063) | -0.109 (0.120) | 0.058 (0.128) | 0.557** (0.272) | | | |
| FF5 + <i>HS</i> | -0.303 (0.208) | 0.258*** (0.065) | -0.049 (0.151) | 0.087 (0.137) | 0.643** (0.303) | -0.395 (0.523) | | |
| FF5 - <i>SMB</i> + <i>HS</i> | -0.390* (0.215) | | 0.067 (0.162) | -0.162** (0.073) | 0.887*** (0.303) | -0.413 (0.560) | | |
| FF5 + <i>mPSS</i> | -0.402* (0.211) | 0.297*** (0.065) | -0.691 (0.424) | 0.106 (0.129) | 0.380 (0.290) | | -0.765* (0.461) | |
| FF5 - <i>SMB</i> + <i>mPSS</i> | -0.282 (0.213) | | 0.169 (0.152) | -0.022 (0.118) | 0.690*** (0.246) | | 0.140 (0.177) | |
| FF5 + <i>PSS</i> | -0.353 (0.293) | 0.271*** (0.071) | -0.208 (0.507) | 0.066 (0.154) | 0.538* (0.290) | | | 0.052 (0.333) |
| FF5 - <i>SMB</i> + <i>PSS</i> | -0.221 (0.210) | | 0.165 (0.143) | -0.023 (0.102) | 0.630*** (0.233) | | | 0.274** (0.120) |
| Panel C. 25 Portfolios Sorted on Size and Coskewness | | | | | | | | |
| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>RMW</i> | <i>CMA</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
| FF5 | -0.100 (0.313) | 0.108** (0.055) | 0.522*** (0.164) | 0.147 (0.109) | 0.130 (0.170) | | | |
| FF5 + <i>HS</i> | -0.064 (0.363) | 0.114** (0.058) | 0.465* (0.274) | 0.121 (0.160) | 0.103 (0.203) | 0.179** (0.083) | | |
| FF5 - <i>SMB</i> + <i>HS</i> | 0.269 (0.253) | | 0.467* (0.266) | -0.029 (0.107) | 0.023 (0.195) | 0.186** (0.076) | | |
| FF5 + <i>mPSS</i> | -0.102 (0.322) | 0.105* (0.063) | 0.514*** (0.178) | 0.151 (0.117) | 0.134 (0.177) | | -0.267 (0.506) | |
| FF5 - <i>SMB</i> + <i>mPSS</i> | -0.024 (0.274) | | 0.561*** (0.129) | 0.097 (0.082) | 0.088 (0.156) | | 0.140 (0.225) | |
| FF5 + <i>PSS</i> | -0.094 (0.304) | 0.089 (0.061) | 0.459** (0.178) | 0.166 (0.127) | 0.170 (0.167) | | | -0.386 (0.406) |
| FF5 - <i>SMB</i> + <i>PSS</i> | 0.024 (0.266) | | 0.566*** (0.118) | 0.056 (0.077) | 0.095 (0.148) | | | 0.033 (0.203) |

Description: This table presents risk premia for the Fama-French five-factor model and an additional coskewness factor: the Harvey and Siddique (2000) factor ($HS = S^- - S^+$), the Langlois (2020) factor (*PSS*), or the modified predicted coskewness factor (*mPSS*). The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and the 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market (*MKT*), size (*SMB*), value (*HML*), profitability (*RMW*), and investment (*CMA*) factors. The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding a coskewness factor to the five-factor model, its risk premium should be positive and significant. This is true for *HS* only in the last panel, and it is weakly true for *mPSS* and *PSS* as long as we remove the size factor *SMB*, which is highly correlated with the persistent coskewness factors.

Table IA.16: Risk Premia for CAPM and Coskewness, 1926 to 1963

| Model | <i>MKT</i> | <i>HS</i> | <i>mPSS</i> |
|--|----------------------|----------------------|---------------------|
| Panel A. 25 Portfolios Sorted by Size and B/M | | | |
| CAPM | 0.811*** (0.151) | | |
| CAPM + <i>HS</i> | 0.551** (0.271) | -0.332** (0.157) | |
| CAPM + <i>mPSS</i> | 0.758*** (0.286) | | 0.287 (0.260) |
| Panel B. 25 Portfolios Sorted on Size and Momentum | | | |
| CAPM | -0.120 (0.397) | | |
| CAPM + <i>HS</i> | -1.938*** (0.291) | -1.448*** (0.191) | |
| CAPM + <i>mPSS</i> | -0.769*** (0.281) | | 1.453*** (0.269) |
| Panel C. 25 Portfolios Sorted on Size and Coskewness | | | |
| CAPM | 1.294*** (0.162) | | |
| CAPM + <i>HS</i> | 1.392*** (0.365) | -0.242 (0.165) | |
| CAPM + <i>mPSS</i> | 0.620*** (0.230) | | 1.182*** (0.231) |

Description: This table presents risk premia for the CAPM model and an additional coskewness factor: the Harvey and Siddique (2000) factor ($HS = S^- - S^+$), the Langlois (2020) factor (*PSS*), or the modified predicted coskewness factor (*mPSS*). The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market factor (*MKT*). The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding a coskewness factor to the CAPM, its risk premium should be positive and significant. This is not true for *HS* in any of the panels, while it is true for *mPSS* in the last two panels.

Table IA.17: Risk Premia from CAPM and Coskewness, 1963 to 1993

| Panel A. 25 Portfolios Sorted by Size and B/M | | | | |
|--|----------------------|---------------------|---------------------|---------------------|
| Model | <i>MKT</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
| CAPM | -0.149 (0.335) | | | |
| CAPM + <i>HS</i> | -0.497 (0.320) | 1.349*** (0.489) | | |
| CAPM + <i>mPSS</i> | -1.647*** (0.359) | | 0.447*** (0.125) | |
| CAPM + <i>PSS</i> | -1.305*** (0.233) | | | 0.635*** (0.092) |
| Panel B. 25 Portfolios Sorted on Size and Momentum | | | | |
| Model | <i>MKT</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
| CAPM | 1.007 (0.724) | | | |
| CAPM + <i>HS</i> | 0.021 (0.710) | 2.121*** (0.693) | | |
| CAPM + <i>mPSS</i> | -0.794 (0.908) | | 0.833*** (0.240) | |
| CAPM + <i>PSS</i> | -0.451 (0.871) | | | 0.773*** (0.224) |
| Panel C. 25 Portfolios Sorted on Size and Coskewness | | | | |
| Model | <i>MKT</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
| CAPM | 1.639*** (0.141) | | | |
| CAPM + <i>HS</i> | 1.580*** (0.140) | 0.230*** (0.064) | | |
| CAPM + <i>mPSS</i> | 1.325*** (0.366) | | 0.541*** (0.053) | |
| CAPM + <i>PSS</i> | 1.173*** (0.393) | | | 0.326*** (0.067) |

Description: This table presents risk premia for the CAPM model and an additional coskewness factor: the Harvey and Siddique (2000) factor ($HS = S^- - S^+$), the Langlois (2020) factor (*PSS*), or the modified predicted coskewness factor (*mPSS*). The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and the 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market factor (*MKT*). The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding a coskewness factor to the CAPM, its risk premium should be positive and significant. This is true for *HS*, *mPSS*, and *PSS* in all panels.

Table IA.18: Risk Premia from the CAPM and Coskewness, 1994 to 2019

| Panel A. 25 Portfolios Sorted by Size and B/M | | | | |
|--|----------------------|---------------------|---------------------|---------------------|
| Model | <i>MKT</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
| CAPM | -0.249 (0.202) | | | |
| CAPM + <i>HS</i> | -0.356 (0.279) | -0.046 (0.119) | | |
| CAPM + <i>mPSS</i> | -0.869** (0.349) | | -0.169 (0.122) | |
| CAPM + <i>PSS</i> | -0.962*** (0.286) | | | 0.151 (0.097) |
| Panel B. 25 Portfolios Sorted on Size and Momentum | | | | |
| Model | <i>MKT</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
| CAPM | -0.424*** (0.158) | | | |
| CAPM + <i>HS</i> | -0.570*** (0.153) | -0.449** (0.189) | | |
| CAPM + <i>mPSS</i> | -0.560*** (0.120) | | 0.200* (0.118) | |
| CAPM + <i>PSS</i> | -0.462*** (0.110) | | | 0.340*** (0.087) |
| Panel C. 25 Portfolios Sorted on Size and Coskewness | | | | |
| Model | <i>MKT</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
| CAPM | 0.560*** (0.168) | | | |
| CAPM + <i>HS</i> | 0.725*** (0.125) | 0.242*** (0.066) | | |
| CAPM + <i>mPSS</i> | 0.177 (0.379) | | 0.496*** (0.158) | |
| CAPM + <i>PSS</i> | -0.049 (0.421) | | | 0.476*** (0.219) |

Description: This table presents risk premia for the CAPM model and an additional coskewness factor: the Harvey and Siddique (2000) factor ($HS = S^- - S^+$), the Langlois (2020) factor (*PSS*), or the modified predicted coskewness factor (*mPSS*). The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and the 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market factor (*MKT*). The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding a coskewness factor to the CAPM, its risk premium should be positive and significant. This is true for *HS* only in last panel, and it is true for *mPSS* and *PSS* only in the last two panels.

Table IA.19: Risk Premia from the CAPM and Coskewness, 1963 to 2019

| Panel A. 25 Portfolios Sorted by Size and B/M | | | | |
|--|----------------------|---------------------|---------------------|---------------------|
| Model | <i>MKT</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
| CAPM | −0.131 (0.261) | | | |
| CAPM + <i>HS</i> | 0.350 (0.306) | 0.821** (0.334) | | |
| CAPM + <i>mPSS</i> | −1.399*** (0.452) | | 0.153 (0.128) | |
| CAPM + <i>PSS</i> | −1.406*** (0.310) | | | 0.494*** (0.118) |
| Panel B. 25 Portfolios Sorted on Size and Momentum | | | | |
| Model | <i>MKT</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
| CAPM | −0.389 (0.400) | | | |
| CAPM + <i>HS</i> | −0.043 (0.597) | 0.909 (1.162) | | |
| CAPM + <i>mPSS</i> | −1.412*** (0.274) | | 0.604*** (0.144) | |
| CAPM + <i>PSS</i> | −1.144*** (0.230) | | | 0.801*** (0.105) |
| Panel C. 25 Portfolios Sorted on Size and Coskewness | | | | |
| Model | <i>MKT</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
| CAPM | 1.194*** (0.146) | | | |
| CAPM + <i>HS</i> | 1.175*** (0.092) | 0.271*** (0.048) | | |
| CAPM + <i>mPSS</i> | 0.952** (0.382) | | 0.596*** (0.090) | |
| CAPM + <i>PSS</i> | 0.728 (0.457) | | | 0.395*** (0.133) |

Description: This table presents risk premia for the CAPM model and an additional coskewness factor: the Harvey and Siddique (2000) factor ($HS = S^- - S^+$), the Langlois (2020) factor (*PSS*), or the modified predicted coskewness factor (*mPSS*). The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and the 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market factor (*MKT*). The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding a coskewness factor to the CAPM, its risk premium should be positive and significant. This is true for *PSS* in all three panels, for *mPSS* in the last two panels, and for *HS* in the first and last panel.

Table IA.20: Risk Premia from the CAPM and Coskewness, 1926 to 2019

| Panel A. 25 Portfolios Sorted by Size and B/M | | | |
|--|----------------------|----------------------|---------------------|
| Model | <i>MKT</i> | <i>HS</i> | <i>mPSS</i> |
| CAPM | 0.698*** (0.207) | | |
| CAPM + <i>HS</i> | -0.266 (0.343) | -1.086*** (0.309) | |
| CAPM + <i>mPSS</i> | 0.980*** (0.332) | | 0.067 (0.173) |
| Panel B. 25 Portfolios Sorted on Size and Momentum | | | |
| Model | <i>MKT</i> | <i>HS</i> | <i>mPSS</i> |
| CAPM | -0.343 (0.374) | | |
| CAPM + <i>HS</i> | -2.028*** (0.485) | -2.036*** (0.507) | |
| CAPM + <i>mPSS</i> | -1.004*** (0.219) | | 0.999*** (0.160) |
| Panel C. 25 Portfolios Sorted on Size and Coskewness | | | |
| Model | <i>MKT</i> | <i>HS</i> | <i>mPSS</i> |
| CAPM | 1.037*** (0.118) | | |
| CAPM + <i>HS</i> | 1.353*** (0.144) | 0.116 (0.085) | |
| CAPM + <i>mPSS</i> | 0.013 (0.183) | | 1.238*** (0.144) |

Description: This table presents risk premia for the CAPM model and an additional coskewness factor: the Harvey and Siddique (2000) factor ($HS = S^- - S^+$), the Langlois (2020) factor (*PSS*), or the modified predicted coskewness factor (*mPSS*). The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and the 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market factor (*MKT*). The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding a coskewness factor to the CAPM, its risk premium should be positive and significant. This is not true for *HS* in any panel, and it is true for *mPSS* only in the last two panels.

Table IA.21: Risk Premia for the 4-Factor Model and Coskewness, 1926 to 1963

| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>MOM</i> | <i>HS</i> | <i>mPSS</i> |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Panel A. 25 Portfolios Sorted by Size and B/M | | | | | | |
| FF4 | -0.679 (0.578) | 0.150*** (0.056) | 0.447*** (0.087) | 0.139 (0.551) | | |
| FF4 + <i>HS</i> | -0.536 (0.522) | 0.141** (0.057) | 0.467*** (0.094) | 0.330 (0.627) | -0.061 (0.216) | |
| FF4 - <i>SMB</i> + <i>HS</i> | -0.252 (0.502) | | 0.486*** (0.087) | 0.526 (0.648) | -0.165 (0.162) | |
| FF4 + <i>mPSS</i> | -0.625 (0.600) | 0.148** (0.058) | 0.445*** (0.090) | 0.125 (0.580) | | -0.000 (0.436) |
| FF4 - <i>SMB</i> + <i>mPSS</i> | -0.259 (0.562) | | 0.447*** (0.088) | 0.377 (0.584) | | 0.430 (0.283) |
| Panel B. 25 Portfolios Sorted on Size and Momentum | | | | | | |
| FF4 | -0.357 (0.539) | 0.015 (0.244) | 1.366* (0.699) | 0.765*** (0.085) | | |
| FF4 + <i>HS</i> | -0.866 (0.695) | 0.330 (0.205) | 0.301 (0.540) | 0.751*** (0.100) | -0.459 (0.413) | |
| FF4 - <i>SMB</i> + <i>HS</i> | -0.653 (0.720) | | 0.604*** (0.155) | 0.797*** (0.098) | -0.739** (0.312) | |
| FF4 + <i>mPSS</i> | -0.295 (0.541) | -0.069 (0.259) | 1.687** (0.759) | 0.781*** (0.086) | | -0.019 (0.351) |
| FF4 - <i>SMB</i> + <i>mPSS</i> | -0.128 (0.523) | | 1.215*** (0.208) | 0.778*** (0.082) | | -0.069 (0.318) |
| Panel C. 25 Portfolios Sorted on Size and Coskewness | | | | | | |
| FF4 | -0.843** (0.380) | 0.416*** (0.078) | 0.424** (0.181) | -0.544** (0.261) | | |
| FF4 + <i>HS</i> | -0.538* (0.322) | 0.327*** (0.113) | 0.614** (0.278) | -0.537** (0.261) | 0.057 (0.119) | |
| FF4 - <i>SMB</i> + <i>HS</i> | -0.407 (0.343) | | 1.000*** (0.111) | -0.503* (0.282) | 0.105 (0.113) | |
| FF4 + <i>mPSS</i> | -0.800** (0.400) | 0.398*** (0.090) | 0.448** (0.193) | -0.570** (0.272) | | 0.142 (0.339) |
| FF4 - <i>SMB</i> + <i>mPSS</i> | -0.538 (0.425) | | 0.644*** (0.154) | -0.710** (0.286) | | 0.634*** (0.227) |

Description: This table presents risk premia for the Carhart-Fama-French four-factor model (the Fama-French three-factor model and momentum) and an additional coskewness factor: the Harvey and Siddique (2000) factor ($HS = S^- - S^+$), the Langlois (2020) factor (*PSS*), or the modified predicted coskewness factor (*mPSS*). The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market (*MKT*), size (*SMB*), value (*HML*), and momentum (*MOM*) factors. The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding a coskewness factor to the four-factor model, its risk premium should be positive and significant. This is not true for *HS* in any of the panels, and it is true for *mPSS* only in the last panel when we remove the size factor *SMB*, which is highly correlated with *mPSS*.

Table IA.22: Risk Premia for the 4-Factor Model and Coskewness, 1963 to 1993

| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>MOM</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|----------------------|---------------------|
| Panel A. 25 Portfolios Sorted by Size and B/M | | | | | | | |
| FF4 | -0.179 (0.420) | 0.214*** (0.051) | 0.500*** (0.065) | -1.024 (0.792) | | | |
| FF4 + <i>HS</i> | -0.312 (0.474) | 0.219*** (0.053) | 0.495*** (0.066) | -0.961 (0.811) | -0.359 (0.486) | | |
| FF4 - <i>SMB</i> + <i>HS</i> | 0.185 (0.320) | | 0.459*** (0.064) | -1.391* (0.714) | 0.110 (0.354) | | |
| FF4 + <i>mPSS</i> | 0.628 (0.397) | 0.256*** (0.042) | 0.466*** (0.052) | -0.570 (0.636) | | -0.783*** (0.278) | |
| FF4 - <i>SMB</i> + <i>mPSS</i> | -0.006 (0.488) | | 0.479*** (0.064) | -1.426* (0.763) | | -0.273 (0.319) | |
| FF4 + <i>PSS</i> | -0.313 (0.480) | 0.222*** (0.054) | 0.494*** (0.067) | -0.688 (0.968) | | | 0.313 (0.560) |
| FF4 - <i>SMB</i> + <i>PSS</i> | -0.290 (0.446) | | 0.468*** (0.063) | -0.766 (0.824) | | | 0.191 (0.324) |
| Panel B. 25 Portfolios Sorted on Size and Momentum | | | | | | | |
| FF4 | 0.465 (0.944) | 0.102 (0.148) | 0.678 (0.731) | 0.959*** (0.124) | | | |
| FF4 + <i>HS</i> | -0.156 (0.986) | 0.190 (0.152) | 0.243 (0.752) | 0.912*** (0.123) | -1.366 (0.942) | | |
| FF4 - <i>SMB</i> + <i>HS</i> | 1.052** (0.483) | | 0.932** (0.397) | 0.849*** (0.113) | -0.385 (0.631) | | |
| FF4 + <i>mPSS</i> | 1.027 (0.995) | 0.336 (0.215) | -0.356 (0.999) | 0.948*** (0.121) | | -0.493 (0.661) | |
| FF4 - <i>SMB</i> + <i>mPSS</i> | 0.887 (0.998) | | 0.872 (0.602) | 0.920*** (0.120) | | 0.419* (0.241) | |
| FF4 + <i>PSS</i> | -2.645** (1.225) | 0.055 (0.122) | 0.318 (0.609) | 0.912*** (0.102) | | | 2.378*** (0.556) |
| FF4 - <i>SMB</i> + <i>PSS</i> | 0.003 (1.114) | | 0.323 (0.717) | 0.906*** (0.118) | | | 0.665*** (0.156) |
| Panel C. 25 Portfolios Sorted on Size and Coskewness | | | | | | | |
| FF4 | 1.240*** (0.409) | 0.359*** (0.096) | -0.121 (0.397) | 0.425 (0.453) | | | |
| FF4 + <i>HS</i> | 1.194*** (0.414) | 0.364*** (0.097) | -0.212 (0.422) | 0.110 (0.641) | 0.202** (0.092) | | |
| FF4 - <i>SMB</i> + <i>HS</i> | 1.367*** (0.367) | | -0.199 (0.345) | -0.109 (0.568) | 0.222*** (0.072) | | |
| FF4 + <i>mPSS</i> | 1.379*** (0.402) | 0.388*** (0.094) | -0.277 (0.393) | -0.040 (0.521) | | -0.198 (0.533) | |
| FF4 - <i>SMB</i> + <i>mPSS</i> | 1.404*** (0.404) | | -0.080 (0.381) | 0.400 (0.436) | | 0.628** (0.252) | |
| FF4 + <i>PSS</i> | 0.867* (0.447) | 0.353*** (0.091) | 0.117 (0.403) | 1.176* (0.615) | | | 1.088*** (0.422) |
| FF4 - <i>SMB</i> + <i>PSS</i> | 1.195*** (0.423) | | -0.188 (0.358) | 0.563 (0.456) | | | 0.546*** (0.211) |

Description: This table presents risk premia for the Carhart-Fama-French four-factor model (the Fama-French three-factor model and momentum) and an additional coskewness factor: the Harvey and Siddique (2000) factor ($HS = S^- - S^+$), the Langlois (2020) factor (*PSS*), or the modified predicted coskewness factor (*mPSS*). The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market (*MKT*), size (*SMB*), value (*HML*), and momentum (*MOM*) factors. The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding a coskewness factor to the four-factor model, its risk premium should be positive and significant. This is true for *HS* only in the last panel, and it is true for *mPSS* and *PSS* in the last two panels as long as we remove the size factor *SMB*, which is highly correlated with the persistent coskewness factors.

Table IA.23: Risk Premia for the 4-Factor Model and Coskewness, 1994 to 2019

| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>MOM</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
|--|---------------------|---------------------|---------------------|----------------------|---------------------|--------------------|---------------------|
| Panel A. 25 Portfolios Sorted by Size and B/M | | | | | | | |
| FF4 | -0.465 (0.390) | 0.052 (0.047) | 0.106* (0.062) | 1.315** (0.669) | | | |
| FF4 + <i>HS</i> | -0.488 (0.399) | 0.047 (0.050) | 0.111* (0.064) | 1.240* (0.693) | -0.079 (0.227) | | |
| FF4 - <i>SMB</i> + <i>HS</i> | -0.228 (0.260) | | 0.122* (0.066) | 1.503*** (0.540) | -0.213 (0.218) | | |
| FF4 + <i>mPSS</i> | -0.312 (0.450) | 0.063 (0.051) | 0.089 (0.068) | 1.299* (0.682) | | -0.113 (0.440) | |
| FF4 - <i>SMB</i> + <i>mPSS</i> | -0.309 (0.484) | | 0.116* (0.065) | 1.521** (0.680) | | 0.289 (0.249) | |
| FF4 + <i>PSS</i> | -0.542 (0.471) | 0.053 (0.048) | 0.101 (0.065) | 1.301* (0.668) | | | 0.453 (0.503) |
| FF4 - <i>SMB</i> + <i>PSS</i> | -0.544 (0.444) | | 0.100 (0.062) | 1.249* (0.693) | | | 0.474* (0.261) |
| Panel B. 25 Portfolios Sorted on Size and Momentum | | | | | | | |
| FF4 | -0.021 (0.373) | 0.127* (0.070) | 0.329 (0.259) | 0.407*** (0.062) | | | |
| FF4 + <i>HS</i> | -0.010 (0.386) | 0.120 (0.081) | 0.365 (0.334) | 0.410*** (0.068) | -0.004 (0.470) | | |
| FF4 - <i>SMB</i> + <i>HS</i> | 0.454 (0.303) | | 0.754*** (0.251) | 0.431*** (0.065) | -0.341 (0.426) | | |
| FF4 + <i>mPSS</i> | 0.040 (0.349) | 0.266*** (0.097) | -0.279 (0.395) | 0.374*** (0.060) | | -0.737* (0.443) | |
| FF4 - <i>SMB</i> + <i>mPSS</i> | 0.069 (0.385) | | 0.536** (0.230) | 0.401*** (0.062) | | 0.286** (0.117) | |
| FF4 + <i>PSS</i> | 0.052 (0.378) | 0.161** (0.080) | 0.125 (0.331) | 0.406*** (0.062) | | | -0.132 (0.373) |
| FF4 - <i>SMB</i> + <i>PSS</i> | -0.031 (0.379) | | 0.439* (0.236) | 0.390*** (0.061) | | | 0.345*** (0.096) |
| Panel C. 25 Portfolios Sorted on Size and Coskewness | | | | | | | |
| FF4 | -0.169 (0.271) | 0.003 (0.067) | 0.523*** (0.139) | -0.263 (0.306) | | | |
| FF4 + <i>HS</i> | -0.021 (0.347) | 0.040 (0.084) | 0.330 (0.303) | -0.329 (0.324) | 0.204** (0.079) | | |
| FF4 - <i>SMB</i> + <i>HS</i> | 0.496*** (0.175) | | 0.132 (0.295) | -0.807*** (0.190) | 0.203*** (0.077) | | |
| FF4 + <i>mPSS</i> | -0.175 (0.278) | 0.002 (0.069) | 0.503*** (0.160) | -0.298 (0.339) | | -0.427 (0.450) | |
| FF4 - <i>SMB</i> + <i>mPSS</i> | -0.107 (0.249) | | 0.544*** (0.133) | -0.273 (0.315) | | -0.039 (0.162) | |
| FF4 + <i>PSS</i> | -0.135 (0.266) | -0.005 (0.070) | 0.482*** (0.130) | -0.305 (0.301) | | | -0.462 (0.362) |
| FF4 - <i>SMB</i> + <i>PSS</i> | -0.085 (0.254) | | 0.479*** (0.122) | -0.353 (0.286) | | | -0.075 (0.183) |

Description: This table presents risk premia for the Carhart-Fama-French four-factor model (the Fama-French three-factor model and momentum) and an additional coskewness factor: the Harvey and Siddique (2000) factor ($HS = S^- - S^+$), the Langlois (2020) factor (*PSS*), or the modified predicted coskewness factor (*mPSS*). The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market (*MKT*), size (*SMB*), value (*HML*), and momentum (*MOM*) factors. The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding a coskewness factor to the four-factor model, its risk premium should be positive and significant. This is true for *HS* only in the last panel, and it is weakly true for *mPSS* and *PSS* in the first two panels as long as we remove the size factor *SMB*, which is highly correlated with the persistent coskewness factors.

Table IA.24: Risk Premia from the 4-Factor Model and Coskewness, 1963 to 2019

| Panel A. 25 Portfolios Sorted by Size and B/M | | | | | | | |
|---|---------------------|---------------------|---------------------|---------------------|-------------------|---------------------|---------------------|
| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>MOM</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
| FF4 | -0.117 (0.437) | 0.146*** (0.044) | 0.328*** (0.055) | 1.684* (1.000) | | | |
| FF4 + <i>HS</i> | -0.210 (0.453) | 0.139*** (0.045) | 0.337*** (0.057) | 1.550 (1.017) | -0.201 (0.360) | | |
| FF4 - <i>SMB</i> + <i>HS</i> | 0.835*** (0.240) | | 0.343*** (0.063) | 3.100*** (0.928) | -0.096 (0.348) | | |
| FF4 + <i>mPSS</i> | 0.249 (0.449) | 0.176*** (0.044) | 0.295*** (0.055) | 1.583* (0.936) | | -0.036 (0.398) | |
| FF4 - <i>SMB</i> + <i>mPSS</i> | 0.255 (0.561) | | 0.335*** (0.060) | 2.392** (1.107) | | 0.871*** (0.309) | |
| FF4 + <i>PSS</i> | -0.062 (0.490) | 0.150*** (0.045) | 0.320*** (0.058) | 1.742* (1.000) | | | 0.600 (0.507) |
| FF4 - <i>SMB</i> + <i>PSS</i> | -0.134 (0.496) | | 0.321*** (0.056) | 1.826* (1.045) | | | 0.924*** (0.336) |

| Panel B. 25 Portfolios Sorted on Size and Momentum | | | | | | | |
|--|---------------------|--------------------|---------------------|---------------------|-------------------|---------------------|---------------------|
| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>MOM</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
| FF4 | 0.369 (0.590) | 0.145* (0.088) | 0.532 (0.394) | 0.723*** (0.075) | | | |
| FF4 + <i>HS</i> | -0.025 (0.627) | 0.077 (0.097) | 0.835* (0.432) | 0.729*** (0.073) | -1.486 (1.077) | | |
| FF4 - <i>SMB</i> + <i>HS</i> | 0.782*** (0.291) | | 1.060*** (0.367) | 0.695*** (0.072) | -0.723 (1.062) | | |
| FF4 + <i>mPSS</i> | 0.446 (0.579) | 0.326** (0.156) | -0.185 (0.644) | 0.687*** (0.078) | | -0.318 (0.480) | |
| FF4 - <i>SMB</i> + <i>mPSS</i> | 0.543 (0.593) | | 0.714** (0.301) | 0.695*** (0.073) | | 0.408*** (0.125) | |
| FF4 + <i>PSS</i> | 0.210 (0.666) | 0.110 (0.112) | 0.675 (0.475) | 0.722*** (0.076) | | | 0.694 (0.468) |
| FF4 - <i>SMB</i> + <i>PSS</i> | 0.265 (0.617) | | 0.557* (0.332) | 0.686*** (0.072) | | | 0.533*** (0.124) |

| Panel C. 25 Portfolios Sorted on Size and Coskewness | | | | | | | |
|--|---------------------|------------------|---------------------|-------------------|---------------------|-------------------|-------------------|
| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>MOM</i> | <i>HS</i> | <i>mPSS</i> | <i>PSS</i> |
| FF4 | 0.230 (0.222) | 0.053 (0.054) | 1.017*** (0.169) | 0.508* (0.307) | | | |
| FF4 + <i>HS</i> | 0.384 (0.252) | 0.102 (0.064) | 0.733*** (0.270) | 0.344 (0.328) | 0.246*** (0.048) | | |
| FF4 - <i>SMB</i> + <i>HS</i> | 0.787*** (0.185) | | 0.512* (0.302) | -0.196 (0.253) | 0.236*** (0.047) | | |
| FF4 + <i>mPSS</i> | 0.232 (0.217) | 0.070 (0.054) | 0.856*** (0.203) | 0.276 (0.344) | | -0.355 (0.343) | |
| FF4 - <i>SMB</i> + <i>mPSS</i> | 0.296 (0.238) | | 1.047*** (0.182) | 0.436 (0.351) | | 0.209 (0.170) | |
| FF4 + <i>PSS</i> | 0.337 (0.254) | 0.059 (0.054) | 0.911*** (0.184) | 0.398 (0.325) | | | 0.097 (0.254) |
| FF4 - <i>SMB</i> + <i>PSS</i> | 0.233 (0.268) | | 1.021*** (0.173) | 0.384 (0.339) | | | 0.339* (0.187) |

Description: This table presents risk premia for the Carhart-Fama-French four-factor model (the Fama-French three-factor model and momentum) and an additional coskewness factor: the Harvey and Siddique (2000) factor ($HS = S^- - S^+$), the Langlois (2020) factor (*PSS*), or the modified predicted coskewness factor (*mPSS*). The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and the 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market (*MKT*), size (*SMB*), value (*HML*), and momentum (*MOM*) factors. The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding a coskewness factor to the four-factor model, its risk premium should be positive and significant. This is true for *HS* only in the last panel, and it is weakly true for *mPSS* and *PSS* in all three panels as long as we remove the size factor *SMB*, which is highly correlated with the persistent coskewness factors.

Table IA.25: Risk Premia for the 4-Factor Model and Coskewness, 1926 to 2019

| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>MOM</i> | <i>HS</i> | <i>mPSS</i> |
|--|--------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Panel A. 25 Portfolios Sorted by Size and B/M | | | | | | |
| FF4 | -0.320 (0.420) | 0.160*** (0.042) | 0.363*** (0.061) | 0.859 (0.752) | | |
| FF4 + <i>HS</i> | -0.343 (0.441) | 0.161*** (0.048) | 0.363*** (0.065) | 0.744 (0.830) | 0.103 (0.438) | |
| FF4 - <i>SMB</i> + <i>HS</i> | 0.327 (0.368) | | 0.388*** (0.068) | 1.726** (0.803) | -0.453 (0.385) | |
| FF4 + <i>mPSS</i> | -0.234 (0.535) | 0.160*** (0.044) | 0.362*** (0.065) | 0.863 (0.783) | | 0.186 (0.392) |
| FF4 - <i>SMB</i> + <i>mPSS</i> | -0.146 (0.557) | | 0.383*** (0.066) | 1.508* (0.794) | | 0.740*** (0.244) |
| Panel B. 25 Portfolios Sorted on Size and Momentum | | | | | | |
| FF4 | 0.609 (0.429) | 0.107 (0.086) | 0.832*** (0.270) | 0.754*** (0.049) | | |
| FF4 + <i>HS</i> | 0.066 (0.507) | 0.152* (0.085) | 0.494 (0.327) | 0.759*** (0.051) | -0.883** (0.411) | |
| FF4 - <i>SMB</i> + <i>HS</i> | 0.108 (0.275) | | 0.526*** (0.182) | 0.748*** (0.046) | -0.965** (0.429) | |
| FF4 + <i>mPSS</i> | 0.746 (0.462) | 0.157 (0.105) | 0.694** (0.324) | 0.750*** (0.051) | | 0.249 (0.231) |
| FF4 - <i>SMB</i> + <i>mPSS</i> | 0.861** (0.417) | | 0.860*** (0.136) | 0.744*** (0.048) | | 0.356*** (0.114) |
| Panel C. 25 Portfolios Sorted on Size and Coskewness | | | | | | |
| FF4 | -0.335 (0.246) | 0.354*** (0.065) | -0.053 (0.202) | -0.633** (0.280) | | |
| FF4 + <i>HS</i> | -0.110 (0.217) | 0.286*** (0.072) | 0.168 (0.230) | -0.566** (0.272) | 0.131** (0.056) | |
| FF4 - <i>SMB</i> + <i>HS</i> | 0.275 (0.282) | | 0.747*** (0.244) | -0.576 (0.383) | 0.182*** (0.068) | |
| FF4 + <i>mPSS</i> | -0.260 (0.247) | 0.364*** (0.065) | -0.105 (0.202) | -0.626** (0.274) | | 0.529 (0.390) |
| FF4 - <i>SMB</i> + <i>mPSS</i> | -0.121 (0.234) | | -0.192 (0.201) | -0.648** (0.273) | | 0.829*** (0.183) |

Description: This table presents risk premia for the Carhart-Fama-French four-factor model (the Fama-French three-factor model and momentum) and an additional coskewness factor: the Harvey and Siddique (2000) factor ($HS = S^- - S^+$), the Langlois (2020) factor (*PSS*), or the modified predicted coskewness factor (*mPSS*). The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market (*MKT*), size (*SMB*), value (*HML*), and momentum (*MOM*) factors. The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding a coskewness factor to the four-factor model, its risk premium should be positive and significant. This is true for *HS* only in the last panel, and it is weakly true for *mPSS* in all three panels as long as we remove the size factor *SMB*, which is highly correlated with the persistent coskewness factors.

4 Persistent Coskewness Factors – Robustness Checks

In this section, we perform robustness checks for Table 8 in the paper and also for Tables IA.19 and IA.24 in the Internet Appendix. We modify the Harvey and Siddique (2000) coskewness proxy HS in several ways: First, we reduce the estimation window of HS from 5 years to 3 years. Second, we exclude microcap stocks (i.e., stocks with a market capitalization of less than 250,000 U.S. dollars) from the portfolio formation of HS . Third, we exclude penny stocks (i.e., stocks with a price of less than 5 U.S. dollars) from the portfolio formation of HS . Fourth, we require the stocks included in the definition of HS to have a number of observations over the past 60 months of at least N , where N is equal to 36, 48, or 60.

Table IA.26: Risk Premia from the CAPM and Coskewness, 1963 to 2019
3-Year Estimation Window

| Panel A. 25 Portfolios Sorted by Size and B/M | | |
|--|---------------------|---------------------|
| Model | <i>MKT</i> | <i>HS</i> |
| CAPM | -0.131 (0.261) | |
| CAPM + <i>HS</i> (5-Yr Window) | 0.350 (0.306) | 0.821** (0.334) |
| CAPM + <i>HS</i> (3-Yr Window) | 0.342 (0.248) | 1.269*** (0.350) |
| Panel B. 25 Portfolios Sorted on Size and Momentum | | |
| Model | <i>MKT</i> | <i>HS</i> |
| CAPM | -0.389 (0.400) | |
| CAPM + <i>HS</i> (5-Yr Window) | -0.043 (0.597) | 0.909 (1.162) |
| CAPM + <i>HS</i> (3-Yr Window) | -0.460 (0.441) | -0.393 (0.934) |
| Panel C. 25 Portfolios Sorted on Size and Coskewness | | |
| Model | <i>MKT</i> | <i>HS</i> |
| CAPM | 1.194*** (0.146) | |
| CAPM + <i>HS</i> (5-Yr Window) | 1.175*** (0.092) | 0.271*** (0.048) |
| CAPM + <i>HS</i> (3-Yr Window) | 1.181*** (0.093) | 0.206*** (0.037) |

Description: This table presents risk premia for the CAPM model and an additional coskewness factor, the Harvey and Siddique (2000) factor ($HS = S^- - S^+$). We use two versions of *HS*: the standard version that uses a window of 1-year for the estimation of coskewness, and a modified version that uses an estimation window of 3 years. The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market factor (*MKT*). The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding the coskewness factor *HS* to the CAPM model, its risk premium should be positive and significant. This result is true only in the first and third panels, regardless of whether we use an estimation window of 5 years or 3 years.

Table IA.27: Risk Premia from the 4-Factor Model and Coskewness, 1963 to 2019
3-Year Estimation Window

| Panel A. 25 Portfolios Sorted by Size and B/M | | | | | |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|
| Model | MKT | SMB | HML | MOM | HS |
| FF4 | -0.117 (0.437) | 0.146*** (0.044) | 0.328*** (0.055) | 1.684* (1.000) | |
| FF4 + HS (5-Yr Window) | -0.210 (0.453) | 0.139*** (0.045) | 0.337*** (0.057) | 1.550 (1.017) | -0.201 (0.360) |
| FF4 + HS (3-Yr Window) | -0.130 (0.451) | 0.144*** (0.046) | 0.332*** (0.058) | 1.670 (1.026) | -0.059 (0.522) |
| FF4 - SMB + HS (5-Yr Window) | 0.835*** (0.240) | | 0.343*** (0.063) | 3.100*** (0.928) | -0.096 (0.348) |
| FF4 - SMB + HS (3-Yr Window) | 0.875*** (0.244) | | 0.334*** (0.065) | 3.064*** (0.966) | 0.057 (0.518) |
| Panel B. 25 Portfolios Sorted on Size and Momentum | | | | | |
| Model | MKT | SMB | HML | MOM | HS |
| FF4 | 0.369 (0.590) | 0.145* (0.088) | 0.532 (0.394) | 0.723*** (0.075) | |
| FF4 + HS (5-Yr Window) | -0.025 (0.627) | 0.077 (0.097) | 0.835* (0.432) | 0.729*** (0.073) | -1.486 (1.077) |
| FF4 + HS (3-Yr Window) | 0.259 (0.558) | 0.091 (0.088) | 0.831** (0.403) | 0.699*** (0.072) | -1.250* (0.716) |
| FF4 - SMB + HS (5-Yr Window) | 0.782*** (0.291) | | 1.060*** (0.367) | 0.695*** (0.072) | -0.723 (1.062) |
| FF4 - SMB + HS (3-Yr Window) | 0.969*** (0.256) | | 1.122*** (0.312) | 0.681*** (0.069) | -0.799 (0.662) |
| Panel C. 25 Portfolios Sorted on Size and Coskewness | | | | | |
| Model | MKT | SMB | HML | MOM | HS |
| FF4 | 0.230 (0.222) | 0.053 (0.054) | 1.017*** (0.169) | 0.508* (0.307) | |
| FF4 + HS (5-Yr Window) | 0.384 (0.252) | 0.102 (0.064) | 0.733*** (0.270) | 0.344 (0.328) | 0.246*** (0.048) |
| FF4 + HS (3-Yr Window) | 0.367 (0.246) | 0.104* (0.062) | 0.727*** (0.256) | 0.318 (0.333) | 0.195*** (0.035) |
| FF4 - SMB + HS (5-Yr Window) | 0.787*** (0.185) | | 0.512* (0.302) | -0.196 (0.253) | 0.236*** (0.047) |
| FF4 - SMB + HS (3-Yr Window) | 0.775*** (0.175) | | 0.498* (0.283) | -0.240 (0.254) | 0.191*** (0.034) |

Description: This table presents risk premia for the Carhart-Fama-French four-factor model (the Fama-French three-factor model and momentum) and an additional coskewness factor, the Harvey and Siddique (2000) factor ($HS = S^- - S^+$). We use two versions of HS : the standard version that uses an estimation window of 1-year for the estimation of coskewness, and a modified version that uses an estimation window of 3 years. The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market factor (MKT). The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding the coskewness factor HS to the four-factor model, its risk premium should be positive and significant. This result is true only in the third panel, regardless of whether we use an estimation window of 5 years or 3 years.

Table IA.28: Risk Premia from the 5-Factor Model and Coskewness, 1963 to 2019
3-Year Estimation Window

| Panel A. 25 Portfolios Sorted by Size and B/M | | | | | | |
|---|-------------------|---------------------|---------------------|---------------------|--------------------|----------------------|
| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>RMW</i> | <i>CMA</i> | <i>HS</i> |
| FF5 | -0.474 (0.357) | 0.260*** (0.053) | 0.264*** (0.056) | 0.402** (0.169) | 0.035 (0.205) | |
| FF5 + <i>HS</i> (5-Yr Window) | -0.307 (0.272) | 0.238*** (0.040) | 0.254*** (0.042) | 0.257* (0.133) | 0.451** (0.187) | -1.116*** (0.336) |
| FF5 + <i>HS</i> (3-Yr Window) | -0.321 (0.349) | 0.249*** (0.051) | 0.264*** (0.053) | 0.322* (0.167) | 0.284 (0.240) | -0.946 (0.616) |
| FF5 - <i>SMB</i> + <i>HS</i> (5-Yr Window) | 0.360 (0.470) | | 0.270*** (0.073) | -0.399** (0.202) | 0.625* (0.335) | -0.696 (0.582) |
| FF5 - <i>SMB</i> + <i>HS</i> (3-Yr Window) | 0.262 (0.500) | | 0.264*** (0.076) | -0.238 (0.220) | 0.364 (0.361) | -0.034 (0.861) |

| Panel B. 25 Portfolios Sorted on Size and Momentum | | | | | | |
|--|-------------------|---------------------|----------------------|----------------------|---------------------|---------------------|
| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>RMW</i> | <i>CMA</i> | <i>HS</i> |
| FF5 | 0.162 (0.432) | 0.448*** (0.081) | -0.661*** (0.191) | 0.300 (0.314) | 0.760 (0.476) | |
| FF5 + <i>HS</i> (5-Yr Window) | -0.343 (0.523) | 0.410*** (0.081) | -0.673*** (0.184) | 0.079 (0.333) | 1.053** (0.494) | -1.677* (0.996) |
| FF5 + <i>HS</i> (3-Yr Window) | -0.033 (0.425) | 0.427*** (0.077) | -0.553*** (0.192) | 0.192 (0.304) | 0.960** (0.466) | -1.329** (0.675) |
| FF5 - <i>SMB</i> + <i>HS</i> (5-Yr Window) | 0.465 (0.712) | | -0.274 (0.228) | -0.474 (0.481) | 1.439** (0.712) | 0.865 (1.263) |
| FF5 - <i>SMB</i> + <i>HS</i> (3-Yr Window) | -0.000 (0.638) | | -0.160 (0.263) | -0.999*** (0.337) | 2.063*** (0.622) | -0.561 (1.005) |

| Panel C. 25 Portfolios Sorted on Size and Coskewness | | | | | | |
|--|---------------------|---------------------|--------------------|---------------------|-------------------|---------------------|
| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>RMW</i> | <i>CMA</i> | <i>HS</i> |
| FF5 | 0.408** (0.168) | 0.215*** (0.030) | 0.342** (0.137) | 0.329*** (0.068) | -0.008 (0.131) | |
| FF5 + <i>HS</i> (5-Yr Window) | 0.409** (0.180) | 0.218*** (0.033) | 0.326** (0.164) | 0.325*** (0.077) | -0.005 (0.134) | 0.207*** (0.037) |
| FF5 + <i>HS</i> (3-Yr Window) | 0.398** (0.175) | 0.218*** (0.032) | 0.329** (0.156) | 0.329*** (0.081) | -0.002 (0.134) | 0.153*** (0.027) |
| FF5 - <i>SMB</i> + <i>HS</i> (5-Yr Window) | 0.869*** (0.203) | | 0.439** (0.218) | 0.073 (0.063) | -0.155 (0.173) | 0.216*** (0.044) |
| FF5 - <i>SMB</i> + <i>HS</i> (3-Yr Window) | 0.863*** (0.199) | | 0.440** (0.210) | 0.060 (0.070) | -0.141 (0.175) | 0.179*** (0.032) |

Description: This table presents risk premia for the Fama-French five-factor model and an additional coskewness factor, the Harvey and Siddique (2000) factor ($HS = S^- - S^+$). We use two versions of *HS*: the standard version that uses an window of 1-year for the estimation of coskewness, and a modified version that uses an estimation window of 3 years. The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market (*MKT*), size (*SMB*), value (*HML*), profitability (*RMW*), and investment (*CMA*) factors. The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***) , 5% (**), and 10% (*) levels.

Interpretation: When adding the coskewness factor *HS* to the five-factor model, its risk premium should be positive and significant. This result is true only in the third panel, regardless of whether we use an estimation window of 5 years or 3 years.

Table IA.29: Risk Premia from the CAPM and Coskewness, 1963 to 2019
No Microcap Stocks

| Panel A. 25 Portfolios Sorted by Size and B/M | | |
|--|---------------------|---------------------|
| Model | <i>MKT</i> | <i>HS</i> |
| CAPM | -0.131 (0.261) | |
| CAPM + <i>HS</i> (w/ Microcaps) | 0.350 (0.306) | 0.821** (0.334) |
| CAPM + <i>HS</i> (No Microcaps) | 0.337 (0.390) | 0.680 (0.436) |
| Panel B. 25 Portfolios Sorted on Size and Momentum | | |
| Model | <i>MKT</i> | <i>HS</i> |
| CAPM | -0.389 (0.400) | |
| CAPM + <i>HS</i> (w/ Microcaps) | -0.043 (0.597) | 0.909 (1.162) |
| CAPM + <i>HS</i> (No Microcaps) | -0.385 (1.012) | 0.001 (1.932) |
| Panel C. 25 Portfolios Sorted on Size and Coskewness | | |
| Model | <i>MKT</i> | <i>HS</i> |
| CAPM | 1.194*** (0.146) | |
| CAPM + <i>HS</i> (w/ Microcaps) | 1.175*** (0.092) | 0.271*** (0.048) |
| CAPM + <i>HS</i> (No Microcaps) | 1.261*** (0.097) | 0.284*** (0.052) |

Description: This table presents risk premia for the CAPM model and an additional coskewness factor, the Harvey and Siddique (2000) factor ($HS = S^- - S^+$). We use two versions of *HS*: the standard version that includes microcap stocks in the portfolio formation, and a modified version that does not include microcap stocks. The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market factor (*MKT*). The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding the coskewness factor *HS* to the CAPM model, its risk premium should be positive and significant. This result is true in the first panel if microcap stocks are included but not if they are excluded, and the result is true in the third panel regardless of whether microcap stocks are included or not.

Table IA.30: Risk Premia from the 4-Factor Model and Coskewness, 1963 to 2019
No Microcap Stocks

| Panel A. 25 Portfolios Sorted by Size and B/M | | | | | |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|
| Model | MKT | SMB | HML | MOM | HS |
| FF4 | -0.117 (0.437) | 0.146*** (0.044) | 0.328*** (0.055) | 1.684* (1.000) | |
| FF4 + HS (w/ Microcaps) | -0.210 (0.453) | 0.139*** (0.045) | 0.337*** (0.057) | 1.550 (1.017) | -0.201 (0.360) |
| FF4 + HS (No Microcaps) | -0.193 (0.456) | 0.139*** (0.045) | 0.334*** (0.057) | 1.589 (1.022) | -0.147 (0.381) |
| FF4 - SMB + HS (w/ Microcaps) | 0.835*** (0.240) | | 0.343*** (0.063) | 3.100*** (0.928) | -0.096 (0.348) |
| FF4 - SMB + HS (No Microcaps) | 0.709*** (0.273) | | 0.343*** (0.061) | 2.969*** (0.915) | -0.202 (0.378) |
| Panel B. 25 Portfolios Sorted on Size and Momentum | | | | | |
| Model | MKT | SMB | HML | MOM | HS |
| FF4 | 0.369 (0.590) | 0.145* (0.088) | 0.532 (0.394) | 0.723*** (0.075) | |
| FF4 + HS (w/ Microcaps) | -0.025 (0.627) | 0.077 (0.097) | 0.835* (0.432) | 0.729*** (0.073) | -1.486 (1.077) |
| FF4 + HS (No Microcaps) | 0.063 (0.645) | 0.077 (0.107) | 0.770* (0.445) | 0.728*** (0.075) | -1.265 (1.247) |
| FF4 - SMB + HS (w/ Microcaps) | 0.782*** (0.291) | | 1.060*** (0.367) | 0.695*** (0.072) | -0.723 (1.062) |
| FF4 - SMB + HS (No Microcaps) | 0.361 (0.501) | | 0.940*** (0.252) | 0.684*** (0.070) | -1.250 (1.169) |
| Panel C. 25 Portfolios Sorted on Size and Coskewness | | | | | |
| Model | MKT | SMB | HML | MOM | HS |
| FF4 | 0.230 (0.222) | 0.053 (0.054) | 1.017*** (0.169) | 0.508* (0.307) | |
| FF4 + HS (w/ Microcaps) | 0.384 (0.252) | 0.102 (0.064) | 0.733*** (0.270) | 0.344 (0.328) | 0.246*** (0.048) |
| FF4 + HS (No Microcaps) | 0.369 (0.249) | 0.100 (0.064) | 0.744*** (0.267) | 0.338 (0.331) | 0.246*** (0.051) |
| FF4 - SMB + HS (w/ Microcaps) | 0.787*** (0.185) | | 0.512* (0.302) | -0.196 (0.253) | 0.236*** (0.047) |
| FF4 - SMB + HS (No Microcaps) | 0.784*** (0.193) | | 0.551* (0.309) | -0.229 (0.269) | 0.236*** (0.050) |

Description: This table presents risk premia for the Carhart-Fama-French four-factor model (the Fama-French three-factor model and momentum) and an additional coskewness factor, the Harvey and Siddique (2000) factor ($HS = S^- - S^+$). We use two versions of HS : the standard version that includes microcap stocks in the portfolio formation, and a modified version that does not include microcap stocks. The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market factor (MKT). The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding the coskewness factor HS to the four-factor model, its risk premium should be positive and significant. This result is true only in the third panel, regardless of whether we include microcap stocks or not.

Table IA.31: Risk Premia from the 5-Factor Model and Coskewness, 1963 to 2019
No Microcap Stocks

| Panel A. 25 Portfolios Sorted by Size and B/M | | | | | | |
|--|-------------------|---------------------|---------------------|---------------------|--------------------|----------------------|
| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>RMW</i> | <i>CMA</i> | <i>HS</i> |
| FF5 | -0.474 (0.357) | 0.260*** (0.053) | 0.264*** (0.056) | 0.402** (0.169) | 0.035 (0.205) | |
| FF5 + <i>HS</i> (w/ Microcaps) | -0.307 (0.272) | 0.238*** (0.040) | 0.254*** (0.042) | 0.257* (0.133) | 0.451** (0.187) | -1.116*** (0.336) |
| FF5 + <i>HS</i> (No Microcaps) | -0.321 (0.277) | 0.237*** (0.041) | 0.246*** (0.043) | 0.265* (0.135) | 0.451** (0.193) | -1.178*** (0.367) |
| FF5 - <i>SMB</i> + <i>HS</i> (w/ Microcaps) | 0.360 (0.470) | | 0.270*** (0.073) | -0.399** (0.202) | 0.625* (0.335) | -0.696 (0.582) |
| FF5 - <i>SMB</i> + <i>HS</i> (No Microcaps) | 0.345 (0.441) | | 0.266*** (0.069) | -0.436** (0.173) | 0.764** (0.316) | -1.160* (0.608) |

| Panel B. 25 Portfolios Sorted on Size and Momentum | | | | | | |
|--|-------------------|---------------------|----------------------|--------------------|--------------------|--------------------|
| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>RMW</i> | <i>CMA</i> | <i>HS</i> |
| FF5 | 0.162 (0.432) | 0.448*** (0.081) | -0.661*** (0.191) | 0.300 (0.314) | 0.760 (0.476) | |
| FF5 + <i>HS</i> (w/ Microcaps) | -0.343 (0.523) | 0.410*** (0.081) | -0.673*** (0.184) | 0.079 (0.333) | 1.053** (0.494) | -1.677* (0.996) |
| FF5 + <i>HS</i> (No Microcaps) | -0.285 (0.548) | 0.411*** (0.084) | -0.726*** (0.195) | 0.131 (0.335) | 0.981** (0.499) | -1.567 (1.140) |
| FF5 - <i>SMB</i> + <i>HS</i> (w/ Microcaps) | 0.465 (0.712) | | -0.274 (0.228) | -0.474 (0.481) | 1.439** (0.712) | 0.865 (1.263) |
| FF5 - <i>SMB</i> + <i>HS</i> (No Microcaps) | 0.282 (0.773) | | -0.172 (0.215) | -0.761* (0.439) | 1.771** (0.688) | 0.299 (1.620) |

| Panel C. 25 Portfolios Sorted on Size and Coskewness | | | | | | |
|--|---------------------|---------------------|--------------------|---------------------|-------------------|---------------------|
| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>RMW</i> | <i>CMA</i> | <i>HS</i> |
| FF5 | 0.408** (0.168) | 0.215*** (0.030) | 0.342** (0.137) | 0.329*** (0.068) | -0.008 (0.131) | |
| FF5 + <i>HS</i> (w/ Microcaps) | 0.409** (0.180) | 0.218*** (0.033) | 0.326** (0.164) | 0.325*** (0.077) | -0.005 (0.134) | 0.207*** (0.037) |
| FF5 + <i>HS</i> (No Microcaps) | 0.408** (0.177) | 0.218*** (0.033) | 0.326** (0.160) | 0.325*** (0.077) | -0.005 (0.134) | 0.214*** (0.038) |
| FF5 - <i>SMB</i> + <i>HS</i> (w/ Microcaps) | 0.869*** (0.203) | | 0.439** (0.218) | 0.073 (0.063) | -0.155 (0.173) | 0.216*** (0.044) |
| FF5 - <i>SMB</i> + <i>HS</i> (No Microcaps) | 0.859*** (0.203) | | 0.465** (0.212) | 0.076 (0.065) | -0.153 (0.174) | 0.220*** (0.046) |

Description: This table presents risk premia for the Fama-French five-factor model and an additional coskewness factor, the Harvey and Siddique (2000) factor ($HS = S^- - S^+$). We use two versions of *HS*: the standard version that includes microcap stocks in the portfolio formation, and a modified version that does not include microcap stocks. The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market factor (*MKT*). The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding the coskewness factor *HS* to the five-factor model, its risk premium should be positive and significant. This result is true only in the third panel, regardless of whether we include microcap stocks or not.

Table IA.32: Risk Premia from the CAPM and Coskewness, 1963 to 2019
No Penny Stocks

| Panel A. 25 Portfolios Sorted by Size and B/M | | |
|--|---------------------|---------------------|
| Model | <i>MKT</i> | <i>HS</i> |
| CAPM | -0.131 (0.261) | |
| CAPM + <i>HS</i> (w/ Penny Stocks) | 0.350 (0.306) | 0.821** (0.334) |
| CAPM + <i>HS</i> (No Penny Stocks) | 0.372 (0.309) | 0.824** (0.331) |
| Panel B. 25 Portfolios Sorted on Size and Momentum | | |
| Model | <i>MKT</i> | <i>HS</i> |
| CAPM | -0.389 (0.400) | |
| CAPM + <i>HS</i> (w/ Penny Stocks) | -0.043 (0.597) | 0.909 (1.162) |
| CAPM + <i>HS</i> (No Penny Stocks) | -0.151 (0.603) | 0.621 (1.171) |
| Panel C. 25 Portfolios Sorted on Size and Coskewness | | |
| Model | <i>MKT</i> | <i>HS</i> |
| CAPM | 1.194*** (0.146) | |
| CAPM + <i>HS</i> (w/ Penny Stocks) | 1.175*** (0.092) | 0.271*** (0.048) |
| CAPM + <i>HS</i> (No Penny Stocks) | 1.178*** (0.092) | 0.274*** (0.047) |

Description: This table presents risk premia for the CAPM model and an additional coskewness factor, the Harvey and Siddique (2000) factor ($HS = S^- - S^+$). We use two versions of *HS*: the standard version that includes penny stocks in the portfolio formation, and a modified version that does not include penny stocks. The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market factor (*MKT*). The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding the coskewness factor *HS* to the CAPM model, its risk premium should be positive and significant. This result is true only in the first and third panels, regardless of whether we include penny stocks or not.

Table IA.33: Risk Premia from the 4-Factor Model and Coskewness, 1963 to 2019
No Penny Stocks

| Panel A. 25 Portfolios Sorted by Size and B/M | | | | | |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|
| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>MOM</i> | <i>HS</i> |
| FF4 | -0.117 (0.437) | 0.146*** (0.044) | 0.328*** (0.055) | 1.684* (1.000) | |
| FF4 + <i>HS</i> (w/ Penny Stocks) | -0.210 (0.453) | 0.139*** (0.045) | 0.337*** (0.057) | 1.550 (1.017) | -0.201 (0.360) |
| FF4 + <i>HS</i> (No Penny Stocks) | -0.201 (0.453) | 0.139*** (0.045) | 0.336*** (0.057) | 1.563 (1.020) | -0.181 (0.363) |
| FF4 - <i>SMB</i> + <i>HS</i> (w/ Penny Stocks) | 0.835*** (0.240) | | 0.343*** (0.063) | 3.100*** (0.928) | -0.096 (0.348) |
| FF4 - <i>SMB</i> + <i>HS</i> (No Penny Stocks) | 0.829*** (0.241) | | 0.343*** (0.063) | 3.090*** (0.927) | -0.097 (0.353) |
| Panel B. 25 Portfolios Sorted on Size and Momentum | | | | | |
| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>MOM</i> | <i>HS</i> |
| FF4 | 0.369 (0.590) | 0.145* (0.088) | 0.532 (0.394) | 0.723*** (0.075) | |
| FF4 + <i>HS</i> (w/ Penny Stocks) | -0.025 (0.627) | 0.077 (0.097) | 0.835* (0.432) | 0.729*** (0.073) | -1.486 (1.077) |
| FF4 + <i>HS</i> (No Penny Stocks) | 0.010 (0.619) | 0.074 (0.098) | 0.852* (0.438) | 0.730*** (0.073) | -1.477 (1.077) |
| FF4 - <i>SMB</i> + <i>HS</i> (w/ Penny Stocks) | 0.782*** (0.291) | | 1.060*** (0.367) | 0.695*** (0.072) | -0.723 (1.062) |
| FF4 - <i>SMB</i> + <i>HS</i> (No Penny Stocks) | 0.755** (0.297) | | 1.080*** (0.362) | 0.695*** (0.072) | -0.826 (1.075) |
| Panel C. 25 Portfolios Sorted on Size and Coskewness | | | | | |
| Model | <i>MKT</i> | <i>SMB</i> | <i>HML</i> | <i>MOM</i> | <i>HS</i> |
| FF4 | 0.230 (0.222) | 0.053 (0.054) | 1.017*** (0.169) | 0.508* (0.307) | |
| FF4 + <i>HS</i> (w/ Penny Stocks) | 0.384 (0.252) | 0.102 (0.064) | 0.733*** (0.270) | 0.344 (0.328) | 0.246*** (0.048) |
| FF4 + <i>HS</i> (No Penny Stocks) | 0.387 (0.252) | 0.103 (0.064) | 0.726*** (0.271) | 0.338 (0.328) | 0.252*** (0.048) |
| FF4 - <i>SMB</i> + <i>HS</i> (w/ Penny Stocks) | 0.787*** (0.185) | | 0.512* (0.302) | -0.196 (0.253) | 0.236*** (0.047) |
| FF4 - <i>SMB</i> + <i>HS</i> (No Penny Stocks) | 0.790*** (0.186) | | 0.504* (0.304) | -0.204 (0.254) | 0.242*** (0.047) |

Description: This table presents risk premia for the Carhart-Fama-French four-factor model (the Fama-French three-factor model and momentum) and an additional coskewness factor, the Harvey and Siddique (2000) factor ($HS = S^- - S^+$). We use two versions of *HS*: the standard version that includes penny stocks in the portfolio formation, and a modified version that does not include penny stocks. The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market (*MKT*), size (*SMB*), value (*HML*), and momentum (*MOM*) factors. The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding the coskewness factor *HS* to the four-factor model, its risk premium should be positive and significant. This result is true only in the third panel, regardless of whether we include penny stocks or not.

Table IA.34: Risk Premia from the 5-Factor Model and Coskewness, 1963 to 2019
No Penny Stocks

| Panel A. 25 Portfolios Sorted by Size and B/M | | | | | | |
|---|-------------------|---------------------|---------------------|---------------------|--------------------|----------------------|
| Model | MKT | SMB | HML | RMW | CMA | HS |
| FF5 | -0.474 (0.357) | 0.260*** (0.053) | 0.264*** (0.056) | 0.402** (0.169) | 0.035 (0.205) | |
| FF5 + HS (w/ Penny Stocks)) | -0.307 (0.272) | 0.238*** (0.040) | 0.254*** (0.042) | 0.257* (0.133) | 0.451** (0.187) | -1.116*** (0.336) |
| FF5 + HS (No Penny Stocks)) | -0.295 (0.274) | 0.237*** (0.041) | 0.253*** (0.042) | 0.259* (0.134) | 0.446** (0.188) | -1.121*** (0.342) |
| FF5 - SMB + HS (w/ Penny Stocks)) | 0.360 (0.470) | | 0.270*** (0.073) | -0.399** (0.202) | 0.625* (0.335) | -0.696 (0.582) |
| FF5 - SMB + HS (No Penny Stocks)) | 0.366 (0.470) | | 0.270*** (0.073) | -0.400** (0.202) | 0.627* (0.334) | -0.709 (0.589) |

| Panel B. 25 Portfolios Sorted on Size and Momentum | | | | | | |
|--|-------------------|---------------------|----------------------|-------------------|--------------------|--------------------|
| Model | MKT | SMB | HML | RMW | CMA | HS |
| FF5 | 0.162 (0.432) | 0.448*** (0.081) | -0.661*** (0.191) | 0.300 (0.314) | 0.760 (0.476) | |
| FF5 + HS (w/ Penny Stocks)) | -0.343 (0.523) | 0.410*** (0.081) | -0.673*** (0.184) | 0.079 (0.333) | 1.053** (0.494) | -1.677* (0.996) |
| FF5 + HS (No Penny Stocks)) | -0.320 (0.514) | 0.411*** (0.081) | -0.667*** (0.184) | 0.079 (0.332) | 1.051** (0.493) | -1.685* (0.996) |
| FF5 - SMB + HS (w/ Penny Stocks)) | 0.465 (0.712) | | -0.274 (0.228) | -0.474 (0.481) | 1.439** (0.712) | 0.865 (1.263) |
| FF5 - SMB + HS (No Penny Stocks)) | 0.422 (0.705) | | -0.270 (0.230) | -0.505 (0.479) | 1.475** (0.712) | 0.806 (1.281) |

| Panel C. 25 Portfolios Sorted on Size and Coskewness | | | | | | |
|--|---------------------|---------------------|--------------------|---------------------|-------------------|---------------------|
| Model | MKT | SMB | HML | RMW | CMA | HS |
| FF5 | 0.408** (0.168) | 0.215*** (0.030) | 0.342** (0.137) | 0.329*** (0.068) | -0.008 (0.131) | |
| FF5 + HS (w/ Penny Stocks)) | 0.409** (0.180) | 0.218*** (0.033) | 0.326** (0.164) | 0.325*** (0.077) | -0.005 (0.134) | 0.207*** (0.037) |
| FF5 + HS (No Penny Stocks)) | 0.409** (0.180) | 0.218*** (0.033) | 0.326** (0.164) | 0.325*** (0.077) | -0.005 (0.134) | 0.211*** (0.037) |
| FF5 - SMB + HS (w/ Penny Stocks)) | 0.869*** (0.203) | | 0.439** (0.218) | 0.073 (0.063) | -0.155 (0.173) | 0.216*** (0.044) |
| FF5 - SMB + HS (No Penny Stocks)) | 0.869*** (0.202) | | 0.437** (0.218) | 0.073 (0.063) | -0.155 (0.173) | 0.221*** (0.044) |

Description: This table presents risk premia for the Fama-French five-factor model and an additional coskewness factor, the Harvey and Siddique (2000) factor ($HS = S^- - S^+$). We use two versions of HS : the standard version that includes penny stocks in the portfolio formation, and a modified version that does not include penny stocks. The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the market (MKT), size (SMB), value (HML), profitability (RMW), and investment (CMA) factors. The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***), 5% (**), and 10% (*) levels.

Interpretation: When adding the coskewness factor HS to the five-factor model, its risk premium should be positive and significant. This result is true only in the third panel, regardless of whether we include penny stocks or not.

Table IA.35: Risk Premia from the 5-Factor Model and Coskewness, 1963 to 2019
Different Minimum Number of Observations

| Panel A. the 25 portfolios Sorted by Size and B/M | | | | | | |
|--|---------------------|---------------------|----------------------|---------------------|--------------------|----------------------|
| Model | MKT | SMB | HML | RMW | CMA | HS |
| FF5 | -0.474 (0.357) | 0.260*** (0.053) | 0.264*** (0.056) | 0.402** (0.169) | 0.035 (0.205) | |
| FF5 + HS_{36} | -0.307 (0.272) | 0.238*** (0.040) | 0.254*** (0.042) | 0.257* (0.133) | 0.451** (0.187) | -1.116*** (0.336) |
| FF5 + HS_{48} | -0.315 (0.270) | 0.238*** (0.040) | 0.252*** (0.042) | 0.255* (0.132) | 0.466** (0.187) | -1.141*** (0.337) |
| FF5 + HS_{60} | -0.305 (0.277) | 0.239*** (0.041) | 0.250*** (0.043) | 0.276** (0.134) | 0.460** (0.193) | -1.114*** (0.346) |
| FF5 - SMB + HS_{36} | 0.360 (0.470) | | 0.270*** (0.073) | -0.399** (0.202) | 0.625* (0.335) | -0.696 (0.582) |
| FF5 - SMB + HS_{48} | 0.361 (0.465) | | 0.269*** (0.072) | -0.411** (0.198) | 0.655* (0.334) | -0.769 (0.585) |
| FF5 - SMB + HS_{60} | 0.364 (0.467) | | 0.268*** (0.072) | -0.396** (0.193) | 0.650* (0.336) | -0.747 (0.586) |
| Panel B. 25 Portfolios Sorted on Size and Momentum | | | | | | |
| Model | MKT | SMB | HML | RMW | CMA | HS |
| FF5 | 0.162 (0.432) | 0.448*** (0.081) | -0.661*** (0.191) | 0.300 (0.314) | 0.760 (0.476) | |
| FF5 + HS_{36} | -0.343 (0.523) | 0.410*** (0.081) | -0.673*** (0.184) | 0.079 (0.333) | 1.053** (0.494) | -1.677* (0.996) |
| FF5 + HS_{48} | -0.345 (0.530) | 0.419*** (0.080) | -0.677*** (0.185) | 0.092 (0.331) | 1.070** (0.501) | -1.688 (1.030) |
| FF5 + HS_{60} | -0.306 (0.510) | 0.424*** (0.079) | -0.687*** (0.185) | 0.111 (0.325) | 1.079** (0.501) | -1.716* (1.035) |
| FF5 - SMB + HS_{36} | 0.465 (0.712) | | -0.274 (0.228) | -0.474 (0.481) | 1.439** (0.712) | 0.865 (1.263) |
| FF5 - SMB + HS_{48} | 0.500 (0.706) | | -0.280 (0.226) | -0.442 (0.471) | 1.371* (0.718) | 0.996 (1.264) |
| FF5 - SMB + HS_{60} | 0.444 (0.690) | | -0.267 (0.224) | -0.478 (0.457) | 1.390* (0.721) | 0.989 (1.275) |
| Panel C. 25 Portfolios Sorted on Size and Coskewness | | | | | | |
| Model | MKT | SMB | HML | RMW | CMA | HS |
| FF5 | 0.408** (0.168) | 0.215*** (0.030) | 0.342** (0.137) | 0.329*** (0.068) | -0.008 (0.131) | |
| FF5 + HS_{36} | 0.409** (0.180) | 0.218*** (0.033) | 0.326** (0.164) | 0.325*** (0.077) | -0.005 (0.134) | 0.207*** (0.037) |
| FF5 + HS_{48} | 0.209 (0.220) | 0.270*** (0.049) | 0.177 (0.223) | 0.450*** (0.088) | -0.040 (0.126) | 0.169*** (0.037) |
| FF5 + HS_{60} | 0.321 (0.290) | 0.357*** (0.077) | -0.101 (0.316) | 0.450*** (0.106) | -0.165 (0.169) | 0.099** (0.042) |
| FF5 - SMB + HS_{36} | 0.869*** (0.203) | | 0.439** (0.218) | 0.073 (0.063) | -0.155 (0.173) | 0.216*** (0.044) |
| FF5 - SMB + HS_{48} | 0.792*** (0.306) | | 0.617** (0.313) | 0.104 (0.089) | -0.062 (0.197) | 0.202*** (0.051) |
| FF5 - SMB + HS_{60} | 0.947*** (0.350) | | 0.553 (0.340) | 0.148 (0.092) | -0.367* (0.223) | 0.093* (0.051) |

Description: This table presents risk premia for the Fama-French five-factor model and the Harvey and Siddique (2000) factor $HS_N = S^-_N - S^+_N$, which is computed in three different ways: Denote by S^-_N (S^+_N) the portfolio of the 30% of stocks with the lowest (highest) past standardized coskewness, where the stocks included in the portfolio are required to have a number of observations over the past 60 months of at least N , where N is equal to 36, 48, or 60. The test portfolios are the 25 Fama-French portfolios sorted on size and book-to-market (Panel A), the 25 Fama-French portfolios sorted on size and momentum (Panel B), and the 25 portfolios sorted on size and coskewness (Panel C). For each test portfolio, we run a time-series regression of the portfolio excess return on a constant and the FF5 factors. The factor premia are obtained from a cross-sectional regression of the average portfolio excess return on a constant and the betas obtained from the time-series regression. Standard errors are in parentheses. The stars indicate significance at 1% (***) , 5% (**), and 10% (*) levels.

Interpretation: When adding a coskewness factor to the five-factor model, its risk premium should be positive and significant. This result is true only in the third panel, regardless of whether which version of the HS factor we use, but it is most significant for the less restrictive version, HS_{36} .

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