# Internet Appendix of "Stock Market Overvaluation, Moon Shots, and Corporate Innovation"

In this Appendix, we provide regression results using two alternative misvaluation measures: the residual income value-to-price ratio (*VP*) and residual *MFFlow* (*MFF_r*). The estimation procedures for *VP* is provided at the end of this appendix. *MFF_r* is defined as the residual from the annual regression of *MFFlow* on *Turnover*. *VP* observations start 1976, while *MFF_r* observations start 1981. Both variables end 2012. In Table IA-8 we report results using industry-adjusted *MFFlow* as the misvaluatino proxy.

## IA-A. Test Results on Sample with Non-Missing *VP* Observations

### Table IA-1. Regressions of Investments and Innovative Output on Stock Misvaluation

The variables are defined in Table 1. All independent variables are standardized to have a mean of zero and standard deviation of one. All regressions include 2-digit SIC industry fixed effects and year fixed effects. *T*-statistics are reported in parentheses. Standard errors are clustered by firm and year. The sample includes U.S. non-financial, non-utility firms listed on NYSE, AMEX and NASDAQ with COMPUSTAT and I/B/E/S coverage during 1976-2012. The patent and citation (*Pat* and *Cites*) data sample period is 1976-2008.

| | (1) | (2) | (3) | (4) | (1) | (2) | (3) | (4) | (1) | (2) | (3) | (4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RD | | | | Log(1+Pat) | | | | Log(1+Cites) | | |
| VP | -2.57 | -2.46 | | | -0.09 | -0.10 | | | -0.09 | -0.10 | | |
| | (-14.86) | (-12.74) | | | (-5.53) | (-4.95) | | | (-6.27) | (-5.45) | | |
| MFF_r | | | -0.98 | -1.04 | | | -0.06 | -0.06 | | | -0.06 | -0.06 |
| | | | (-5.25) | (-5.50) | | | (-5.76) | (-5.84) | | | (-5.74) | (-5.85) |
| BP | -0.48 | | -1.73 | | -0.06 | | -0.08 | | -0.06 | | -0.08 | |
| | (-2.75) | | (-6.91) | | (-4.02) | | (-6.11) | | (-4.41) | | (-6.43) | |
| GS | | 0.92 | | 1.20 | | 0.03 | | 0.03 | | 0.04 | | 0.04 |
| | | (5.49) | | (6.63) | | (4.39) | | (3.83) | | (5.50) | | (4.53) |
| CF | 1.51 | 2.14 | 0.26 | 1.08 | 0.13 | 0.19 | 0.09 | 0.13 | 0.14 | 0.19 | 0.09 | 0.13 |
| | (5.50) | (8.62) | (0.96) | (4.11) | (9.49) | (11.67) | (6.37) | (8.75) | (9.16) | (10.71) | (6.33) | (8.23) |
| Leverage | -1.69 | -1.35 | -1.26 | -0.99 | -0.20 | -0.21 | -0.18 | -0.17 | -0.20 | -0.21 | -0.18 | -0.17 |
| | (-13.18) | (-10.78) | (-8.05) | (-6.49) | (-11.58) | (-11.41) | (-12.72) | (-11.71) | (-11.79) | (-11.43) | (-12.27) | (-11.33) |
| Log(Age) | -0.83 | -0.81 | -1.69 | -1.74 | 0.09 | 0.18 | 0.11 | 0.15 | 0.08 | 0.17 | 0.10 | 0.13 |
| | (-7.03) | (-5.17) | (-10.31) | (-8.45) | (5.94) | (6.94) | (5.22) | (5.09) | (4.95) | (6.49) | (4.59) | (4.70) |
| Log(Assets) | -3.00 | -2.48 | -3.83 | -3.21 | 0.69 | 0.72 | 0.63 | 0.65 | 0.67 | 0.69 | 0.60 | 0.62 |
| | (-11.33) | (-10.38) | (-13.93) | (-12.57) | (19.10) | (19.61) | (18.17) | (18.32) | (17.35) | (17.50) | (15.58) | (15.55) |
| Intercept | 7.42 | 7.09 | 8.21 | 8.07 | -0.27 | -0.35 | -0.16 | -0.18 | -0.39 | -0.47 | -0.25 | -0.27 |
| | (41.70) | (56.57) | (58.31) | (58.39) | (-12.26) | (-14.32) | (-8.88) | (-7.84) | (-17.40) | (-18.34) | (-12.96) | (-11.23) |
| N | 40,206 | 34,658 | 39,773 | 35,911 | 55,048 | 47,295 | 53,150 | 47,986 | 53,935 | 46,296 | 51,853 | 46,802 |
| $R^2$ | 0.3271 | 0.3233 | 0.2975 | 0.2778 | 0.3909 | 0.4103 | 0.3737 | 0.3838 | 0.3735 | 0.3956 | 0.3562 | 0.3676 |

**Table IA-2. Regressions of Innovative Inventiveness on Stock Misvaluation**

The variables are defined in Table 1. All independent variables are standardized to have a mean of zero and standard deviation of one. *Novelty, Originality*, and *Scope* are in percentage. All regressions include 2-digit SIC industry fixed effects and year fixed effects. *T*-statistics are reported in parentheses. Standard errors are clustered by firm and year. The sample includes U.S. non-financial, non-utility firms listed on NYSE, AMEX and NASDAQ with COMPUSTAT, I/B/E/S, and patent-citation data coverage during 1976-2008.

| | (1) | (2) | (3) | (4) | (1) | (2) | (3) | (4) | (1) | (2) | (3) | (4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Novelty* | | | | *Originality* | | | | *Scope* | | | |
| VP | -6.13 | -5.98 | | | -2.06 | -2.12 | | | -1.88 | -1.77 | | |
| | (-9.54) | (-7.64) | | | (-7.27) | (-6.21) | | | (-8.96) | (-6.93) | | |
| MFF_r | | | -2.18 | -2.48 | | | -0.87 | -1.00 | | | -0.92 | -1.01 |
| | | | (-5.15) | (-5.52) | | | (-5.26) | (-5.78) | | | (-5.64) | (-6.04) |
| BP | -2.04 | | -5.15 | | -0.68 | | -1.86 | | -0.38 | | -1.37 | |
| | (-2.64) | | (-6.78) | | (-2.11) | | (-6.28) | | (-1.41) | | (-5.21) | |
| GS | | 3.35 | | 3.27 | | 0.59 | | 0.78 | | 0.66 | | 0.72 |
| | | (5.73) | | (5.61) | | (3.25) | | (4.90) | | (3.92) | | (4.98) |
| CF | 6.29 | 8.07 | 3.85 | 5.57 | 1.90 | 2.54 | 1.01 | 1.78 | 2.05 | 2.58 | 1.27 | 1.85 |
| | (7.87) | (10.41) | (5.02) | (7.17) | (7.51) | (10.44) | (3.86) | (7.35) | (6.89) | (8.06) | (4.41) | (6.23) |
| Leverage | -8.34 | -7.54 | -7.30 | -6.61 | -2.94 | -2.79 | -2.79 | -2.52 | -3.07 | -2.95 | -2.68 | -2.50 |
| | (-11.80) | (-10.95) | (-11.25) | (-10.13) | (-11.22) | (-10.55) | (-11.33) | (-10.38) | (-11.91) | (-11.13) | (-10.14) | (-9.81) |
| Log(Age) | 1.19 | 3.38 | -0.23 | 0.23 | 1.57 | 2.56 | 1.18 | 1.47 | 1.36 | 2.42 | 1.08 | 1.36 |
| | (1.50) | (3.33) | (-0.26) | (0.24) | (5.98) | (6.55) | (3.15) | (3.38) | (4.91) | (6.34) | (2.97) | (3.46) |
| Log(Assets) | 13.34 | 13.44 | 12.55 | 13.12 | 5.53 | 5.50 | 5.59 | 5.79 | 5.09 | 5.00 | 4.60 | 4.73 |
| | (14.67) | (14.04) | (14.99) | (15.83) | (17.26) | (16.20) | (19.27) | (19.88) | (12.14) | (11.40) | (10.33) | (10.19) |
| Intercept | -6.07 | -6.10 | -1.99 | -0.53 | 1.32 | 1.09 | 1.91 | 2.26 | -6.50 | -7.31 | -4.59 | -4.68 |
| | (-9.00) | (-7.93) | (-2.81) | (-0.56) | (4.43) | (3.67) | (7.77) | (7.19) | (-14.11) | (-13.57) | (-8.85) | (-8.04) |
| N | 53,935 | 46,296 | 51,853 | 46,802 | 54,968 | 47,228 | 53,072 | 47,917 | 53,935 | 46,296 | 51,853 | 46,802 |
| $R^2$ | 0.1328 | 0.1432 | 0.1217 | 0.1240 | 0.1904 | 0.1963 | 0.1770 | 0.1799 | 0.2220 | 0.2368 | 0.2144 | 0.2245 |

**Table IA-3. Long-Term Misvaluation Effects: Regressions of Innovative Input, Output and Inventiveness on 3-Year Lagged Stock Misvaluation**

The misvaluation measure (*VP* or *MFF_r*) is lagged by 3 years. The variables are defined in Table 1. All independent variables are standardized to have a mean of zero and standard deviation of one. *Novelty, Originality*, and *Scope* are in percentage. All regressions include 2-digit SIC industry fixed effects and year fixed effects. *T*-statistics are reported in parentheses. Standard errors are clustered by firm and year. The sample includes U.S. non-financial, non-utility firms listed on NYSE, AMEX and NASDAQ with COMPUSTAT and I/B/E/S coverage during 1976-2012. The patent and citation data (*Pat, Cites, Novelty, Originality,* and *Scope*) sample period is 1976-2008.

| | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RD | | Log(1+Pat) | | Log(1+Cites) | | Novelty | | Originality | | Scope | |
| VP | -2.45 | | -0.10 | | -0.09 | | -5.27 | | -2.00 | | -1.27 | |
| | (-11.81) | | (-5.12) | | (-5.53) | | (-6.70) | | (-5.84) | | (-5.63) | |
| MFF_r | | -0.95 | | -0.06 | | -0.06 | | -2.85 | | -1.03 | | -0.78 |
| | | (-5.17) | | (-4.93) | | (-5.04) | | (-5.02) | | (-5.63) | | (-3.92) |
| GS | 1.49 | 1.91 | -0.03 | -0.01 | -0.02 | 0.00 | 2.18 | 2.17 | 0.53 | 0.62 | 0.40 | 0.42 |
| | (5.05) | (6.30) | (-2.04) | (-0.69) | (-1.17) | (0.02) | (2.14) | (1.92) | (1.84) | (1.92) | (1.70) | (1.44) |
| CF | 1.79 | 1.00 | 0.20 | 0.16 | 0.20 | 0.17 | 7.33 | 6.28 | 2.61 | 2.21 | 2.57 | 2.19 |
| | (7.39) | (3.27) | (9.79) | (7.57) | (8.97) | (6.96) | (7.59) | (6.12) | (8.00) | (6.49) | (6.36) | (5.40) |
| Leverage | -0.63 | -0.83 | -0.17 | -0.17 | -0.17 | -0.17 | -6.05 | -5.95 | -2.19 | -2.24 | -2.55 | -2.16 |
| | (-4.05) | (-4.89) | (-9.52) | (-10.17) | (-9.61) | (-9.79) | (-7.77) | (-8.05) | (-7.59) | (-8.21) | (-9.69) | (-8.02) |
| Log(Age) | -0.93 | -2.05 | 0.19 | 0.16 | 0.16 | 0.14 | 1.89 | -1.19 | 2.60 | 1.31 | 2.10 | 1.04 |
| | (-4.71) | (-9.15) | (5.51) | (4.24) | (4.88) | (3.78) | (1.72) | (-0.96) | (5.49) | (2.34) | (4.58) | (2.10) |
| Log(Assets) | -2.86 | -3.13 | 0.73 | 0.69 | 0.70 | 0.65 | 13.22 | 13.45 | 5.41 | 6.02 | 4.76 | 4.63 |
| | (-9.82) | (-11.57) | (18.75) | (17.34) | (16.54) | (14.21) | (12.76) | (15.67) | (15.02) | (19.12) | (10.37) | (9.40) |
| Intercept | 7.69 | 8.36 | -0.42 | -0.27 | -0.53 | -0.36 | -5.59 | -0.25 | 1.33 | 2.13 | -7.21 | -4.90 |
| | (51.86) | (47.60) | (-16.07) | (-7.84) | (-17.85) | (-9.84) | (-6.80) | (-0.23) | (4.27) | (5.21) | (-10.99) | (-6.64) |
| N | 28,852 | 28,113 | 38,367 | 36,068 | 37,497 | 35,040 | 37,497 | 35,040 | 38,313 | 36,013 | 37,497 | 35,040 |
| $R^2$ | 0.3135 | 0.2776 | 0.4111 | 0.3992 | 0.3981 | 0.3860 | 0.1429 | 0.1370 | 0.1957 | 0.1896 | 0.2462 | 0.2505 |

## Table IA-4. Path Analysis of the Effects of Misvaluation (*VP*) on R&D

This analysis is based on a sample during 1976-2012, using *VP* instead of *MFFlow* to measure misvaluation. The variables in Panel A are defined in Table 1. In Panel B, *ROA* is operating income before depreciation and R&D expenses scaled by total assets for the prior fiscal year, and *ΔCR* is change in the current ratio (total current assets divided by total current liabilities). All variables are not standardized. All regressions include industry and year fixed effects. *T*-statistics are reported in parentheses. Standard errors are clustered by firm and year. We break the total effect of *MFFlow* on R&D into three parts: the direct catering effect, and the indirect effects through the equity issuance and debt issuance channels.

Panel A. *RD* Regression

| | RD |
|---|---|
| *MFFlow* | -15.3534 |
| | (-5.10) |
| *EI* | 0.1512 |
| | (16.47) |
| *DI* | 0.0242 |
| | (3.56) |
| *GS* | 0.3041 |
| | (4.74) |
| *CF* | 0.1095 |
| | (9.16) |
| *Leverage* | -4.2067 |
| | (-8.10) |
| *Log(Age)* | -1.2682 |
| | (-7.81) |
| *Size* | -1.1582 |
| | (-11.01) |
| *Intercept* | 15.5408 |
| | (21.12) |
| | |
| *N* | 35,876 |
| $R^2$ | 0.4458 |

Panel B. Equity Issuance (*EI*) and Debt Issuance (*DI*) Regressions

| | EI | DI |
|---|---|---|
| *MFFlow* | -28.9719 | -4.4143 |
| | (-8.73) | (-3.15) |
| *GS* | 1.0648 | 0.5948 |
| | (7.51) | (7.01) |
| *ROA* | -0.3165 | 0.0489 |
| | (-9.42) | (5.24) |
| *ΔCR* | 3.8641 | -1.6183 |
| | (4.99) | (-8.53) |
| *Leverage* | -0.4384 | -4.4071 |
| | (-0.29) | (-5.65) |
| *Log(Age)* | -2.2359 | -1.1561 |
| | (-6.19) | (-5.78) |
| *Size* | -2.5526 | 0.1917 |
| | (-12.83) | (1.89) |
| *Intercept* | 32.5107 | 7.9510 |
| | (14.71) | (13.75) |
| | | |
| *N* | 55,320 | 55,405 |
| $R^2$ | 0.1444 | 0.0424 |

Panel C. Path analysis results for the effects of *MFFlow* on *RD*

| | Coefficient | T-stat |
|---|---|---|
| (1) Direct Effect of *MFFlow* on *RD* | | |
| MFFlow → RD | -15.3534 | (-5.10) |
| | | |
| (2) Indirect Effect of *MFFlow* on RD via Equity Channel | | |
| MFFlow → EI | -28.9719 | (-8.73) |
| EI → RD | 0.1512 | (16.47) |
| Equity Path Effect | -4.3806 | |
| | | |
| (3) Indirect Effect of *MFFlow* on RD via Debt Channel | | |
| MFFlow → DI | -4.4143 | (-3.15) |
| DI → RD | 0.0242 | (3.56) |
| Debt Path Effect | -0.10683 | |
| | | |
| (4) Total *MFFlow* Effect on *RD* | -19.8408 | |
| % Direct Path | 77.38% | |
| % Equity Path | 22.08% | |
| % Debt Path | 0.54% | |

**Table IA-5. Path Analysis of the Effects of Misvaluation (*MFF_r*) on R&D**

This analysis is based on a sample during 1981-2012. The variables in Panel A are defined in Table 1. In Panel B, *ROA* is operating income before depreciation and R&D expenses scaled by total assets for the prior fiscal year, and *ΔCR* is change in the current ratio (total current assets divided by total current liabilities). All variables are not standardized. All regressions include industry and year fixed effects. *T*-statistics are reported in parentheses. Standard errors are clustered by firm and year. We break the total effect of *MFFlow* on R&D into three parts: the direct catering effect, and the indirect effects through the equity issuance and debt issuance channels.

Panel A. *RD* Regression | | Panel B. Equity Issuance (*EI*) and Debt Issuance (*DI*) Regressions | | |
|---|---|---|---|---|

| | RD | | | EI | DI |
|---|---|---|---|---|---|
| MFF_r | -3.5020 | | MFF_r | -5.4387 | -0.3437 |
| | (-11.49) | | | (-6.78) | (-0.89) |
| EI | 0.1302 | | GS | 1.0296 | 0.6159 |
| | (11.44) | | | (9.38) | (7.79) |
| DI | 0.0185 | | ROA | -0.1611 | 0.0669 |
| | (2.73) | | | (-6.01) | (6.10) |
| GS | 0.2331 | | ΔCR | 3.3297 | -1.6798 |
| | (3.47) | | | (4.11) | (-7.85) |
| CF | 0.1235 | | Leverage | -3.0156 | -3.1460 |
| | (10.39) | | | (-2.49) | (-4.48) |
| Leverage | -5.3987 | | Log(Age) | -1.2193 | -1.0151 |
| | (-10.73) | | | (-4.14) | (-6.15) |
| Log(Age) | -0.6293 | | Size | -1.9367 | 0.0151 |
| | (-4.83) | | | (-11.78) | (0.18) |
| Size | -0.9512 | | Intercept | 27.0351 | 8.2442 |
| | (-8.58) | | | (13.28) | (11.65) |
| Intercept | 14.5921 | | | | |
| | (17.77) | | | | |
| | | | | | |
| N | 34,626 | | N | 53,524 | 53,598 |
| R² | 0.4360 | | R² | 0.1232 | 0.0445 |

Panel C. Path analysis results for the effects of *MFF_r* on *RD*

| | Coefficient | *T*-stat |
|---|---|---|
| (1) Direct Effect of *MFF_r* on *RD* | | |
| MFF_r → RD | -3.5020 | (-11.49) |
| | | |
| (2) Indirect Effect of *MFF_r* on RD via Equity Channel | | |
| MFF_r → EI | -5.4387 | (-6.78) |
| EI → RD | 0.1302 | (11.44) |
| Equity Path Effect | -0.7081 | |
| | | |
| (3) Indirect Effect of *MFF_r* on RD via Debt Channel | | |
| MFF_r → DI | -0.3437 | (-0.89) |
| DI → RD | 0.0185 | (2.73) |
| Debt Path Effect | -0.0064 | |
| | | |
| (4) Total *MFF_r* Effect on *RD* | -4.2165 | |
| % Direct Path | 83.06% | |
| % Equity Path | 16.79% | |
| % Debt Path | 0.15% | |

**Table IA-6. Regressions of Investments and Innovative Output on Stock Misvaluation: Interaction with Growth or Turnover**

The misvaluation measure (*VP* or *MFF_r*) is interacted with share turnover (*Turnover*). *HighTurn* is an indicator variable for the highest *Turnover* quintile. The variables are defined in Table 1. *Novelty, Originality*, and *Scope* are in percentage. All independent variables are standardized to have a mean of zero and standard deviation of one. All regressions include 2-digit SIC industry fixed effects and year fixed effects. *T*-statistics are reported in parentheses. Standard errors are clustered by firm and year. The sample includes U.S. non-financial, non-utility firms listed on NYSE, AMEX and NASDAQ with COMPUSTAT and I/B/E/S coverage during 1976-2012. The patent and citation (*Pat* and *Cites*) data sample period is 1976-2008.

| | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RD | | Log(1+Pat) | | Log(1+Cites) | | Novelty | | Originality | | Scope | |
| VP | -2.47 | | -0.08 | | -0.08 | | -4.93 | | -1.89 | | -1.58 | |
| | (-12.94) | | (-4.66) | | (-4.99) | | (-6.30) | | (-5.48) | | (-6.08) | |
| VP*HighTurn | 0.14 | | -0.06 | | -0.06 | | -3.18 | | -0.98 | | -0.80 | |
| | (0.51) | | (-2.11) | | (-1.96) | | (-2.77) | | (-2.92) | | (-2.27) | |
| MFF_r | | -1.25 | | -0.06 | | -0.06 | | -2.79 | | -1.07 | | -1.21 |
| | | (-7.44) | | (-6.52) | | (-6.60) | | (-6.39) | | (-6.23) | | (-7.98) |
| MFF_r*HighTurn | | -1.43 | | -0.25 | | -0.26 | | -7.88 | | -2.53 | | -4.12 |
| | | (-2.73) | | (-5.21) | | (-5.13) | | (-4.45) | | (-4.60) | | (-4.36) |
| GS | 0.83 | 1.03 | 0.03 | 0.02 | 0.04 | 0.03 | 2.83 | 2.56 | 0.50 | 0.61 | 0.63 | 0.60 |
| | (5.00) | (5.90) | (3.70) | (2.35) | (4.66) | (3.08) | (5.22) | (4.72) | (2.96) | (3.90) | (3.83) | (4.28) |
| CF | 2.09 | 1.01 | 0.18 | 0.13 | 0.19 | 0.13 | 7.64 | 5.26 | 2.48 | 1.70 | 2.57 | 1.81 |
| | (8.77) | (4.07) | (11.97) | (8.90) | (11.11) | (8.42) | (10.04) | (7.02) | (10.10) | (7.18) | (8.23) | (6.32) |
| Leverage | -1.36 | -0.94 | -0.21 | -0.17 | -0.21 | -0.17 | -7.61 | -6.34 | -2.82 | -2.45 | -2.99 | -2.44 |
| | (-10.88) | (-6.89) | (-11.16) | (-11.60) | (-11.17) | (-11.29) | (-11.25) | (-10.37) | (-10.72) | (-10.67) | (-11.03) | (-9.78) |
| Log(Age) | -0.80 | -1.39 | 0.18 | 0.16 | 0.16 | 0.14 | 3.63 | 1.22 | 2.60 | 1.71 | 2.36 | 1.50 |
| | (-5.23) | (-6.61) | (6.99) | (5.67) | (6.66) | (5.43) | (3.50) | (1.23) | (6.38) | (3.88) | (6.15) | (3.90) |
| Log(Assets) | -2.70 | -3.79 | 0.72 | 0.63 | 0.69 | 0.59 | 12.57 | 11.33 | 5.37 | 5.36 | 4.97 | 4.50 |
| | (-10.42) | (-13.43) | (18.90) | (18.07) | (17.07) | (15.60) | (12.06) | (12.25) | (14.59) | (16.71) | (11.39) | (10.34) |
| Turnover | 0.65 | 1.05 | 0.03 | 0.03 | 0.04 | 0.03 | 3.54 | 3.99 | 0.56 | 0.84 | 0.09 | -0.00 |
| | (3.48) | (4.14) | (1.06) | (1.06) | (1.50) | (1.22) | (3.89) | (3.84) | (1.58) | (2.35) | (0.44) | (-0.02) |
| Intercept | 6.85 | 7.59 | -0.39 | -0.22 | -0.52 | -0.32 | -10.24 | -5.14 | 0.42 | 1.24 | -7.35 | -4.93 |
| | (51.43) | (43.23) | (-9.53) | (-5.75) | (-11.93) | (-7.87) | (-7.30) | (-3.46) | (0.80) | (2.32) | (-10.43) | (-6.92) |
| N | 33,945 | 35,911 | 46,152 | 47,986 | 45,155 | 46,802 | 45,155 | 46,802 | 46,085 | 47,917 | 45,155 | 46,802 |
| R² | 0.3276 | 0.2919 | 0.4131 | 0.3878 | 0.3992 | 0.3726 | 0.1468 | 0.1293 | 0.1974 | 0.1828 | 0.2392 | 0.2277 |

**Table IA-7. Quantile Regressions**

We perform quantile regressions of R&D, and innovative output (*Pat* and *Cites*) and inventiveness variables (*Novelty, Originality* and *Scope*) on misvaluation (measured by *VP* as in Panel A, or by *MFF_r* as in Panel B) and control variables with industry and year fixed effects. We choose quantile values of Q to be 0.2, 0.4, 0.6, and 0.8 for *RD*; and quantile values of 0.65, 0.7, 0.75, and 0.8 for innovative output and inventive measures because these variables have a median value of zero. We report only the coefficient on *VP* (Panel A) or *MFF_r* (Panel B). *T*-statistics of the *VP* or *MFF_r* coefficient of the quantile regressions are reported in parentheses, with *p*-values of the *F*-test for the difference in the coefficients between the top or bottom quantiles shown in square brackets.

Panel A. Misvaluation measured by *VP*.

|  | $Q(0.2)$ | $Q(0.4)$ | $Q(0.6)$ | $Q(0.8)$ | $Q(0.8)-Q(0.2)$ [*p*-value] |
|---|---|---|---|---|---|
| *RD* | -0.414 | -1.105 | -1.637 | -2.038 | -1.624 |
|  | (-33.11) | (-43.04) | (-39.66) | (-29.53) | [0.000] |

|  | $Q(0.65)$ | $Q(0.7)$ | $Q(0.75)$ | $Q(0.8)$ | $Q(0.8)-Q(0.65)$ [*p*-value] |
|---|---|---|---|---|---|
| *Pat* | -0.079 | -0.098 | -0.121 | -0.134 | -0.055 |
|  | (-10.71) | (-11.68) | (-12.03) | (-12.82) | [0.000] |
| *Cites* | -0.039 | -0.050 | -0.061 | -0.069 | -0.030 |
|  | (-11.85) | (-14.40) | (-14.52) | (-17.65) | [0.000] |
| *Novelty* | -2.147 | -3.604 | -5.805 | -7.781 | -5.634 |
|  | (-9.23) | (-11.96) | (-12.81) | (-12.59) | [0.000] |
| *Originality* | -0.427 | -1.477 | -2.799 | -3.760 | -3.333 |
|  | (-10.00) | (-10.76) | (-11.60) | (-13.36) | [0.000] |
| *Scope* | -0.893 | -1.936 | -2.963 | -3.300 | -2.407 |
|  | (-9.44) | (-15.15) | (-18.57) | (-20.26) | [0.000] |

Panel B. Misvaluation measured by *MFF_r*.

| | *Q*(0.2) | *Q*(0.4) | *Q*(0.6) | *Q*(0.8) | *Q*(0.8)-*Q*(0.2) [*p*-value] |
|---|---|---|---|---|---|
| *RD* | -0.065 | -0.339 | -0.692 | -1.119 | -1.054 |
| | (-7.00) | (-14.15) | (-18.16) | (-17.47) | [0.000] |

| | *Q*(0.65) | *Q*(0.7) | *Q*(0.75) | *Q*(0.8) | *Q*(0.8)-*Q*(0.65) [*p*-value] |
|---|---|---|---|---|---|
| *Pat* | -0.054 | -0.063 | -0.074 | -0.080 | -0.025 |
| | (-9.34) | (-8.31) | (-8.75) | (-8.81) | [0.000] |
| *Cites* | -0.026 | -0.028 | -0.034 | -0.038 | -0.012 |
| | (-9.36) | (-9.73) | (-10.02) | (-11.05) | [0.000] |
| *Novelty* | -1.141 | -1.649 | -2.467 | -3.355 | -2.214 |
| | (-7.21) | (-6.73) | (-6.72) | (-6.83) | [0.000] |
| *Originality* | -0.085 | -0.496 | -1.225 | -1.817 | -1.732 |
| | (-6.49) | (-5.76) | (-6.44) | (-7.74) | [0.000] |
| *Scope* | -0.511 | -1.006 | -1.543 | -1.827 | -1.316 |
| | (-9.28) | (-11.23) | (-11.80) | (-14.10) | [0.000] |

**Table IA-8. Regressions of Investments and Innovative Output on Stock Misvaluation**

*MFFlow_I* is the industry-adjusted mutual fund flow based misvaluation measure (raw *MFFlow* minus 2-digit-SIC industry mean *MFFlow*). The variables are defined in Table 1. All independent variables are standardized to have a mean of zero and standard deviation of one. *Novelty, Originality*, and *Scope* are in percentage. All regressions include industry and year fixed effects. *T*-statistics are reported in parentheses. Standard errors are clustered by firm and year. The sample includes U.S. non-financial, non-utility firms listed on NYSE, AMEX and NASDAQ with COMPUSTAT and I/B/E/S coverage during 1976-2012. The patent and citation data (*Pat, Cites, Novelty, Originality,* and *Scope*) sample period is 1996-2008.

| | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RD | | Log(1+Pat) | | Log(1+Cites) | | Novelty | | Originality | | Scope | |
| MFFlow_I | -1.31 | -1.24 | -0.07 | -0.07 | -0.03 | -0.03 | -3.71 | -3.43 | -1.22 | -1.20 | -1.34 | -1.27 |
| | (-6.85) | (-6.53) | (-5.60) | (-5.51) | (-6.23) | (-6.18) | (-5.92) | (-5.98) | (-4.21) | (-4.35) | (-5.91) | (-5.94) |
| BP | -0.72 | | -0.05 | | -0.02 | | -2.82 | | -1.03 | | -0.54 | |
| | (-3.74) | | (-3.37) | | (-3.26) | | (-3.52) | | (-2.84) | | (-1.66) | |
| GS | | 1.04 | | 0.03 | | 0.02 | | 3.72 | | 0.77 | | 0.76 |
| | | (5.51) | | (3.39) | | (4.43) | | (5.81) | | (3.89) | | (4.20) |
| CF | 1.28 | 1.87 | 0.13 | 0.18 | 0.06 | 0.08 | 6.11 | 7.63 | 1.62 | 2.27 | 1.87 | 2.34 |
| | (4.88) | (6.92) | (7.78) | (9.93) | (7.86) | (9.91) | (6.88) | (8.82) | (5.37) | (8.31) | (5.45) | (6.67) |
| Leverage | -1.62 | -1.39 | -0.22 | -0.21 | -0.09 | -0.08 | -7.85 | -7.20 | -3.01 | -2.78 | -2.89 | -2.67 |
| | (-11.95) | (-10.39) | (-11.35) | (-10.86) | (-11.87) | (-11.29) | (-10.95) | (-10.07) | (-10.57) | (-9.88) | (-10.36) | (-10.15) |
| Log(Age) | -1.45 | -1.27 | 0.10 | 0.15 | 0.04 | 0.06 | -0.03 | 1.48 | 1.57 | 2.20 | 1.37 | 1.92 |
| | (-9.33) | (-6.69) | (4.37) | (4.95) | (3.79) | (4.68) | (-0.03) | (1.29) | (3.83) | (4.53) | (3.47) | (4.43) |
| Log(Assets) | -3.32 | -2.88 | 0.70 | 0.72 | 0.24 | 0.25 | 12.33 | 12.70 | 5.22 | 5.28 | 4.46 | 4.49 |
| | (-12.06) | (-11.16) | (17.39) | (17.54) | (18.23) | (18.45) | (12.54) | (12.73) | (14.32) | (14.31) | (9.64) | (9.39) |
| Intercept | 7.49 | 7.28 | -0.16 | -0.19 | -0.08 | -0.10 | -0.00 | 0.54 | 3.06 | 3.04 | -4.64 | -5.06 |
| | (47.39) | (49.43) | (-7.01) | (-7.53) | (-9.49) | (-9.12) | (-0.00) | (0.51) | (10.63) | (8.89) | (-8.53) | (-8.27) |
| N | 31,084 | 27,982 | 40,692 | 36,598 | 39,714 | 35,701 | 39,714 | 35,701 | 40,633 | 36,544 | 39,714 | 35,701 |
| $R^2$ | 0.3131 | 0.3095 | 0.3980 | 0.4112 | 0.3651 | 0.3803 | 0.1355 | 0.1428 | 0.1899 | 0.1954 | 0.2325 | 0.2459 |

**Table IA-9. Regressions of Investments and Innovative Output on Stock Misvaluation: R&D-Adjusted *MFFlow***

*MFFlow_RD* is the R&D-adjusted mutual fund flow measure Specifically, we sort firms into R&D quintiles, with the bottom quintile having zero R&D, and the top quintile being the highest R&D quartile of positive R&D firms. *MFFlow_RD* is the difference between *MFFlow* and the mean *MFFlow* of the firm's R&D quintile. The variables are defined in Table 1. All independent variables are standardized to have a mean of zero and standard deviation of one. *Novelty, Originality*, and *Scope* are in percentage. All regressions include industry and year fixed effects. *T*-statistics are reported in parentheses. Standard errors are clustered by firm and year. The sample includes U.S. non-financial, non-utility firms listed on NYSE, AMEX and NASDAQ with COMPUSTAT and I/B/E/S coverage during 1976-2012. The patent and citation data (*Pat, Cites, Novelty, Originality,* and *Scope*) sample period is 1996-2008.

| | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RD | | Log(1+Pat) | | Log(1+Cites) | | Novelty | | Originality | | Scope | |
| MFFlow_RD | -0.49 | -0.63 | -0.05 | -0.06 | -0.02 | -0.03 | -1.77 | -2.39 | -0.43 | -0.67 | -0.78 | -0.98 |
| | (-4.01) | (-5.39) | (-4.49) | (-5.27) | (-5.11) | (-5.91) | (-3.16) | (-4.03) | (-2.45) | (-3.46) | (-4.55) | (-5.17) |
| BP | -1.78 | | -0.12 | | -0.05 | | -6.91 | | -2.19 | | -1.75 | |
| | (-7.32) | | (-6.71) | | (-6.94) | | (-6.65) | | (-5.87) | | (-4.75) | |
| GS | | 1.22 | | 0.04 | | 0.02 | | 3.80 | | 0.90 | | 0.77 |
| | | (6.67) | | (4.68) | | (5.12) | | (5.79) | | (4.82) | | (4.42) |
| CF | 0.22 | 1.07 | 0.05 | 0.10 | 0.03 | 0.05 | 3.25 | 4.81 | 0.72 | 1.43 | 0.97 | 1.50 |
| | (0.79) | (4.02) | (3.97) | (6.46) | (4.95) | (7.46) | (3.99) | (5.44) | (2.80) | (5.44) | (3.51) | (4.96) |
| Leverage | -1.29 | -1.00 | -0.18 | -0.17 | -0.07 | -0.07 | -6.83 | -5.88 | -2.29 | -1.92 | -2.56 | -2.32 |
| | (-8.30) | (-6.49) | (-9.80) | (-8.85) | (-9.56) | (-8.52) | (-7.26) | (-6.17) | (-7.05) | (-5.98) | (-8.23) | (-7.78) |
| Log(Age) | -1.73 | -1.76 | 0.15 | 0.19 | 0.05 | 0.06 | -1.48 | -1.38 | 1.16 | 1.35 | 1.15 | 1.30 |
| | (-10.44) | (-8.40) | (5.58) | (5.40) | (4.06) | (4.18) | (-1.28) | (-1.08) | (2.50) | (2.48) | (2.56) | (2.62) |
| Log(Assets) | -3.87 | -3.27 | 0.84 | 0.86 | 0.30 | 0.30 | 14.73 | 15.22 | 6.44 | 6.57 | 5.17 | 5.24 |
| | (-13.36) | (-12.06) | (20.59) | (20.74) | (21.62) | (21.95) | (14.51) | (14.93) | (19.47) | (19.17) | (10.52) | (10.37) |
| Intercept | 8.26 | 8.10 | -0.02 | -0.04 | -0.04 | -0.04 | 3.76 | 6.55 | 5.69 | 6.32 | -4.35 | -4.23 |
| | (57.97) | (55.40) | (-0.94) | (-1.29) | (-4.02) | (-3.31) | (3.50) | (4.83) | (12.62) | (11.62) | (-7.38) | (-6.71) |
| N | 39,271 | 35,493 | 33,356 | 30,014 | 32,276 | 29,039 | 32,276 | 29,039 | 33,292 | 29,959 | 32,276 | 29,039 |
| $R^2$ | 0.2951 | 0.2737 | 0.4499 | 0.4607 | 0.3938 | 0.4064 | 0.1003 | 0.1016 | 0.1507 | 0.1533 | 0.2345 | 0.2477 |

**Table IA-10. Regressions of Innovative Input, Output and Inventiveness on Stock Misvaluation: Interaction with High Valuation Indicator (*LowVP*)**

The misvaluation measure (*VP*) is interacted with an overvaluation indicator. *LowVP* is an indicator variable for the lowest *VP* quintile. The variables are defined in Table 1. All independent variables are standardized to have a mean of zero and standard deviation of one. *Novelty, Originality*, and *Scope* are in percentage. All regressions include 2-digit SIC industry fixed effects and year fixed effects. *T*-statistics are reported in parentheses. Standard errors are clustered by firm and year. The sample includes U.S. non-financial, non-utility firms listed on NYSE, AMEX and NASDAQ with COMPUSTAT and I/B/E/S coverage during 1976-2012. The patent and citation data (*Pat, Cites, Novelty, Originality,* and *Scope*) sample period is 1976-2008.

| | RD | Log(1+Pat) | Log(1+Cites) | Novelty | Originality | Scope |
|---|---|---|---|---|---|---|
| VP | -0.19 | -0.04 | -0.02 | -3.09 | -1.08 | -0.93 |
| | (-0.98) | (-1.96) | (-2.86) | (-4.04) | (-3.56) | (-3.70) |
| VP*LowVP | -6.53 | -0.19 | -0.07 | -9.23 | -3.33 | -2.67 |
| | (-13.45) | (-7.38) | (-6.89) | (-7.00) | (-7.38) | (-5.74) |
| GS | 0.78 | 0.03 | 0.02 | 3.00 | 0.50 | 0.58 |
| | (5.36) | (3.86) | (4.81) | (5.46) | (2.90) | (3.61) |
| CF | 2.56 | 0.19 | 0.08 | 8.13 | 2.59 | 2.58 |
| | (11.97) | (12.61) | (12.54) | (11.21) | (11.59) | (8.50) |
| Leverage | -1.23 | -0.19 | -0.08 | -6.81 | -2.51 | -2.65 |
| | (-11.31) | (-11.66) | (-12.28) | (-11.19) | (-10.78) | (-11.27) |
| Log(Age) | -0.63 | 0.20 | 0.08 | 3.82 | 2.77 | 2.60 |
| | (-4.28) | (7.30) | (7.17) | (3.66) | (6.96) | (6.64) |
| Log(Assets) | -1.92 | 0.70 | 0.25 | 13.39 | 5.45 | 4.94 |
| | (-9.74) | (19.98) | (21.15) | (14.77) | (16.80) | (11.70) |
| Intercept | 5.42 | -0.22 | -0.12 | -3.46 | 2.05 | -6.37 |
| | (30.98) | (-10.25) | (-14.29) | (-3.94) | (6.61) | (-12.51) |
| | | | | | | |
| N | 34,658 | 47,295 | 46,296 | 46,296 | 47,228 | 46,296 |
| R² | 0.3690 | 0.4127 | 0.3819 | 0.1454 | 0.1987 | 0.2384 |

**Table IA-11. Regressions of Innovative Input, Output and Inventiveness on Stock Misvaluation: Interaction with Low *MFF_r* Indicator**

The misvaluation measure (*MFF_r*) is interacted with an overvaluation indicator. *LowMFF_r* is an indicator variable for the lowest *MFF_r* quintile. The variables are defined in Table 1. All independent variables are standardized to have a mean of zero and standard deviation of one. *Novelty, Originality*, and *Scope* are in percentage. All regressions include 2-digit SIC industry fixed effects and year fixed effects. *T*-statistics are reported in parentheses. Standard errors are clustered by firm and year. The sample includes U.S. non-financial, non-utility firms listed on NYSE, AMEX and NASDAQ with COMPUSTAT and CDA/Spectrum mutual fund flows data during 1981-2012. The patent and citation data (*Pat, Cites, Novelty, Originality,* and *Scope*) sample period is 1976-2008.

| | RD | Log(1+Pat) | Log(1+Cites) | Novelty | Originality | Scope |
|---|---|---|---|---|---|---|
| MFF_r | -1.20 | -0.05 | -0.03 | -2.97 | -1.22 | -1.13 |
| | (-8.85) | (-4.24) | (-5.69) | (-6.19) | (-6.19) | (-7.60) |
| MFF_r*LowMFF_r | 0.89 | -0.06 | -0.00 | 2.96 | 1.34 | 0.74 |
| | (1.58) | (-1.48) | (-0.30) | (2.54) | (3.08) | (1.60) |
| GS | 1.20 | 0.03 | 0.02 | 3.25 | 0.77 | 0.72 |
| | (6.63) | (3.96) | (4.79) | (5.60) | (4.87) | (4.95) |
| CF | 1.07 | 0.13 | 0.06 | 5.53 | 1.76 | 1.84 |
| | (4.09) | (8.86) | (9.29) | (7.14) | (7.25) | (6.22) |
| Leverage | -0.98 | -0.17 | -0.07 | -6.59 | -2.51 | -2.49 |
| | (-6.49) | (-11.74) | (-11.88) | (-10.12) | (-10.37) | (-9.80) |
| Log(Age) | -1.71 | 0.14 | 0.05 | 0.28 | 1.50 | 1.37 |
| | (-8.46) | (5.05) | (4.29) | (0.29) | (3.43) | (3.48) |
| Log(Assets) | -3.27 | 0.65 | 0.24 | 12.98 | 5.72 | 4.69 |
| | (-12.43) | (18.63) | (19.40) | (15.31) | (19.52) | (10.16) |
| Intercept | 8.17 | -0.18 | -0.09 | -0.29 | 2.37 | -4.62 |
| | (50.80) | (-8.26) | (-9.52) | (-0.31) | (7.51) | (-8.02) |
| N | 35,911 | 47,986 | 46,802 | 46,802 | 47,917 | 46,802 |
| R² | 0.2782 | 0.3840 | 0.3536 | 0.1241 | 0.1801 | 0.2245 |

**Table IA-12. The Evolution of MFFlow Over a Five-Year Period for Top and Bottom *MFFlow* Quintiles**

This table reports the mean value of *MFFlow* or lagged *MFFlow* (each lag is 1-year long) for the current-year top and bottom quintiles of *MFFlow*. The sample mean *MFFlow* is 3.52% (as reported in Table 1).

| No. of Lags of *MFFlow* | 0 (Current Year) | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| | Top *MFFlow* Quintile | | | | | |
| Mean *MFFlow* (%) | 10.95 | 7.60 | 6.61 | 6.14 | 5.58 | 5.36 |
| N | 12,692 | 10,993 | 9,845 | 8,906 | 7,997 | 7,267 |
| | Bottom *MFFlow* Quintile | | | | | |
| Mean *MFFlow* (%) | 0.26 | 1.39 | 1.89 | 2.15 | 2.36 | 2.60 |
| N | 12,683 | 9,500 | 8,069 | 7,033 | 6,011 | 5,081 |

**Table IA-13. Path Analysis of the Effects of Misvaluation on R&D: High Valuation (Low-*MFFlow*) Years**

High valuation years are years in which the aggregate *MFFlow* is below median. The variables in Panel A are defined in Table 1. In Panel B, *ROA* is income before depreciation and R&D expenses scaled by total assets for the prior fiscal year, and *ΔCR* is change in the current ratio (total current assets divided by total current liabilities). All variables are not standardized. All regressions operating include industry and year fixed effects. *T*-statistics are reported in parentheses. Standard errors are clustered by firm and year. We break the total effect of *MFFlow* on R&D into three parts: the direct catering effect, and the indirect effects through the equity issuance and debt issuance channels.

Panel A. *RD* Regression

| | RD |
|---|---|
| *MFFlow* | -37.4851 |
| | (-9.04) |
| EI | 0.1585 |
| | (15.96) |
| DI | 0.0262 |
| | (2.75) |
| GS | 0.2446 |
| | (2.88) |
| CF | 0.1189 |
| | (7.94) |
| Leverage | -4.5273 |
| | (-7.06) |
| Log(Age) | -1.3253 |
| | (-6.55) |
| Size | -1.2009 |
| | (-11.55) |
| Intercept | 14.0421 |
| | (16.01) |
| | |
| N | 18,604 |
| $R^2$ | 0.4403 |

Panel B. Equity Issuance (*EI*) and Debt Issuance (*DI*) Regressions

| | EI | DI |
|---|---|---|
| *MFFlow* | -67.9207 | -8.4301 |
| | (-10.09) | (-2.15) |
| GS | 0.7987 | 0.6301 |
| | (7.85) | (4.77) |
| ROA | -0.3198 | 0.0601 |
| | (-7.96) | (4.88) |
| *ΔCR* | 2.7009 | -1.8991 |
| | (5.74) | (-10.68) |
| Leverage | 0.9307 | -3.1727 |
| | (0.84) | (-3.40) |
| Log(Age) | -1.5571 | -1.2526 |
| | (-4.68) | (-4.05) |
| Size | -2.7523 | 0.1420 |
| | (-10.71) | (0.88) |
| Intercept | 34.3344 | 9.6497 |
| | (11.69) | (11.07) |
| | | |
| N | 28,322 | 28,362 |
| $R^2$ | 0.1322 | 0.0434 |

Panel C. Path analysis results for the effects of *MFFlow* on *RD*

| | Coefficient | T-stat |
|---|---|---|
| (1) Direct Effect of *MFFlow* on *RD* | | |
| MFFlow → RD | -37.4851 | (-9.04) |
| | | |
| (2) Indirect Effect of *MFFlow* on RD via Equity Channel | | |
| MFFlow → EI | -67.9207 | (-10.09) |
| EI → RD | 0.1585 | (15.96) |
| Equity Path Effect | -10.7654 | |
| | | |
| (2) Indirect Effect of *MFFlow* on RD via Debt Channel | | |
| MFFlow → DI | -8.4301 | (-2.15) |
| DI → RD | 0.0262 | (2.75) |
| Debt Path Effect | -0.22087 | |
| | | |
| (3) Total *MFFlow* Effect on *RD* | -48.4714 | |
| % Direct Path | 77.33% | |
| % Equity Path | 22.21% | |
| % Debt Path | 0.46% | |

**Table IA-14. Path Analysis of the Effects of Misvaluation on R&D: Low Valuation (High-*MFFlow*) Years**

Low valuation years are years in which the aggregate *MFFlow* is above median. The variables in Panel A are defined in Table 1. In Panel B, *ROA* is income before depreciation and R&D expenses scaled by total assets for the prior fiscal year, and *ΔCR* is change in the current ratio (total current assets divided by total current liabilities). All variables are not standardized. All regressions operating include industry and year fixed effects. *T*-statistics are reported in parentheses. Standard errors are clustered by firm and year. We break the total effect of *MFFlow* on R&D into three parts: the direct catering effect, and the indirect effects through the equity issuance and debt issuance channels.

Panel A. *RD* Regression

| | RD |
|---|---|
| MFFlow | -14.9968 |
| | (-6.28) |
| EI | 0.1439 |
| | (12.18) |
| DI | 0.0216 |
| | (2.18) |
| GS | 0.3467 |
| | (4.53) |
| CF | 0.0999 |
| | (6.99) |
| Leverage | -3.8498 |
| | (-7.11) |
| Log(Age) | -1.0365 |
| | (-6.43) |
| Size | -1.2163 |
| | (-7.74) |
| Intercept | 16.0622 |
| | (16.77) |
| | |
| N | 17,272 |
| R² | 0.4612 |

Panel B. Equity Issuance (*EI*) and Debt Issuance (*DI*) Regressions

| | EI | DI |
|---|---|---|
| MFFlow | -40.9575 | -8.7515 |
| | (-7.87) | (-5.30) |
| GS | 1.3192 | 0.5248 |
| | (6.82) | (6.85) |
| ROA | -0.3201 | 0.0352 |
| | (-6.16) | (3.66) |
| ΔCR | 4.9278 | -1.3616 |
| | (3.92) | (-4.85) |
| Leverage | -1.7706 | -5.6692 |
| | (-0.71) | (-5.30) |
| Log(Age) | -2.5355 | -0.9967 |
| | (-5.09) | (-5.01) |
| Size | -2.6443 | 0.1836 |
| | (-9.55) | (1.54) |
| Intercept | 35.2025 | 8.2708 |
| | (9.80) | (11.14) |
| | | |
| N | 26,998 | 27,043 |
| R² | 0.1702 | 0.0429 |

Panel C. Path analysis results for the effects of *MFFlow* on *RD*

| | Coefficient | T-stat |
|---|---|---|
| (1) Direct Effect of *MFFlow* on *RD* | | |
| MFFlow → RD | -14.9968 | (-6.28) |
| | | |
| (2) Indirect Effect of *MFFlow* on RD via Equity Channel | | |
| MFFlow → EI | -40.9575 | (-7.87) |
| EI → RD | 0.1439 | (12.18) |
| Equity Path Effect | -5.8938 | |
| | | |
| (2) Indirect Effect of *MFFlow* on RD via Debt Channel | | |
| MFFlow → DI | -8.7515 | (-5.30) |
| DI → RD | 0.0216 | (2.18) |
| Debt Path Effect | -0.18903 | |
| | | |
| (3) Total *MFFlow* Effect on *RD* | -21.0796 | |
| % Direct Path | 71.14% | |
| % Equity Path | 27.96% | |
| % Debt Path | 0.90% | |

**Table IA-15. Path Analysis of the Effects of Misvaluation on R&D: High Turnover Firms**

High turnover firms are firms in the highest turnover quintile. The variables in Panel A are defined in Table 1. In Panel B, *ROA* is income before depreciation and R&D expenses scaled by total assets for the prior fiscal year, and *ΔCR* is change in the current ratio (total current assets divided by total current liabilities). All variables are not standardized. All regressions operating include industry and year fixed effects. *T*-statistics are reported in parentheses. Standard errors are clustered by firm and year. We break the total effect of *MFFlow* on R&D into three parts: the direct catering effect, and the indirect effects through the equity issuance and debt issuance channels.

Panel A. *RD* Regression

| | RD |
|---|---|
| *MFFlow* | -36.4972 |
| | (-4.47) |
| EI | 0.1273 |
| | (13.54) |
| DI | 0.0295 |
| | (2.28) |
| GS | 0.1392 |
| | (1.46) |
| CF | 0.0983 |
| | (6.78) |
| Leverage | -3.7961 |
| | (-4.20) |
| Log(Age) | -0.6717 |
| | (-2.43) |
| Size | -1.3361 |
| | (-5.93) |
| Intercept | 16.1902 |
| | (11.59) |
| | |
| N | 9,041 |
| $R^2$ | 0.4723 |

Panel B. Equity Issuance (*EI*) and Debt Issuance (*DI*) Regressions

| | EI | DI |
|---|---|---|
| *MFFlow* | -99.9084 | -6.9753 |
| | (-5.59) | (-0.74) |
| GS | 0.6984 | 0.6771 |
| | (4.49) | (3.47) |
| ROA | -0.3571 | 0.0175 |
| | (-7.07) | (0.77) |
| *ΔCR* | 5.0419 | -0.7221 |
| | (3.39) | (-2.11) |
| Leverage | -1.4215 | -3.4616 |
| | (-0.98) | (-2.45) |
| Log(Age) | -1.1582 | -1.0606 |
| | (-2.30) | (-2.55) |
| Size | -5.1579 | -0.0031 |
| | (-8.38) | (-0.01) |
| Intercept | 55.2219 | 11.5630 |
| | (9.67) | (9.17) |
| | | |
| N | 12,927 | 12,960 |
| $R^2$ | 0.2029 | 0.0376 |

Panel C. Path analysis results for the effects of *MFFlow* on *RD*

| | Coefficient | *T*-stat |
|---|---|---|
| (1) Direct Effect of *MFFlow* on *RD* | | |
| *MFFlow* → *RD* | -36.4972 | (-4.47) |
| | | |
| (2) Indirect Effect of *MFFlow* on RD via Equity Channel | | |
| *MFFlow* → *EI* | -99.9084 | (-5.59) |
| *EI* → *RD* | 0.1273 | (13.54) |
| Equity Path Effect | -12.7183 | |
| | | |
| (2) Indirect Effect of *MFFlow* on RD via Debt Channel | | |
| *MFFlow* → *DI* | -6.9753 | (-0.74) |
| *DI* → *RD* | 0.0295 | (2.28) |
| Debt Path Effect | -0.20577 | |
| | | |
| (3) Total *MFFlow* Effect on *RD* | -49.4213 | |
| % Direct Path | 73.85% | |
| % Equity Path | 25.73% | |
| % Debt Path | 0.42% | |

**Table IA-16. Path Analysis of the Effects of Misvaluation on R&D: Low Turnover Firms**

Low turnover firms are firms in the lowest turnover quintile. The variables in Panel A are defined in Table 1. In Panel B, *ROA* is income before depreciation and R&D expenses scaled by total assets for the prior fiscal year, and *ΔCR* is change in the current ratio (total current assets divided by total current liabilities). All variables are not standardized. All regressions operating include industry and year fixed effects. *T*-statistics are reported in parentheses. Standard errors are clustered by firm and year. We break the total effect of *MFFlow* on R&D into three parts: the direct catering effect, and the indirect effects through the equity issuance and debt issuance channels.

Panel A. *RD* Regression

| | RD |
|---|---|
| *MFFlow* | -4.9980 |
| | (-2.59) |
| EI | 0.1688 |
| | (6.97) |
| DI | 0.0352 |
| | (1.75) |
| GS | 0.3531 |
| | (2.72) |
| CF | 0.1120 |
| | (4.69) |
| Leverage | -5.2145 |
| | (-7.19) |
| Log(Age) | -1.8096 |
| | (-5.75) |
| Size | -1.6820 |
| | (-8.29) |
| Intercept | 18.1928 |
| | (12.02) |
| | |
| N | 4,505 |
| $R^2$ | 0.4137 |

Panel B. Equity Issuance (*EI*) and Debt Issuance (*DI*) Regressions

| | EI | DI |
|---|---|---|
| *MFFlow* | -9.3129 | -3.5698 |
| | (-3.63) | (-1.65) |
| GS | 0.7558 | 0.5061 |
| | (2.77) | (2.80) |
| ROA | -0.3154 | 0.0287 |
| | (-5.74) | (1.23) |
| *ΔCR* | 1.7689 | -2.1210 |
| | (4.02) | (-9.78) |
| Leverage | 3.0968 | -3.0514 |
| | (2.09) | (-2.52) |
| Log(Age) | -1.2663 | -1.3952 |
| | (-3.73) | (-4.10) |
| Size | -2.5058 | -0.4086 |
| | (-5.72) | (-1.64) |
| Intercept | 23.7588 | 11.1757 |
| | (8.62) | (8.50) |
| | | |
| N | 7,872 | 7,872 |
| $R^2$ | 0.1105 | 0.0512 |

Panel C. Path analysis results for the effects of *MFFlow* on *RD*

| | Coefficient | *T*-stat |
|---|---|---|
| (1) Direct Effect of *MFFlow* on *RD* | | |
| *MFFlow* → *RD* | -4.9980 | (-2.59) |
| | | |
| (2) Indirect Effect of *MFFlow* on RD via Equity Channel | | |
| *MFFlow* → *EI* | -9.3129 | (-3.63) |
| *EI* → *RD* | 0.1688 | (6.97) |
| Equity Path Effect | -1.5720 | |
| | | |
| (2) Indirect Effect of *MFFlow* on RD via Debt Channel | | |
| *MFFlow* → *DI* | -3.5698 | (-1.65) |
| *DI* → *RD* | 0.0352 | (1.75) |
| Debt Path Effect | -0.12566 | |
| | | |
| (3) Total *MFFlow* Effect on *RD* | -6.6957 | |
| % Direct Path | 74.65% | |
| % Equity Path | 23.48% | |
| % Debt Path | 1.88% | |

## Appendix IA-B. Calculation of Residual Income Value-to-Price (*VP*)

Our estimation procedure for *VP* is similar to that of Lee, Myers, and Swaminathan (1999). For each stock in month *t*, we estimate the residual income model (RIM) price, denoted by *V* (*t*). *VP* is the ratio of *V(t)* to the stock price at the end of month *t*. With the assumption of 'clean surplus' accounting, which states that the change in book value of equity equals earnings minus dividends, the intrinsic value of firm stock can be written as the book value plus the discounted value of an infinite sum of expected residual incomes (see Ohlson (1995)),

$$V(t) = B(t) + \sum_{t=1}^{\infty} \frac{E_t[\{ROE(t+i) - r_e(t+i-1)\}B(t+i-1)]}{[1 + r_e(t)]^i},$$

where *Et* is the expectations operator, *B(t)* is the book value of equity at time *t* (negative *B(t)* observations are deleted), *ROE(t + i)* is the return on equity for period *t + i*, and *re(t)* is the firm's annualized cost of equity capital.

For practical purposes, the above infinite sum needs to be replaced by a finite series of $T-1$ periods, plus an estimate of the terminal value beyond period *T*. This terminal value is estimated by viewing the period *T* residual income as a perpetuity. Lee, Myers, and Swaminathan (1999) report that the quality of their *V* (*t*) estimates was not sensitive to the choice of the forecast horizon beyond three years. Of course, residual income *V* (*t*) cannot perfectly capture growth, so our misvaluation proxy *VP* does not perfectly filter out growth effects. However, since *V* reflects forward-looking earnings forecasts, a large portion of the growth effects contained in *BP* should be filtered out of *VP*.

We use a three-period forecast horizon:

$$V(t) = \frac{[f^{ROE}(t+1) - r_e(t)]B(t)}{1 + r_e(t)} + \frac{[f^{ROE}(t+2) - r_e(t)]B(t+1)}{[1 + r_e(t)]^2} + \frac{[f^{ROE}(t+3) - r_e(t)]B(t+2)}{[1 + r_e(t)]^2 r_e(t)},$$

where $f^{ROE}(t + i)$ is the forecasted return on equity for period *t + i*, the length of a period is one year, and where the last term discounts the period *t* + 3 residual income as a perpetuity.[1]

Forecasted ROE's are computed as

$$f^{ROE}(t+i) = \frac{f^{EPS}(t+i)}{\bar{B}(t+i-1)},$$

where $\bar{B}(t+i-1)$ is defined as the average of *B* (*t + i −*1) and *B* (*t + i −*2), and where $f^{EPS}(t+i)$ is the forecasted EPS for period *t + i*. If the EPS forecast for any horizon is not available, it is substituted by the EPS forecast for the previous horizon and compounded at the long-term growth rate (as provided by I/B/E/S). If the long-term growth rate is not available from I/B/E/S, the EPS forecast for the first preceding available horizon is used as a surrogate for $f^{EPS}(t + i)$. We require that each of these $f^{ROE}$'s be less than 1.

Future book values of equity are computed as

$$B(t+i) = B(t+i-1) + (1-k)f^{EPS}(t+i),$$

---

[1] In unreported robustness tests we estimate *V* using a 5-year rather than 3-year forecast period. Many firms have missing EPS forecasts beyond forecast year 3; to preserve sample size, when the 4-year and 5-year EPS forecasts are missing, we use the 3-year EPS forecast multiplied by the long-run growth forecast rate as a proxy. Our results are highly robust, with only slightly reduced magnitude of the effects.

where *k* is the dividend payout ratio determined by

$$k = \frac{D(t)}{EPS(t)},$$

and *D*(*t*) and *EPS*(*t*) are respectively the dividend and EPS for period *t*. Following Lee, Myers, and Swaminathan (1999), if $k < 0$ (owing to negative EPS), we divide dividends by ($0.06 \times$ total assets) to derive an estimate of the payout ratio, i.e., we assume that earnings are on average 6% of total assets. Observations in which the computed *k* is greater than 1 are deleted from the study.

The annualized cost of equity, *re*(*t*), is determined as a firm-specific rate using the CAPM, where the time-*t* beta is estimated using the trailing five years (or, if there is not enough data, at least two years) of monthly return data. The market risk premium assumed in the CAPM is the average annual premium over the risk-free rate for the CRSP value-weighted index over the preceding 30 years. Any estimate of the CAPM cost of capital that is outside the range of 5%-20% is winsorized to lie at the border of the range. The literature shows that the inferences from *V* estimates are not sensitive to the choice of forecast horizon (such as three years) and cost of capital models (Lee, Myers, and Swaminathan 1999), and to whether the discount rate is allowed to vary across firms (D'Mello and Shroff 2000).

There is strong support for *VP* as an indicator of mispricing. It is a stronger return predictor than *BP* (Lee, Myers, and Swaminathan 1999, Frankel and Lee 1998, Ali, Hwang, and Trombley 2003).

The benchmark for fair valuation for *BP* and *VP* is not equal to 1. Book is an historical value that does not reflect growth, and residual income model valuations have been found to be too low on average. We retain negative *V* values caused by low earnings forecasts relative to the cost of equity capital, because such cases should also be informative about overvaluation; negative and low values of *VP* indicate overvaluation and large values of *VP* indicate undervaluation. Similarly, to avoid problems with low or zero book value, and for consistency, we also use a *BP* variable rather than *P/B*. Removing negative *VP* observations (about 6% of the sample) tends to reduce statistical significance levels in our tests without materially altering the results.