# Investment Strategies Based on Accounting-based Valuation Models

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**Abstract**

This paper examines the effectiveness of accounting-based valuation models in making investment decisions. The main purpose of this paper to examine why the findings of Frankel and Lee (1998) (hereafter FL) in the U.S. market cannot be replicated in Japanese market, as reported by Okumura and Yoshida (2000) and Watabe and Kobayashi (2002) (hereafter OY and WK, respectively) .

This study explores three possible explanations of such inconsistency. The three explanations are; 1) alternative valuation model to residual income model is suitable to the Japanese market, 2) the characteristics of firms are different in Japan, and 3) longer holding period may realize profitability from the FL trading strategy in Japan.

The findings of this study are as follows. First, on the aggregate, the residual income model outperforms other variations of accounting-based valuation models. Second, firm size has limited power in improving the investment performance whereas the expected growth rate of residual income can be used to identify which group of firms are suitable for VP strategy rather than BP strategy. Third, extending investment horizon does not improve investment performance.

In conclusion, although the three proposed explanations does not completely explain the inconsistent results between FL and OY/WK, further examination of firm characteristics in finding the answer is warranted. This paper concludes with some proposals to further our understanding.

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# 1 Introduction

This paper examines the effectiveness of accounting-based valuation models in making investment decisions. The main purpose of this paper to examine why the findings of Frankel and Lee (1998) (hereafter FL) in the U.S. market cannot be replicated in Japanese market, as reported by Okumura and Yoshida (2000) and Watabe and Kobayashi (2002) (hereafter OY and WK, respectively) .

This paper was motivated by the findings of two independent studies of replicating FL using Japanese data, and reported somewhat inconsistent results with the findings of FL. OY and WK both reported that investment strategies proposed by FL underperformed the benchmark investment strategy based on a popular book to price (BP) ratio between late 1980's and mid-1990's. On the other hand, FL strategy has been outperforming the benchmark around mid-1990's in Japan. The findings of these two studies are very similar and thus seem to be robust.

This study explores three possible explanations of such inconsistency. The first explanation is that an alternative valuation model is more suitable to the Japanese market. As will be discussed in the next section, residual income model (RIM) is not always the most accurate valuation model among variations of accounting-based models. Alternatives include capitalization model (CM) and combination

model (COMBO). The portfolio performance based on these models are compared to that of RIM in this study.

The second explanation is that certain characteristics of firms is driving the result. The effect of firm size and expected growth rate of residual income is investigated.

The third explanation is that longer investment horizon is required in Japan. Prior studies, including FL, OY, and WK, did not investigate the portfolio performance beyond three years after the their portfolios were formed. This paper extends the portfolio holding period to five years and examine whether the performance of Japanese portfolios 'catches up' that of U.S. peers.

The findings of this study are as follows. First, on the aggregate, the residual income model outperforms other variations of accounting-based valuation models. Second, firm size has limited power in improving the investment performance whereas the expected growth rate of residual income can be used to identify which group of firms are suitable for VP strategy rather than BP strategy. Third, extending investment horizon does not improve investment performance.

The remainder of this paper proceeds as follows. Section 2 reviews previous

studies. Section 3 describes the research design and hypothesis of this study. Section 4 reports empirical results and Section 5 concludes this study.

# 2 Literature Review

Since Ohlson (1995) and Feltham and Ohlson (1995), valuation models that use accounting numbers are drawing attention of both academics and practitioners (Lee 1999). One of the most popular use of accounting-based valuation models is to establish a profitable investment strategy based on the difference between the observed equity prices and theoretical equity prices based on the valuation models(intrinsic values). In FL, their (intrinsic) value to price trading strategy was reported to have outperformed a trading strategy based on the book to price ratio[1].

FL's strategy, however, leaves some rooms for improvement. FL themselves reported that one can improve the investment performance by considering potential errors in analysts' earnings forecasts. Their findings are consistent with the findings in studies that found analysts do not fully incorporate publicly available information into their earnings forecasts (Abarbanell and Bushee 1997, Abar-

[1]Fama and French (1992) found book to price ratio as one of the most relevant to future return of stocks. Since then, trading strategy based on the book to price ratio became a popular benchmark for evaluating investment performance.

banell and Bushee 1998, Lev and Thiagarajan 1993). Sougiannis and Yaekura (2001) documented that accounting fundamentals can explain part of valuation errors of accounting-based models. In addition, FL's and others' analyses were limited to three years investment horizon. How their strategy works in the long-run is not well understood (French 1998).

OY and WK reported that the FL strategy did not outperform book to price strategy in Japan except for the final years in their tests(i.e., around 1995). They did not provide why their results were not consistent with FL's and it still is an open question. This study tries to shed light on the effect of fundamentals to the performance of the portfolio strategies in a longer time horizon.

# 3 Research Design

## 3.1 Valuation Models

This study employs accounting-based valuation models in three different forms: Residual Income Model (RIM), Capitalization Model (CM), and Combination Model (COMBO). These models converge to each other (and toward the dividend discount model and the discounted free cash flow model) as the time horizon approaches infinity. In a finite horizon, however, the models are expected to dif-

fer from the 'true' value of a firm. A good accounting system is expected to minimize the differences by having the 'future' incorporated into current observable accounting figures (Penman 1997, Coopers & Lybrand Academic Advisory Committee 1997).

Following Penman (1997), Penman and Sougiannis (1998), and Sougiannis and Yaekura (2001), this study uses three valuation models derived from the discounted dividend model and the assumption of clean surplus accounting. The models are:

$$RIMModel : P_t^T(RIM) = B_t + \sum_{\tau=1}^{T} \rho^{-\tau} E[\widetilde{X}_{t+\tau}^a] \tag{1}$$

$$CMModel : P_t^T(CM) = (\rho^T - 1)^{-1} E[\sum_{\tau=1}^{T} \widetilde{X}_{t+\tau} + \sum_{\tau=1}^{T} \widetilde{d}_{t+\tau}(\rho^{T-\tau} - 1)] \tag{2}$$

$$COMBOModel : P_t^T(COMBO) = B_t + \sum_{\tau=1}^{T-1} \rho^{-\tau} E[\widetilde{X}_{t+\tau}^a] + \frac{\rho^{-\tau}}{\rho - K_S} E[\widetilde{X}_{t+T}^a] \tag{3}$$

Where:

$P_t^T$ = value of equity at time t, using forecasts for the next T years;

$B_t$ = book value of a firm at time t;

$\widetilde{X}_t$ = earnings forecast for period t;

$\widetilde{X}_t^a$ = forecasted residual income for period t ($= \tilde{X}_t - (\rho - 1)B_{t-1}$)

$\widetilde{d}_t$ = forecasted dividend for period t;

$K_S$ = expected growth rate of market premium over book value[2];

$\rho$ = (one plus) discount rate.

In the finite horizom RIM and CM need terminal values beyond the final year of earnings forecast. If one knows the book value and market value of the equity at T+t, one can algebratically show the theoretical terminal values(TV) can be expressed as;

$$TV(RIM)_t^T = \rho^{-T}[E(\widetilde{P}_{t+T}) - E(\widetilde{B}_{t+T})] \tag{4}$$

$$TV(CM)_t^T = (\rho^T - 1)^{-1}[E(\widetilde{P}_{t+T}) - E(\widetilde{B}_{t+T}) - (P_t - B_t)] \tag{5}$$

.

These theoretical terminal values tell that if RIM and CM are implemented without estimating the terminal values, 1) RIM will work best for firms with small difference between the book value and market values at the terminal year, and 2) CM will work best if such difference is constant between time t and T+t. This translates that if residual income declines in the future, RIM works best and if

[2]Penman (1997) analytically shows that one needs to incorporate appropriate growth term in estimating terminal values in COMBO model. In practice, however, it is often difficult to estimate this growth rate. In this study, following Sougiannis and Yaekura (2001), growth rate of residual income between years $T-1$ and $T$ is used as a proxy of $K_S$. Sougiannis and Yaekura (2001) reported the use of estimated firm- and time-specific growth rate over the use of constant growth rate (e.g., 4%) results in marginally less biased estimate of the value of stocks.

residual income remains constant, CM works best[3].

The above analysis implies that if CM or COMBO estimates Japanese stocks more accurately than RIM, then the inconsistency between FL and OY/WK can be explained as the matter of the choice of valuation model. Therefore this study test the following hypothesis.

Hypothesis 1

*Investment strategies based on CM and/or COMBO outperform investment strategy based on RIM in Japan.*

Sougiannis and Yaekura (2001) reported that the valuation errors of accounting-based valuation models can be partially explained by the fundamental variables such as the firm size and expected growth rate of residual income (Ks in equation (3)). This suggests that difference in fundamentals can explain the poor performance of VP strategy in Japan and leads to the following hypothesis.

Hypothesis 2

*The performance of investment strategies based on VP strategies are dependent on fundamental variables such as firm size and Ks.*

Prior works, including FL, OY, and WK, tested the investment performance for up to 36 months (three years). If it takes longer for Japanese stock market to realize

[3]This analysis cannot be applied to COMBO because the last term in COMBO itself is an estimated terminal value

mispricing and correct it, then extending a time horizon under investigation may find an improved performance of VP strategy. In this study, the time horizon is extended to five years and the following hypothesis is tested.

Hypothesis 3

*The performance of investment strategies based on VP strategies prevail in the fourth anf fifth years after portfolio formation.*

# 4 Empirical Results

## 4.1 Data and Implementation Issues

The sample firms used in this study were drawn from 2000 PACAP-Japan database[4]. The sample firms also satisfy the following criteria. First, monthly stock returns are available for 60 consecutive months (five years) after the fiscal year end in PACAP-Japan. Second, earnings forecasts are available in I/B/E/S international summary database for five years at the fiscal year end[5]. 1,934 firms years from 1988 and 1993 are selected. Descriptive statistics are shown in Table 1. Note Firms whose fiscal year end was March 1993 are included in 1992, resulting few

[4]PACAP-Japan covers firms that are listed in the first section of the Tokyo Stock Exchange.

[5]I used forecasted long term growth rate of earnings in extending forecast horizon. For example, for firms whose earnings forecast is available for only two years but expected earnings growth ($gr$) is available, I obtained third, fourth, and fifth years' earnings forecasts by multiplying the second year's earnings forecast by $gr$, $gr^2$, and $gr^3$, respectively.

firms listed in 1993. Because the monthly returns are available up to December 1998 in 2000 PACAP-Japan, December 1993 is the most recent fiscal year end included in this study. Note this is the exact period when OY and WK found inconsistent result with FL. The reason of observing few firms in 1988 and 1989 is that I/B/E/S started covering Japan in 1988 and it covered limited number of firms in Japan in early years.

This study uses fiscal year ends as the timing of portfolio formation. Most prior studies, including FL, used several months after the fiscal year end to ensure all the necessary financial statement information become available. However, this practice raises concern because firms continue to grow between the fiscal year end and portfolio formation. When computing value to price ratio, this growth will add errors in estimating intrinsic value.

This study uses the analysts' earnings forecasts as of the fiscal year end. The five year forecast as of the fiscal year end includes the expected earnings for the year just ended. One can estimate 'expected' ending book value of equity of the firm by using clean surplus relationship as;

$$EndingBV = BeginningBV + E[NetIncome_t] - DividendPayment. \quad (6)$$

Estimation of intrinsic values used this estimated book value and earnings forecasts for the remaining four years that follow. Therefore, the estimated intrinsic value in this study uses the five years' forecast, the first as a part of book value and the rest as parts of expected residual income.

In applying RIM, no terminal value was estimated. This is because about fifty percent of the firms reported growing estimated residual income in the final year of the analysis. Although the residual income will eventually converge to zero, it is not necessarily reasonable to expect the convergence to occur within short period of time.

Estimating cost of equity capital always is difficult. This study used a fixed rate of six percent per year in estimating intrinsic values[6]. One can of course argue that firm-specific cost of equity should be used. However, as the main focus of this study is to compare the portfolio performance and not to estimate the intrinsic values themselves, the inference from this study will not be seriously affected by the choice of cost of equity.

After estimating the intrinsic values, the sample firms were divided into five

[6]Six percent was chosen as it was the median of ROE during the sample period.

portfolios based on VP(value to price) ratio or BP(book to price). Seemingly overpriced portfolios (low VP or BP) were sold short and seemingly underpriced portfolios (high VP or BP) were held long. VP abnormal return was calculated as the difference between low-VP and high-VP portfolio returns, and BP abnormal return was calculated as such.

## 4.2 Results

Figures 1 through 3 demonstrate performance of VP and BP strategies using three variations of accounting-based valuation models on the aggregate sample. Table 2 summarizes the data and reports statistical significance. It is clear that BP outperforms all three models. Among the three models, RIM offers the best result. It closely follows BP for the first three years, however, BP outperforms VP as the time horizon gets longer.

Table 3 and Figures 4 through 6 report the effect of firm size (as measured by the market capitalization) to the investment performance. The upper half of Table 3 shows values of fundamental variables. Except for VP and BP, the expected return on equity (EROE) and expected growth of earnings (GR) values are evenly distributed. The bottom half of the Table shows the difference of the abnormal returns based on VP strategy and BP strategy for five years. Given the poor overall

performance of CM and COMBO, only the results using RIM is reported. Figures 4 through 6 demonstrates the movement of those returns over the five year horizon.

From Table 3 and Figures 4 through 6, the effect of firm size on the performance of the VP portfolios is not present. The portfolio with the best performance seems to be randomly distributed as each annual return (DIF12, DIF24, and so on in Table 3) has different portfolio as the best performer (Portfolio 5 for DIF12, Portfolio 3 for DIF24, and so on). This result does not support the hypothesis that different firm size is the cause of poor performance of VP portfolio.

Table 4 and Figures 7 through 12 report the effect of the expected growth rate of residual income. The results of using both RIM and CM are reported because the discussion in the previous Section suggests that future behavior of residual income affects the accuracy of the valuation models in a different manner.

The bottom half of the Table 4 shows that RIM works best when residual income is constant (i.e., Ks is close to one) whereas CM works best when residual income grows very fast. The way Ks affects the performance of the portfolios, however, is not consistent with the predictions made in the previous Section. In Section 3, RIM was predicted to work best for firms with declining residual income (i.e., Ks ¡ 1) and CM was predicted to work best for firms with constant

residual income. One possible reason for this inconsistency is the misestimation of residual income by using cost of equity that is too low. Had I used higher cost of equity, Portfolio 3 would have had Ks that is lower than one and Portfolio 5 would have had Ks around one. Nevertheless, the result shows that future growth rate of residual income matters in equity valuation.

Overall, the findings show that simple implementation of the trading strategy on the aggregate sample may not be optimal. Rather, stratifying the sample and applying appropriate strategy (or do nothing) on them seem to improve the performance. Further analysis of the determinant other than size and Ks is warranted and future revisions will take care of them.

# 5 Discussion and Conclusion

This study examined whether the fundamental variables can explain the performance of FL portfolio strategy in Japan. It found that the FL strategy was effective for firms that are large and with low expected earnings growth in Japan.

The findings of this study are as follows. First, on the aggregate, the residual income model outperforms other variations of accounting-based valuation models while being outperformed by BP strategy. Second, firm size has limited power

in improving the investment performance whereas the expected growth rate of residual income can be used to identify which group of firms are suitable for VP strategy rather than BP strategy. Third, extending investment horizon does not improve investment performance.

In conclusion, although the three proposed explanations does not completely explain the inconsistent results between FL and OY/WK, further examination of firm characteristics in finding the answer is warranted. This paper concludes with some proposals to further our understanding.

There are two logical extensions of this study. The first is to examine how other fundamental variables than used in this study affect the portfolio performance. Further revisions of this study will include, price-to-earnings ratio (Penman 1996), and analysts' earnings forecast errors (Brown 1996, Brown and Jeong 1998). Another path is applying similar tests in this study to the U.S. sample, which is under way as part of Sougiannis and Yaekura (2002). These extensions will allow us to better understand the nature of VP trading strategy, which seems to be much more complex than was originally thought.

Another potential extension of this study is to examine whether the market's perception of the particular valuation model is necessary for the valuation model

to work. This hypothesis is consistent with the behavioral finance literature such as herding. Accounting-based valuation models were not well recognized until mid-1990's in Japan and this may be the ultimate cause of the unsuccessful investment performance based on RIM and other accounting-based valuation models.

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Table 1: Descriptive Statistics

| | Pooled | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 |
|---|---|---|---|---|---|---|---|
| obs. | 1934 | 31 | 184 | 583 | 623 | 469 | 44 |
| V/P | 0.48 | 0.33 | 0.43 | 0.36 | 0.53 | 0.57 | 0.55 |
| B/P | 0.46 | 0.3 | 0.41 | 0.34 | 0.51 | 0.57 | 0.55 |
| EROE | 0.07 | 0.07 | 0.08 | 0.07 | 0.07 | 0.05 | 0.05 |
| GR | 1.06 | 1.12 | 1.07 | 1.05 | 1.05 | 1.08 | 1.07 |
| TA | 269028 | 415866 | 375652 | 243396 | 238693 | 304477 | 110972 |
| BV | 66162 | 76111 | 79825 | 59527 | 59998 | 77963 | 51398 |
| MV | 201306 | 289682 | 313385 | 212862 | 180290 | 174813 | 97176 |
| NI | 4038 | 6496 | 5439 | 4012 | 3713 | 3937 | 2441 |

Note:
obs.: Number of observations
V/P: Value-to-Price Ratio
B/P: Book-to-Price Ratio
EROE: Expected ROE for the year
GR: Expected long-term earnings growth
TA: Total asset (in MM yen)
BV: Book value of equity (in MM yen)
MV: Market Value of equity (in MM yen)
NI: Net income for the year (in MM yen)
All numbers are means.

Table 2: Comparison of Valuation Models

| Model | RIM | CM | COMBO |
|---|---|---|---|
| DIF12 | 0.004* | -0.073* | -0.009* |
| DIF24 | -0.001 | -0.145* | -0.039* |
| DIF36 | -0.009* | -0.210* | -0.061* |
| DIF48 | -0.028* | -0.229* | -0.069* |
| DIF60 | -0.018* | -0.194* | -0.063* |

Note:
DIFXX's are the difference of XX months abnormal returns between the V/P portfolio (based on respective models) and B/P portfolio. Positive number means that the V/P return exceeded B/P returns. * means the difference was significant at 5 percent level on two-tailed t-tests.
See Note for Table 1 for the description of other variables.

Table 3: Firm Size and Portfolio Performance

| | 1(small) | 2 | 3(middle) | 4 | 5(large) |
|---|---|---|---|---|---|
| obs. | 383 | 388 | 386 | 388 | 389 |
| V/P | 0.53 | 0.48 | 0.49 | 0.46 | 0.44 |
| B/P | 0.52 | 0.47 | 0.48 | 0.44 | 0.41 |
| EROE | 0.07 | 0.06 | 0.06 | 0.07 | 0.07 |
| GR | 1.07 | 1.06 | 1.06 | 1.06 | 1.06 |
| TA | 48020 | 76100 | 121115 | 171513 | 923095 |
| BV | 12553 | 22596 | 32970 | 50760 | 210694 |
| MV | 34759 | 58726 | 87575 | 147416 | 674101 |
| NI | 653 | 1025 | 1767 | 3068 | 13595 |
| DIF12 | -0.011* | -0.010 | 0.002 | -0.017* | 0.005 |
| DIF24 | 0.002 | -0.009 | 0.003 | -0.006 | -0.015* |
| DIF36 | -0.004 | -0.010 | -0.016* | -0.009 | -0.013 |
| DIF48 | -0.003 | -0.009 | -0.017* | 0.006 | -0.005 |
| DIF60 | -0.060* | -0.035* | -0.021* | -0.003 | -0.012 |

Note:
DIFXX's are the difference of XX months abnormal returns between the V/P portfolio (based on RIM) and B/P portfolio. Positive number means that the V/P return exceeded B/P returns. * means the difference was significant at 5 percent level on two-tailed t-tests.
See Note for Table 1 for the description of other variables.

Table 4: Growth Rate of Residual Income (Ks) and Portfolio Performance

| | 1(low Ks) | 2 | 3(middle) | 4 | 5(high Ks) |
|---|---|---|---|---|---|
| obs. | 383 | 388 | 386 | 388 | 389 |
| Ks | 0.76 | 0.95 | 1.01 | 1.11 | 1.64 |
| V/P | 0.48 | 0.56 | 0.50 | 0.44 | 0.42 |
| B/P | 0.47 | 0.54 | 0.48 | 0.41 | 0.41 |
| EROE | 0.06 | 0.06 | 0.06 | 0.07 | 0.07 |
| GR | 1.09 | 1.06 | 1.05 | 1.05 | 1.07 |
| TA | 324289 | 278365 | 295191 | 175257 | 272874 |
| BV | 66060 | 79543 | 66675 | 52564 | 65968 |
| MV | 178711 | 231412 | 220327 | 171483 | 204394 |
| NI | 3817 | 4474 | 3775 | 3857 | 4260 |
| DIF12 | -0.009* | -0.005 | -0.001 | -0.044* | 0.002 |
| DIF24 | -0.006 | -0.020* | 0.010 | -0.053* | 0.001 |
| DIF36 | -0.017* | -0.045* | 0.010 | -0.067* | -0.013* |
| DIF48 | -0.128* | -0.037* | 0.007 | -0.061* | -0.027* |
| DIF60 | -0.086* | -0.033* | 0.017* | -0.039* | -0.026* |
| CMDIF12 | -0.064* | -0.078* | -0.147* | -0.116* | 0.061* |
| CMDIF24 | -0.131* | -0.175* | -0.168* | -0.192* | 0.029* |
| CMDIF36 | -0.201* | -0.283* | -0.247* | -0.239* | 0.010 |
| CMDIF48 | -0.331* | -0.290* | -0.286* | -0.196* | 0.020* |
| CMDIF60 | -0.274* | -0.264* | -0.273* | -0.138* | 0.044* |

Note:
DIFXX's and CMDIFXX's are the difference of XX months abnormal returns between the V/P portfolio (based on RIM and CM, respectively) and B/P portfolio. Positive number means that the V/P return exceeded B/P returns. * means the difference was significant at 5 percent level on two-tailed t-tests.
See Note for Table 1 for the description of other variables.

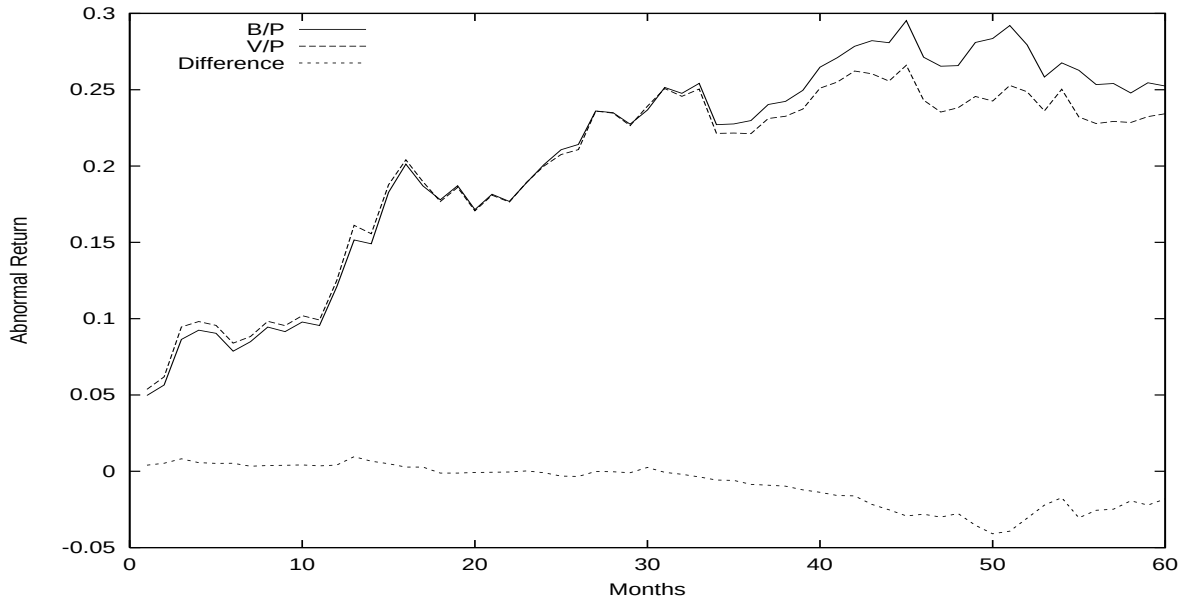


Figure 1: Abnormal Return on RIM: All Firms

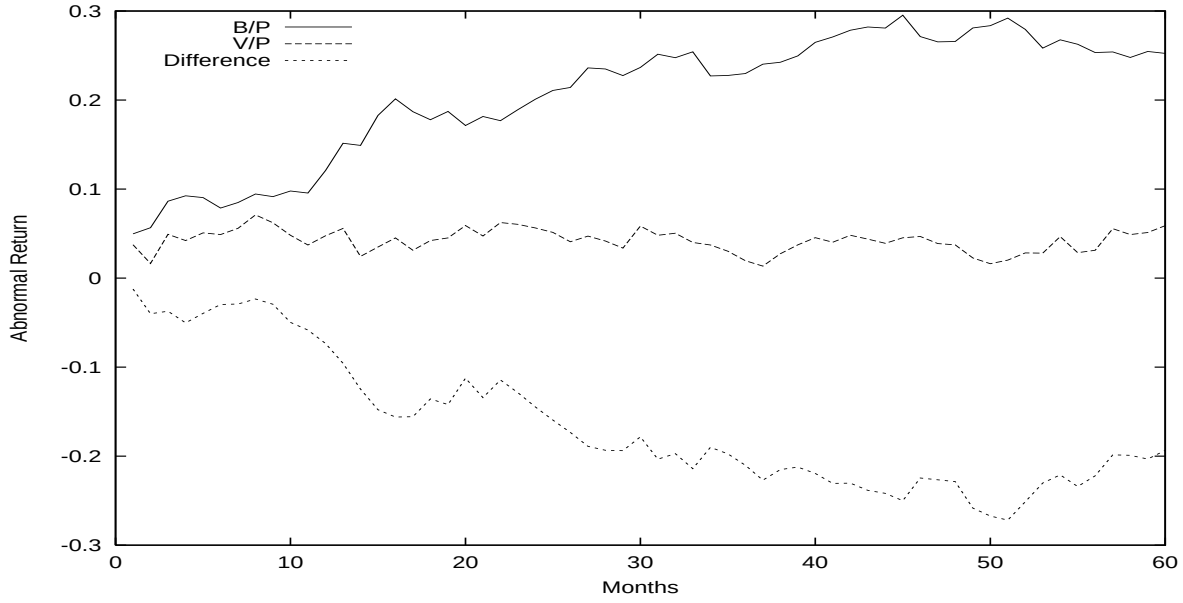


Figure 2: Abnormal Return on CM: All Firms

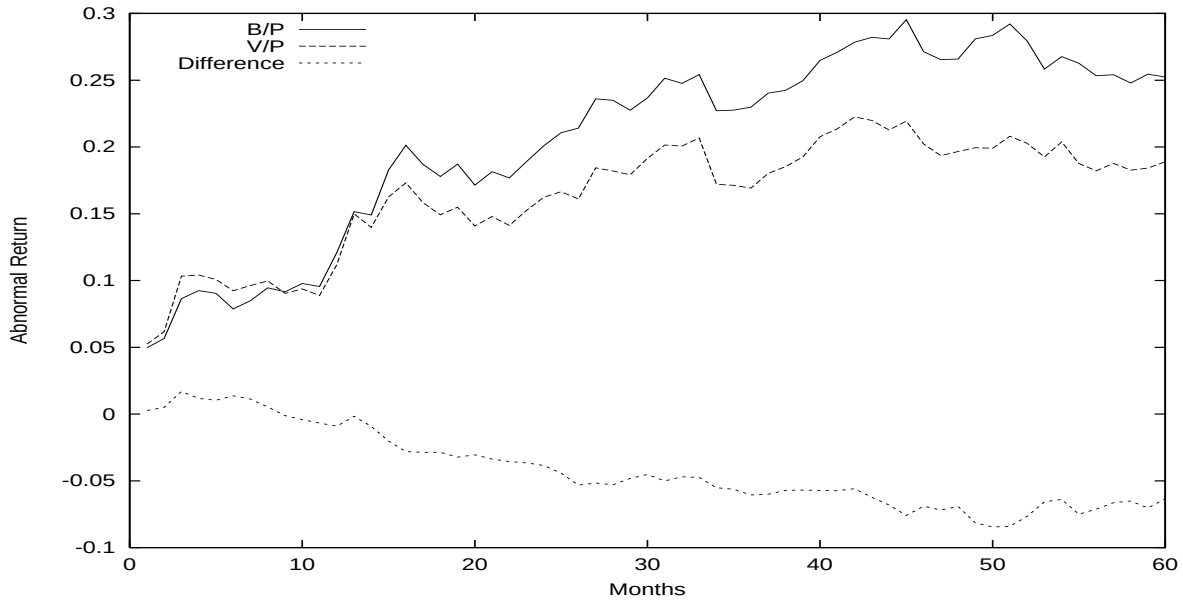


Figure 3: Abnormal Return on COMBO Model: All Firms

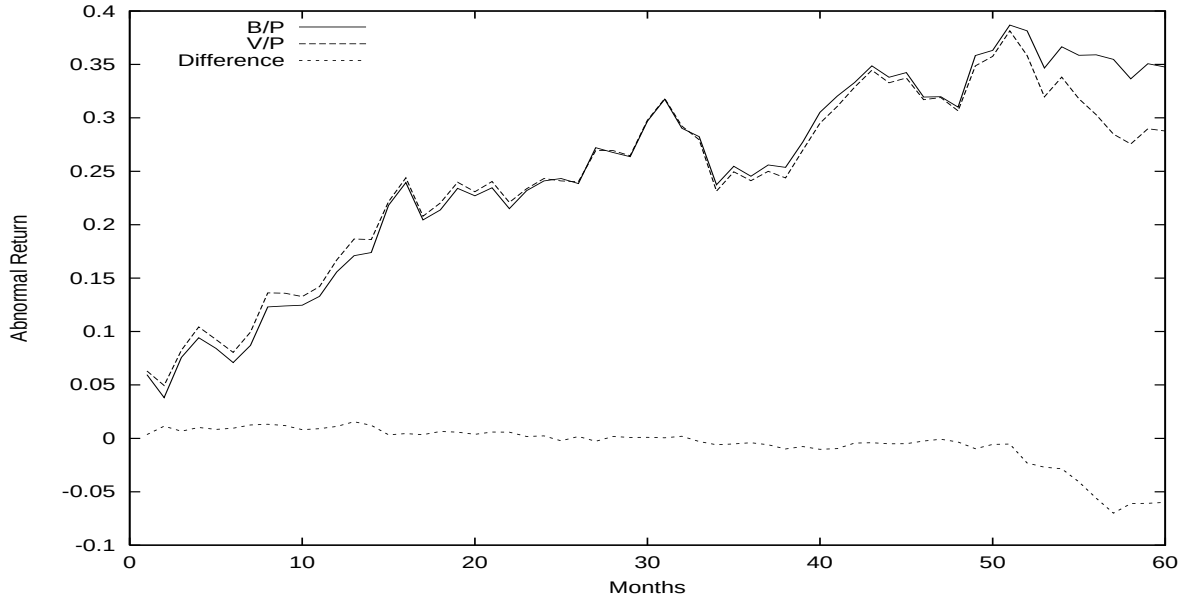


Figure 4: Effect of Firm Size: Small Firms

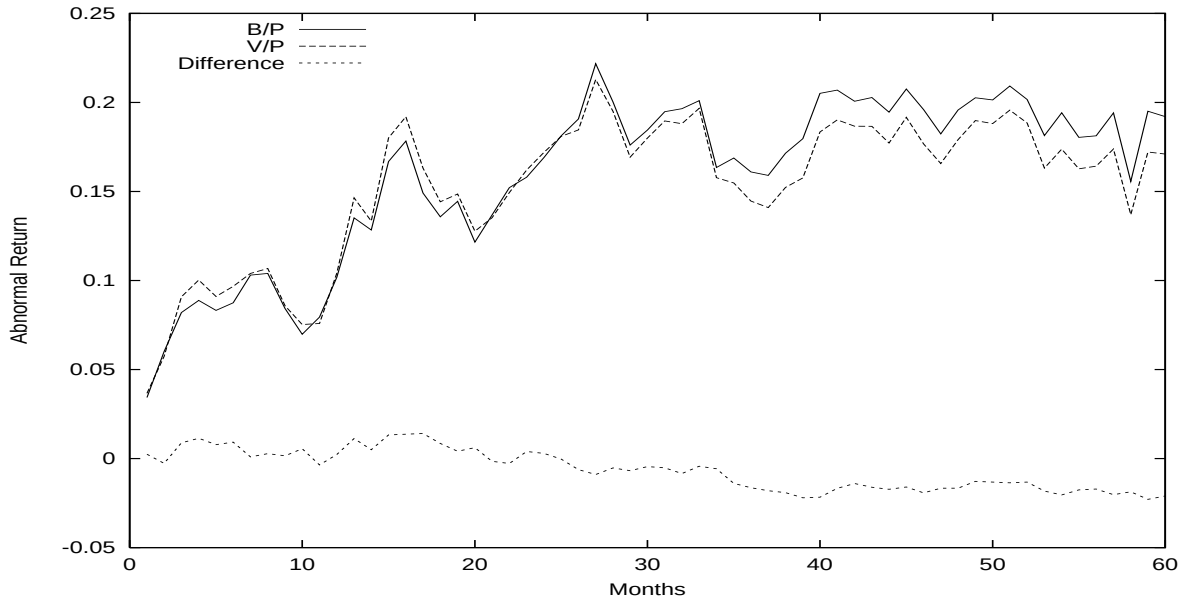


Figure 5: Effect of Firm Size: Mid-sized Firms

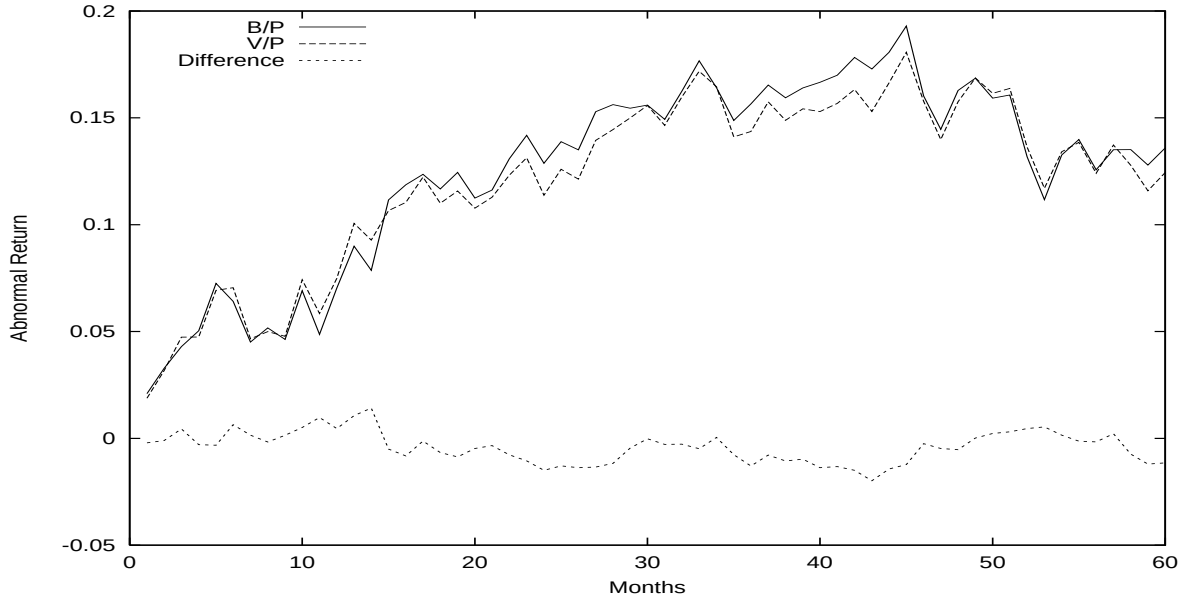


Figure 6: Effect of Firm Size: Large Firms

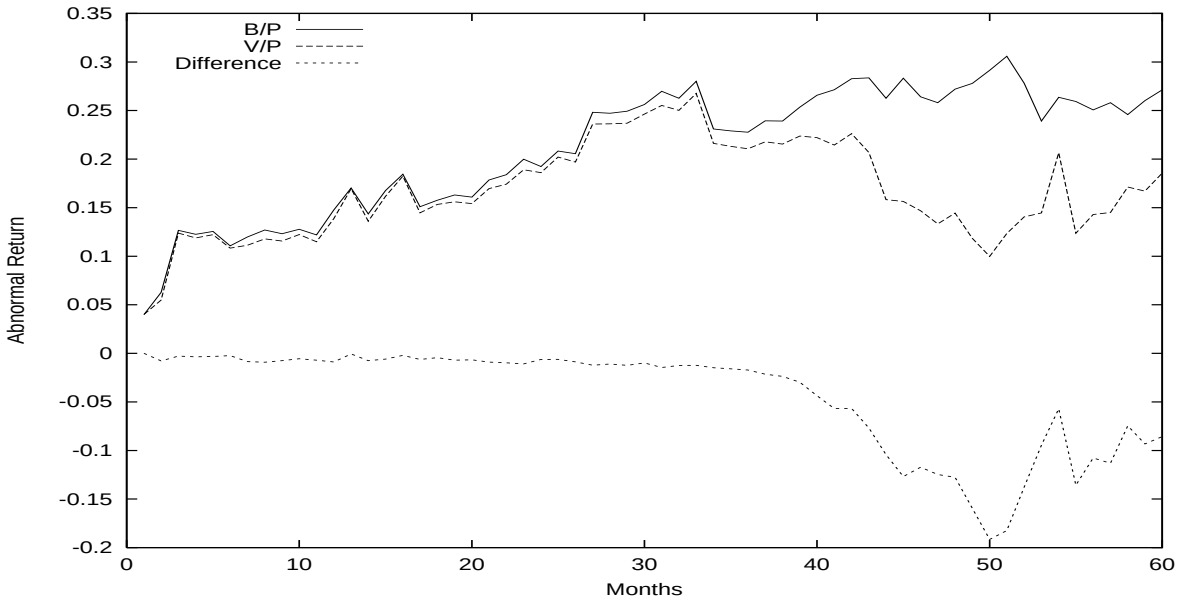


Figure 7: Effect of Residual Income Growth: Low Ks Firms (RIM)

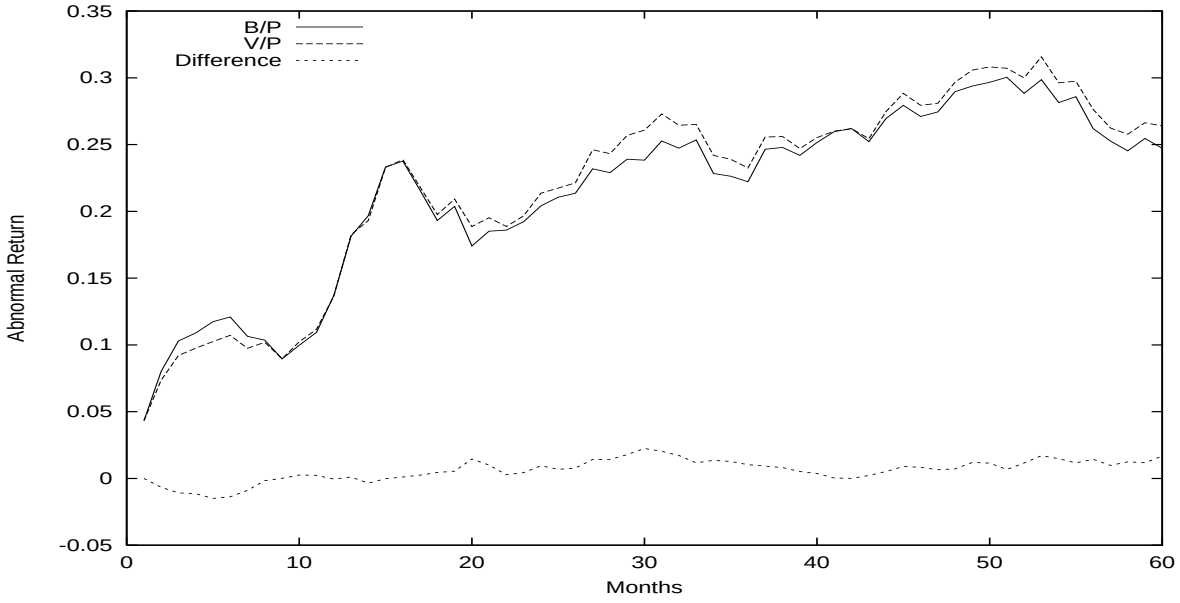


Figure 8: Effect of Residual Income Growth: Middle Ks Firms (RIM)

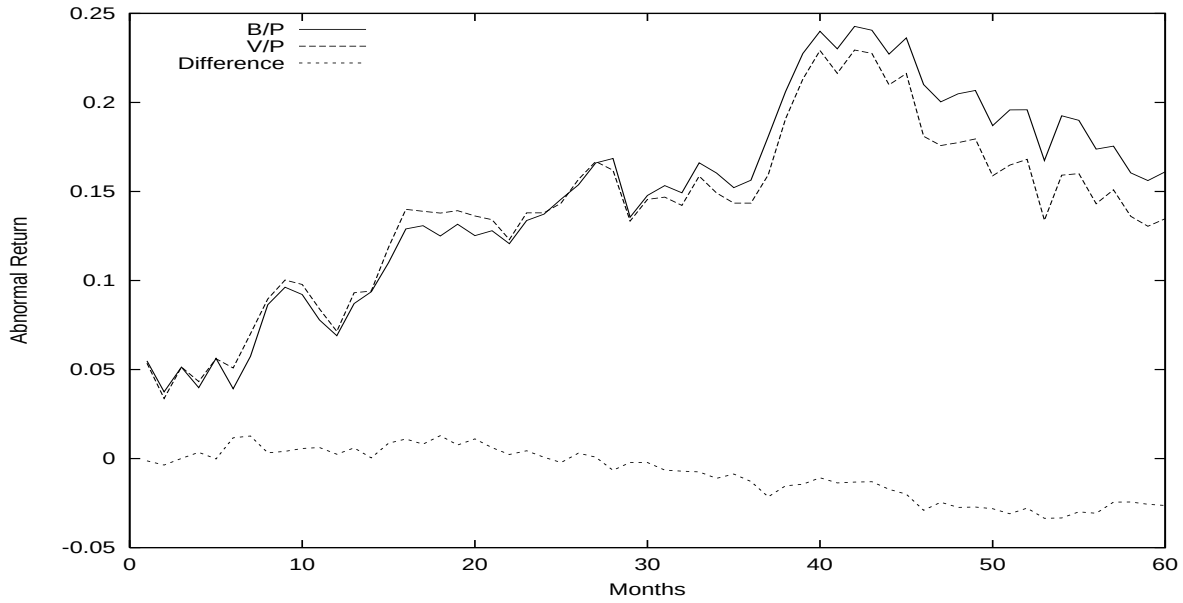


Figure 9: Effect of Residual Income Growth: High Ks Firms (RIM)

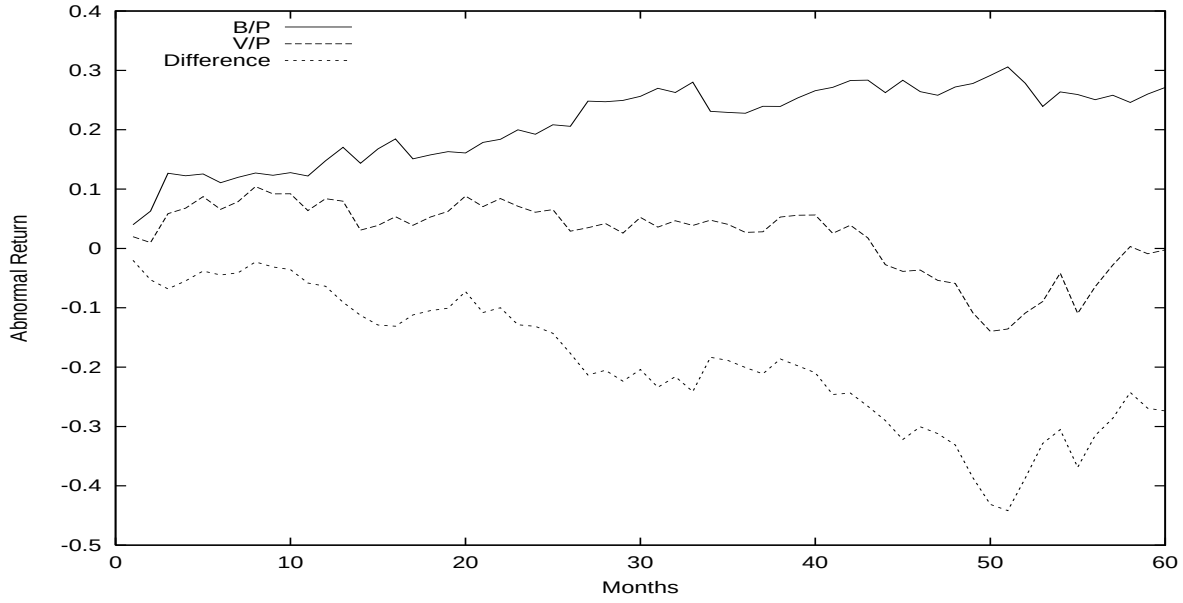


Figure 10: Effect of Residual Income Growth: Low Ks Firms (CM)

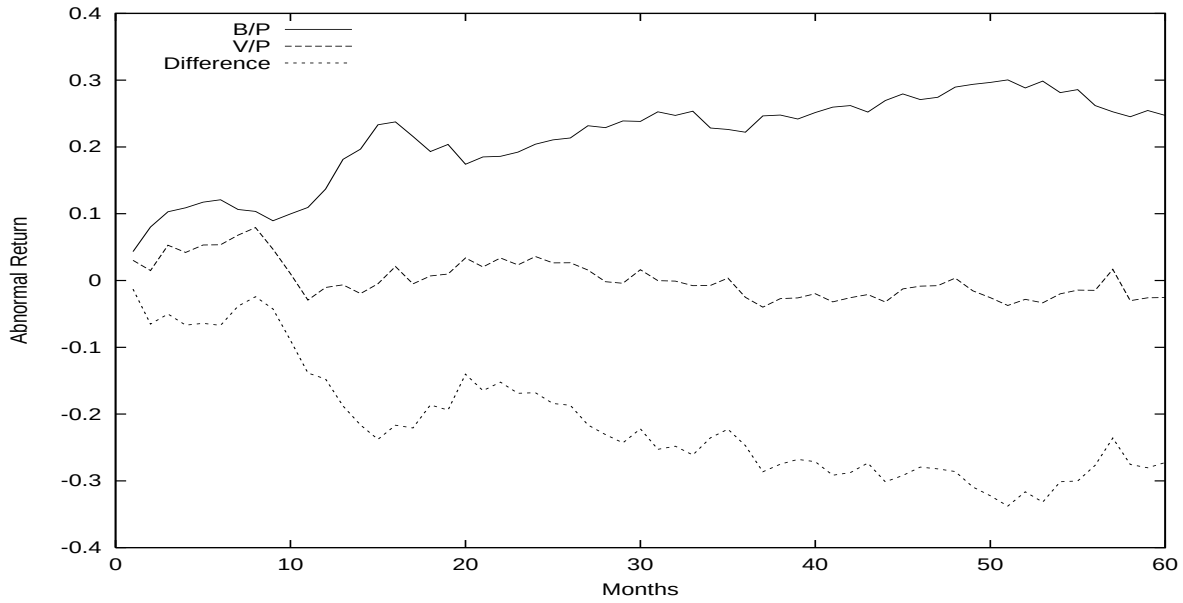


Figure 11: Effect of Residual Income Growth: Middle Ks Firms (CM)

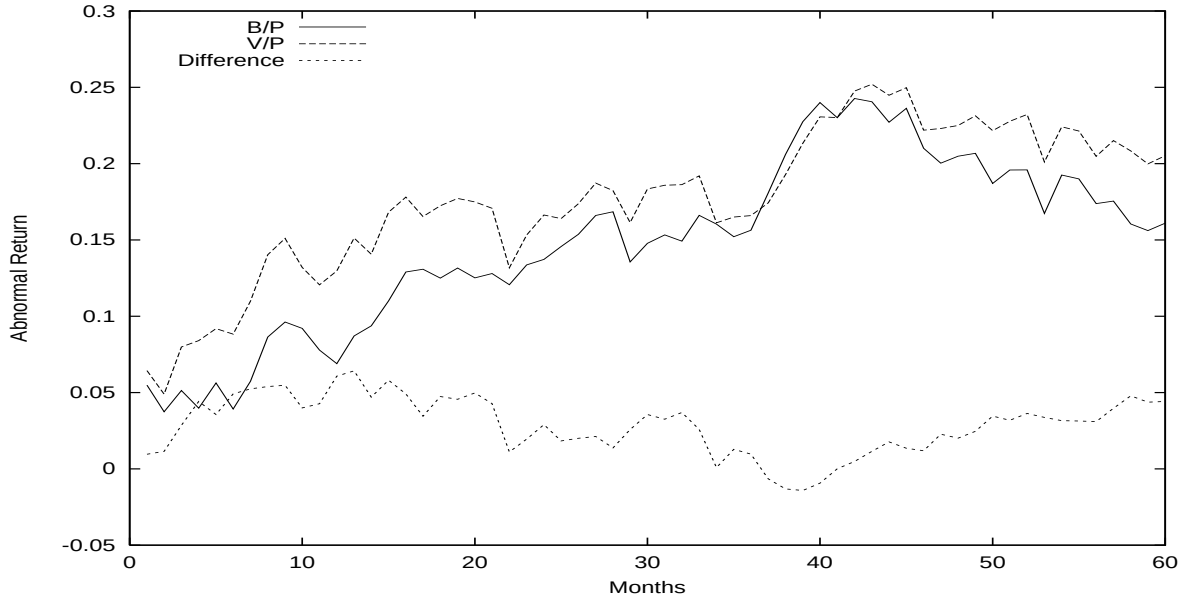


Figure 12: Effect of Residual Income Growth: High Ks Firms (CM)