# Value versus growth: Taiwan evidence

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## Abstract

**Purpose** – The purpose of this paper is to use a stochastic dominance test to examine the relative performance of value vs growth stocks based on multiple value-growth proxies in the Taiwan stock market.

**Design/methodology/approach** – This work examines whether the return distribution of a value portfolio stochastically dominates that of a growth portfolio using a test proposed by Linton *et al.* (2005).

**Findings** – By applying stochastic dominance analysis on the full-sample period, the sub-sample period and the state of the world's economic conditions, the authors find that the earnings-to-price or dividend-to-price ratio is better than the book-to-market ratio as a value-growth proxy in Taiwan. There are robust results even after adjusting for data frequency, a sampling method and sample excluding financial services.

**Originality/value** – This study makes the first attempt to examine value vs growth strategies based on multiple value-growth proxies in the emerging market of Taiwan by administering the stochastic dominance test.

**Keywords** Book-to-market, Dividend-to-price, Earnings-to-price, Stochastic dominance

**Paper type** Research paper

## 1. Introduction

It is well documented in the finance literature that stocks with high valuation ratios of book-to-market (BM), earnings-to-price (EP) or dividend-to-price (DP) yield higher returns than stocks with low corresponding valuation ratios (see Bauman *et al.*, 1998; Chan *et al.*, 1991; Fama and French, 1998, 2006; Abhyankar *et al.*, 2008). The available evidence indicates there has been a great amount of debate between risk-based and behavioral-based models that demonstrate why value stocks outperform growth stocks. Fama and French (1992) argue that the value premium is

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simply a compensation for bearing more risk, but De Bondt and Thaler (1985) argue that value premiums arise from mispricing. Hence, there is the value premium puzzle for developed markets.

Prior studies (Fama and French, 1998; Chen and Zhang, 1998; Chui and Wei, 1998; Ding *et al.*, 2005; Brown *et al.*, 2008) show that value-growth strategies do not produce significant profits for the emerging stock market of Taiwan, and recent studies (Hung *et al.*, 2012; Ko *et al.*, 2014) try to improve this strategy from a different dimension. However, most of them use the BM criterion to define value and growth stocks. This study generalizes several valuation methods to show the presence of a value premium.

Fama and French (1998) argue that the return data in emerging markets are leptokurtic and right skewed, making statistical inference difficult. In this work, we examine whether the distribution of returns to an investment in a value portfolio stochastically dominates an investment in a growth portfolio using a test proposed by Linton *et al.* (2005) (hereafter LMW). Our statistical inferences based on stochastic dominance tests do not depend on any asset pricing model. If the distribution of stock returns is such that all expected utility maximizers prefer value stocks to growth stocks, then the omitted risk factors cannot explain the value effect. In other words, risk compensation is unlikely to be a compelling explanation for the profitability of a value investment strategy (Seyhun, 1993). Furthermore, if value stocks are fundamentally riskier, they must underperform growth stocks during poor worldwide economic conditions[1]. We therefore present the stochastic dominance relations between value and growth stocks during the boom and recession states.

We examine the Taiwan stock market for the following reasons. First, no studies have been reported on Taiwan's stock market using multiple value-growth proxies, especially using the EP or DP ratios, to examine presence of a value premium. Second, this study makes the first attempt to use a stochastic dominance test to examine the value vs growth strategies in Taiwan[2]. Third, the Taiwan market, which has been dominated by electronics manufacturers, provides a setting for examining the value-growth effect, since Gharghori *et al.* (2013) argue that the value-growth effect using the BM criterion for evaluation has been shown to be stronger in smaller concentrated markets, such as Australia[3]. Fourth, the emerging market of Taiwan also provides an interesting setting to examine the argument by Wang and Xu (2004) that investors in the emerging market understand that book equities are inaccurate and therefore, it is difficult to evaluate future cash flows and growth opportunities by comparing a company's book equity with its market equity.

Our study documents some innovative findings. First, our results show that the EP or DP ratio is better than the BM ratio to be a value-growth proxy in Taiwan. The stochastic dominance analyses for the full-sample period and the recent period provide strong support for the high performance of value stocks based on the EP and DP sorting criteria. In addition, our results based on the BM for the full-sample period confirm the widely documented fact that there is no BM effect in Taiwan (Fama and French, 1998; Chen and Zhang, 1998; Chui and Wei, 1998; Brown *et al.*, 2008; Hung *et al.*, 2012). While these results do not support the argument regarding a strong BM effect in a small concentrated market made by Gharghori *et al.* (2013), they support the inaccurate cash-flow argument on book equity forwarded by Wang and Xu (2004).

According to asset pricing models, the boom period results and full-sample period results should be different because of the risk-based predictions. Value stocks should outperform growth stocks during good worldwide economic conditions where the

marginal utility of wealth is low, and the risk-return dispersions between stocks are low. Furthermore, value stocks are expected to be unattractive to risk-averse investors during poor economic conditions. Our results on the boom period are qualitatively similar to the results of the full-sample period. In addition, regardless of the sorting criteria, we find no significant stochastic dominance relation between value and growth stocks during a recession period, which contradicts risk-based predictions.

Using 33 years of Taiwanese data on value and growth stocks, we demonstrate that the EP or DP ratio is better than the BM ratio as a value-growth proxy in Taiwan. The presence of a stochastic dominance relation of value stocks over growth stocks based on EP or DP implies that risk compensation is unlikely to be a compelling explanation for the profitability of value investment strategy in Taiwan. Our results are robust even after adjusting for data frequency, a sampling method and sample excluding financial services.

The rest of this work is organized as follows. Section 2 describes the methodology. Section 3 presents the empirical results. Section 4 indicates the robustness checks. Section 5 concludes this work.

## 2. Methodology

This study uses the LMW test to examine whether value stocks outperform growth stocks based on different value-growth proxies in the Taiwan stock market. LMW uses the idea of the sub-sampling bootstrap procedure to the sampled blocks of data without replacement to account for non-identically and independently distributed features of the data. The appeal of the test is that it deals with the issue in return autocorrelation. Recently, many studies have used the LMW test to examine the IPO effect (Abhyankar *et al.*, 2006), currency carry trades (Fong, 2010) and dim sum bond (Fung *et al.*, 2014). We present the first-order stochastic dominance (FSD) and second-order stochastic dominance (SSD) relations between value and growth portfolios based on the BM, EP, DP ratios.

The stochastic dominance approach compares the cumulative distribution functions of the two candidate portfolios ($A$ and $B$) at all points in the sample. The null hypothesis is that the cumulative distribution function of portfolio $A$ stochastically dominates the cumulative distribution function of portfolio $B$ for the $J$th order of stochastic dominance. The first order of stochastic dominance ($J=1$) invokes the assumption of non-satiation of investors. That is, investors are assumed to prefer more to less. The second order ($J=2$) only assumes that investors are risk averse, which is still general but more restrictive than the first order of stochastic dominance. The hypotheses can be written as:

$$H_0 : D_A^{(J)}(r) \leqslant D_B^{(J)}(r) \quad \text{for all } r \left(\text{i.e. } A \succ_J B\right),$$

$$H_1 : D_A^{(J)}(r) > D_B^{(J)}(r) \quad \text{for some } r \left(\text{i.e. } A \not\succ_J B\right),$$

where $\succ_J$ indicates stochastic dominance at the $J$th order. The test statistic proposed by LMW is:

$$\overline{LMW}^{(J)} = \sup_r \sqrt{n}\left\{\hat{D}_A^{(J)}(r) \leqslant \hat{D}_B^{(J)}(r)\right\}, \tag{1}$$

where the operator $\hat{D}^{(J)}$ can be shown as:

$$\hat{D}_A^{(J)}(r) = \frac{1}{n(J-1)!}\sum_{i=1}^{n}(r-A_i)^{J-1}I(A_i \leqslant r), \tag{2}$$

$$\hat{D}_B^{(J)}(r) = \frac{1}{n(J-1)!}\sum_{i=1}^{n}(r-B_i)^{J-1}I(B_i \leqslant r). \tag{3}$$

Since the sub-sampling approach allows for general dependence and for autocorrelation in the returns, LMW use this approach to compute the empirical $p$-values for testing the hypotheses. The LMW sub-sampling method requires computing $n-b+1$ times the following test statistic for a sub-sample of size $b$ given the data sample:

$$\overline{LMW}_k^{(J)} = \sup_r \sqrt{b}\left\{\hat{D}_{A,k}^{(J)}(r) \leqslant \hat{D}_{B,k}^{(J)}(r)\right\} \quad \text{for } k = 1, .., n-b+1. \tag{4}$$

The empirical $\hat{p}$-values from the sub-sampling can be obtained as follows:

$$\hat{p} = \frac{1}{n-b+1}\sum_{k=1}^{n-b+1} I\left(\overline{LMW}_k^{(J)} - \overline{LMW}^{(J)} > 0\right) \tag{5}$$

We reject the null hypothesis at a significant level if $\hat{p} < \alpha$ (the level of significance).

In this study, we evaluate the performance of value portfolio ($V$) against growth portfolio ($G$) using the LMW stochastic dominance test, which involves testing two null hypotheses regarding the return distribution. We first test whether the distribution of $V$ stochastically dominates the distribution of $G$:$H_0^1 : V \succ G$. Second, we test for the converse hypothesis of whether the distribution of $G$ stochastically dominates the distribution of $V$:$H_0^2 : G \succ V$. If we fail to reject $H_0^1 : V \succ G$ but reject $H_0^2 : G \succ V$, we conclude that the value portfolio stochastically dominates the growth portfolio. However, if we reject or fail to reject both null hypotheses, we conclude that there is no stochastic dominance relation between the two portfolios.

## 3. Data and stochastic dominance results

### *3.1 Data*

We use monthly return data of value and growth portfolios based on the three sorting criteria: BM, EP and DP ratios to examine the relative performance of value vs growth stocks. Value stocks are characterized by high BM, EP and DP ratios. Growth stocks are classified as stocks exhibiting the opposite characteristics from value stocks. All return data of value and growth portfolios constructed in a similar manner as the US Fama-French portfolios are obtained from the *Taiwan Economic Journal* (*TEJ*) multi-factors model. We briefly describe this data set as follows.

The book equity matched to returns over the period from July of the current year ($t$) to June of the following year ($t+1$) is the value for the last fiscal year end in ($t-1$). Each firm's market equity is the price multiplied by shares outstanding at the end of the previous year ($t-1$). The earnings used for the EP sorts in June of year ($t$) are total earnings before extraordinary items for the previous fiscal year end in ($t-1$). The dividend yield that is used to form portfolios in June of the current year ($t$) is defined as the total dividends paid (cash dividends + stock dividends) from July of ($t-1$) year to

June of ($t$) year per dollar of equity in June of ($t$) year. All portfolios are constructed from all of the listed stocks in the Taiwan Stock Exchange and the Gretai Security Exchange. Owing to the availability of the data, the sample period is from January 1982 to May 2014. The value portfolios ($V$) contain firms in the top 30 percent of a ratio, and the growth portfolios ($G$) contain firms in the bottom 30 percent. Additionally, the returns of big value (BV), big growth (BG), small value (SV), small growth (SG) stocks in our stochastic dominance tests are for portfolios constructed from $2 \times 3$ sorts on size and value-growth proxy.

Table I reports the summary statistics of monthly returns for the $V$, $G$, BV, BG, SV and SG portfolios conditional on the different valuation ratios. We find that for the ratios of EP and DP, the value portfolios have larger mean returns than the growth portfolios do. However, the standard deviations of value portfolios are smaller than that of the growth portfolios. As for the ratio of BM, value portfolios have both larger means and standard deviations than those of growth portfolios. For all types of value and growth portfolio, value portfolios have larger Sharpe ratios than those of growth portfolios, implying that value portfolio provide a better risk-return tradeoff. Standard statistical tests also reject the null hypothesis of return normality for all value and growth portfolios.

### *3.2 Results for a full-period sample*

Table II presents the results of the LMW tests for stochastic dominance relations between the value and growth portfolios based on BM, EP and DP over the full-sample

| | Mean (%) | Volatility | Sharpe | JB | |
|---|---|---|---|---|---|
| *BM* | | | | | |
| *V* | 1.634 | 11.982 | 0.472 | 3,610 | (0.000) |
| *G* | 1.467 | 11.345 | 0.448 | 498 | (0.000) |
| BV | 1.630 | 12.102 | 0.467 | 4,410 | (0.000) |
| BG | 1.496 | 11.500 | 0.451 | 583 | (0.000) |
| SV | 1.637 | 12.219 | 0.464 | 153 | (0.000) |
| SG | 1.340 | 11.752 | 0.395 | 212 | (0.000) |
| *EP* | | | | | |
| *V* | 1.416 | 9.777 | 0.502 | 174 | (0.000) |
| *G* | 1.168 | 11.197 | 0.361 | 253 | (0.000) |
| BV | 1.397 | 9.893 | 0.489 | 170 | (0.000) |
| BG | 1.199 | 11.501 | 0.361 | 347 | (0.000) |
| SV | 1.421 | 11.001 | 0.447 | 179 | (0.000) |
| SG | 1.298 | 11.646 | 0.386 | 206 | (0.000) |
| *DP* | | | | | |
| *V* | 1.414 | 8.918 | 0.549 | 854 | (0.000) |
| *G* | 1.256 | 11.170 | 0.390 | 316 | (0.000) |
| BV | 1.402 | 8.929 | 0.544 | 873 | (0.000) |
| BG | 1.285 | 11.284 | 0.394 | 372 | (0.000) |
| SV | 1.794 | 11.195 | 0.555 | 311 | (0.000) |
| SG | 1.526 | 11.808 | 0.448 | 171 | (0.000) |

**Notes:** All returns are in percentage. Sharpe ratios are annualized. JB is the Jacque-Bera statistics for testing the null hypothesis that returns are normally distributed. $p$-values of the Jacque-Bera statistics are in the parenthesis

**Table I.** Summary statistics for monthly returns of value and growth portfolios in Taiwan from January 1982 to May 2014

period. First, we find that there is no FSD or SSD relation between the value and growth portfolio based on the BM criterion for the whole sample, since we reject both of the null hypotheses in FSD, but we cannot reject both null hypotheses in SSD. This result is consistent with the widely documented fact that there is no value premium in Taiwan on the basis of BM (Fama and French, 1998; Chen and Zhang, 1998; Chui and Wei, 1998; Brown *et al.*, 2008; Hung *et al.*, 2012).

Second, the evidence shows that there is a clear FSD (or SSD) relation of value and growth strategies based on EP and DP for the whole sample. Specifically, we fail to reject the null that the value portfolios stochastically dominate the growth portfolios, but reject the alternative that the growth portfolios stochastically dominate the value portfolios.

Four portfolios (BV, BG, SV and SG) are selected to examine the relative performance of the value vs growth strategies, conditional on the size. The test results for the sub-sample controlling for the size effect is similar to those of the full sample. Table II shows that we cannot reject the hypothesis of a value premium based on EP and DP.

### *3.3 Results for a sub-period sample*

The sub-period test results before and after 2000 are shown in panels A and B of Table III. Before 2000, evidence indicates that value portfolios stochastically dominate the growth portfolios only for the DP in the SSD.

After 2000, the test results confirm the existence of a value premium based on EP and DP found earlier. It is worth noting that there is a value discount based on BM, especially for big firms, since we reject the null that the value portfolios are second-order stochastically dominate the growth portfolios, but fail to reject the alternative that the growth portfolios are second-order stochastically dominant regarding the value portfolios. Overall, Tables II and III indicate that the EP or DP ratio is better than the BM ratio as a value-growth proxy in Taiwan over the full-sample period (1982-2014) and the sub-sample period (2000-2014).

### *3.4 Results for different states of the world*

We examine the stochastic dominance relations between value and growth portfolios during the various states of the world defined by the National Bureau of Economic

| | All | | Big | | Small | |
|---|---|---|---|---|---|---|
| | $H_0^1: V \succ G$ | $H_0^2: G \succ V$ | $H_0^1: V \succ G$ | $H_0^2: G \succ V$ | $H_0^1: V \succ G$ | $H_0^2: G \succ V$ |
| *BM* | | | | | | |
| FSD | 0.084* | 0.091* | 0.105 | 0.125 | 0.099* | 0.055* |
| SSD | 0.305 | 0.280 | 0.296 | 0.309 | 0.362 | 0.171 |
| *EP* | | | | | | |
| FSD | 0.590 | 0.054* | 0.726 | 0.137 | 0.549 | 0.132 |
| SSD | 0.985 | 0.021** | 0.925 | 0.035** | 0.514 | 0.097* |
| *DP* | | | | | | |
| FSD | 0.201 | 0.017** | 0.277 | 0.019** | 0.225 | 0.048** |
| SSD | 0.999 | 0.000*** | 0.997 | 0.000*** | 0.876 | 0.089* |

**Table II.** Stochastic dominance tests of value vs growth portfolios for the full-sample period from January 1982 to May 2014

**Notes:** The size of the sub-sample for computing the *p*-values in the simulation analysis is (6, 7, …, 65). *,**,***Significance at the 10, 5 and 1 percent levels, respectively

| | | All | | Big | | Small | |
|---|---|---|---|---|---|---|---|
| | | $H_0^1: V \succ G$ | $H_0^2: G \succ V$ | $H_0^1: V \succ G$ | $H_0^2: G \succ V$ | $H_0^1: V \succ G$ | $H_0^2: G \succ V$ |
| *Panel (A): the earlier period before 2000*[a] | | | | | | | |
| BM | FSD | 0.126 | 0.523 | 0.132 | 0.554 | 0.153 | 0.124 |
| | SSD | 0.506 | 0.332 | 0.522 | 0.307 | 0.373 | 0.593 |
| EP | FSD | 0.304 | 0.315 | 0.526 | 0.390 | 0.566 | 0.287 |
| | SSD | 0.950 | 0.266 | 0.893 | 0.269 | 0.556 | 0.301 |
| DP | FSD | 0.253 | 0.168 | 0.352 | 0.151 | 0.145 | 0.213 |
| | SSD | 0.979 | 0.073* | 0.887 | 0.077* | 0.430 | 0.336 |
| *Panel (B): The recent period after 2000*[b] | | | | | | | |
| BM | FSD | 0.038** | 0.007*** | 0.082* | 0.010*** | 0.461 | 0.162 |
| | SSD | 0.060* | 0.196 | 0.052* | 0.223 | 0.466 | 0.149 |
| EP | FSD | 0.254 | 0.000*** | 0.387 | 0.006*** | 0.463 | 0.128 |
| | SSD | 0.852 | 0.012** | 0.863 | 0.014** | 0.952 | 0.048** |
| DP | FSD | 0.105 | 0.010*** | 0.078* | 0.003*** | 0.800 | 0.035** |
| | SSD | 1.000 | 0.000*** | 1.000 | 0.000*** | 0.593 | 0.075* |

**Notes:** [a]The size of the sub-sample for computing the *p*-values in the simulation analysis is (6, 7, …, 43); [b]the size of the sub-sample for computing the *p*-values in the simulation analysis is (5, 6, …, 36). *,**,*** Significance at the 10, 5 and 1 percent levels, respectively

**Table III.** Stochastic dominance tests of value vs growth portfolios for the sub-sample period

Research (NBER) business cycle reference dates using the approach by Abhyankar *et al.* (2008).

Table IV (panels A and B) shows the stochastic dominance test results of the value and growth portfolios during boom and recession periods. In panel A, the test results of

| | | All | | Big | | Small | |
|---|---|---|---|---|---|---|---|
| | | $H_0^1: V \succ G$ | $H_0^2: G \succ V$ | $H_0^1: V \succ G$ | $H_0^2: G \succ V$ | $H_0^1: V \succ G$ | $H_0^2: G \succ V$ |
| *Panel (A): Boom period*[a] | | | | | | | |
| BM | FSD | 0.059* | 0.018** | 0.063* | 0.023** | 0.093* | 0.032** |
| | SSD | 0.240 | 0.242 | 0.245 | 0.262 | 0.291 | 0.401 |
| EP | FSD | 0.551 | 0.027** | 0.735 | 0.037** | 0.507 | 0.067** |
| | SSD | 0.799 | 0.039** | 0.755 | 0.023** | 0.928 | 0.029** |
| DP | FSD | 0.347 | 0.023** | 0.350 | 0.023** | 0.242 | 0.076* |
| | SSD | 1.000 | 0.009*** | 0.962 | 0.010** | 0.952 | 0.093* |
| *Panel (B): Recession period*[b] | | | | | | | |
| BM | FSD | 0.133 | 0.846 | 0.385 | 0.829 | 0.909 | 0.150 |
| | SSD | 0.639 | 0.543 | 0.585 | 0.550 | 0.714 | 0.152 |
| EP | FSD | 0.300 | 0.556 | 0.333 | 0.147 | 0.143 | 0.854 |
| | SSD | 0.333 | 0.455 | 0.270 | 0.595 | 0.146 | 1.000 |
| DP | FSD | 0.200 | 0.343 | 0.344 | 0.212 | 0.286 | 0.611 |
| | SSD | 1.000 | 0.125 | 1.000 | 0.091* | 0.441 | 0.222 |

**Notes:** [a]The size of the sub-sample for computing the *p*-values in the simulation analysis is (6, 7, …, 59); [b]the size of the sub-sample for computing the *p*-values in the simulation analysis is (4, 5, …, 14). For the whole-sample period (1982/01-2014/05), there are four boom periods (1982/12-1990/07, 1991/04-2001/03, 2001/12-2007/12, and 2009/07-2014/05) and four recession periods (1982/01-1982/11, 1990/08-1991/03, 2001/04-2001/11, and 2008/01-2009/06) based on NBER business cycle reference dates. *,**,***Significance at the 10, 5 and 1 percent levels, respectively

**Table IV.** Stochastic dominance tests of value vs growth portfolios for the boom and recession periods

the boom period are qualitatively similar to the results of the full-sample period. In other words, the value portfolios first-order stochastically dominate the growth portfolios for the EP and DP, but there is no evidence that the value portfolios stochastically dominate the growth portfolios for the BM.

Panel B shows that there is no significant stochastic dominance relation between value and growth portfolios for the recession periods, except for the only case of the big high DP vs big low DP portfolio. There is a weak SSD relation of the big firms with high ratios of DP over the big firms with the corresponding low ratios. The result implies that DP ratio is the superior value-growth proxy for big firms during poor economic conditions.

## 4. Robustness checks

### *4.1 Data frequency*

For a robustness check of the above results, we then examine the stochastic dominance relations between value and growth portfolios for the different frequency of data, including the yearly, quarterly and weekly return data. The data is also obtained from *TEJ*.

Table V shows the result of stochastic dominance tests of value and growth portfolios for different data frequency. The results indicate that there is no stochastic dominance relation between value and growth stocks for the sorting criteria of BM, but there is a clear stochastic dominance relation of value stocks over growth stocks for the sorting criteria of EP and DP, implying that EP or DP ratio is robust and is indeed the superior value-growth proxy over the BM ratio in Taiwan.

### *4.2 Sampling method*

Donald and Hsu (2014) find that their stochastic dominance tests based on the re-centering idea of Hansen (2005) may be more powerful than the sub-sampling test of LMW in some simulation scenarios. To address this issue, we re-examine our results using the approach by Donald and Hsu. Table VI shows the test results of Donald and Hsu (2014) for the full-sample period. They are similar to the corresponding tests in LMW, indicating that our results of the EP or DP strategy are robust across different sampling methods.

| | Yearly | | Quarterly | | Weekly | |
|---|---|---|---|---|---|---|
| | $H_0^1: V \succ G$ | $H_0^2: G \succ V$ | $H_0^1: V \succ G$ | $H_0^2: G \succ V$ | $H_0^1: V \succ G$ | $H_0^2: G \succ V$ |
| *BM* | | | | | | |
| FSD | 0.857 | 0.929 | 0.091* | 0.057* | 0.057* | 0.015** |
| SSD | 0.591 | 0.577 | 0.586 | 0.237 | 0.160 | 0.449 |
| *EP* | | | | | | |
| FSD | 0.360 | 0.115 | 0.488 | 0.305 | 0.556 | 0.079* |
| SSD | 1.000 | 0.000*** | 0.990 | 0.004*** | 0.997 | 0.008*** |
| *DP* | | | | | | |
| FSD | 0.375 | 0.087* | 0.234 | 0.050** | 0.000*** | 0.000*** |
| SSD | 1.000 | 0.036** | 1.000 | 0.000*** | 1.000 | 0.000*** |

**Table V.** Stochastic dominance tests of value vs growth portfolios for the different data frequency

**Notes:** The size of the sub-sample for yearly, quarterly and weekly data are (3, 4, …, 11), (5, 6, …, 30), (10, 11, …, 181), respectively. *,**,***Significance at the 10, 5 and 1 percent levels, respectively

*4.3 Results excluding the financial services*

We examine the stochastic dominance relations between value and growth portfolios excluding the financial services, such as banks, securities, insurance companies. The data is obtained from *TEJ*.

Table VII shows the result of stochastic dominance tests of value and growth portfolios for the sample excluding the financial services. The results indicate that there is no stochastic dominance relation between the value and growth stocks for the BM sorting criterion. However, there is a clear stochastic dominance relation of the value stocks over the growth stocks for the EP or DP sorting criterion.

*4.4 Results for other value-growth proxies*

We use the *TEJ* multi-factors model to obtain three proxies (BM, EP and DP) for value/growth. For the cash-flow-to-price (CFP) and cash-earnings-to-price (CEP) proxies, we construct the value and growth portfolios using the free cash-flow figures from *TEJ* to calculate the CFP ratios, and using the cash-earnings figures obtained from Data Stream to calculate the CEP ratios. Similar to early analysis, the value

| | All | | Big | | Small | |
|---|---|---|---|---|---|---|
| | $H_0^1: V \succ G$ | $H_0^2: G \succ V$ | $H_0^1: V \succ G$ | $H_0^2: G \succ V$ | $H_0^1: V \succ G$ | $H_0^2: G \succ V$ |
| *BM* | | | | | | |
| FSD | 0.085* | 0.030** | 0.085* | 0.060* | 0.165 | 0.120 |
| SSD | 0.305 | 0.320 | 0.330 | 0.435 | 0.310 | 0.130 |
| *EP* | | | | | | |
| FSD | 0.500 | 0.030** | 0.680 | 0.030** | 0.635 | 0.170 |
| SSD | 0.490 | 0.025** | 0.545 | 0.020** | 0.670 | 0.140 |
| *DP* | | | | | | |
| FSD | 0.160 | 0.000*** | 0.170 | 0.000*** | 0.350 | 0.040** |
| SSD | 0.430 | 0.000*** | 0.455 | 0.000*** | 0.580 | 0.090* |

**Note:** *,**,***Significance at the 10, 5 and 1 percent levels, respectively

**Table VI.** Stochastic dominance tests of value vs growth portfolios for the different sampling method

| | All | | Big | | Small | |
|---|---|---|---|---|---|---|
| | $H_0^1: V \succ G$ | $H_0^2: G \succ V$ | $H_0^1: V \succ G$ | $H_0^2: G \succ V$ | $H_0^1: V \succ G$ | $H_0^2: G \succ V$ |
| *BM* | | | | | | |
| FSD | 0.099* | 0.008*** | 0.078* | 0.046** | 0.177 | 0.102 |
| SSD | 0.103 | 0.399 | 0.100 | 0.615 | 0.275 | 0.236 |
| *EP* | | | | | | |
| FSD | 0.151 | 0.032** | 0.216 | 0.011** | 0.375 | 0.234 |
| SSD | 0.991 | 0.000*** | 0.846 | 0.006*** | 0.969 | 0.017** |
| *DP* | | | | | | |
| FSD | 0.016** | 0.006*** | 0.052* | 0.000*** | 0.393 | 0.009*** |
| SSD | 0.910 | 0.000*** | 0.863 | 0.000*** | 0.957 | 0.000*** |

**Notes:** The size of the sub-sample for computing the *p*-values in the simulation analysis is (6, 7, …, 65). *,**,***Significance at the 10, 5 and 1 percent levels, respectively

**Table VII.** Stochastic dominance tests of value vs growth portfolios excluding the financial services

portfolio contains firms in the top 30 percent of CFP or CEP, and the growth portfolio contains firms in the bottom 30 percent. All of the portfolios are formed at the end of each June, and the value-weighted returns are calculated for the following 12 months.

Table VIII reports the results of stochastic dominance tests of value vs growth portfolios, based on the CFP and CEP proxies. The results show that there is no stochastic dominance relation between value stocks and growth stocks for the CFP and CEP ratio sorting criteria over the full-sample period, implying that the CFP (CEP) ratio cannot be used to differentiate the performance between the value and growth portfolios in Taiwan. Our results support the argument forwarded by Wang and Xu (2004) that investors in the emerging market fully realize the inaccurate report of the book values. Hence, the cash_flow and cash-earnings (i.e. funds from operations) figures are derived after several interpretations of the balance sheet and income statements, and they are more likely subject to confounding errors. Therefore, these sorting criteria are not useful to differentiate between different performances by value and growth stocks.

## 5. Conclusions

This work examines the extent of value premium based on several different value-growth measures that are used to define value stocks and growth stocks under the perspective of stochastic dominance. Our study period covers monthly data from January 1982 to May 2014.

Using 33 years of Taiwanese data on value and growth stocks, we find that the EP or DP ratio is better than the BM ratio as a value-growth proxy in Taiwan. There is a clear stochastic dominance relation of value stocks over growth stocks for the EP and DP sorting criteria over the full-sample period (1982-2014) and the sub-sample period (2000-2014). Our test results of the boom period are qualitatively similar to the results of the full-sample period. Regardless of the sorting criteria, we find no significant stochastic dominance relation between value and growth stocks during a recession period, except for the only case of the big high DP vs big low DP portfolio.

Overall, the presence of stochastic dominance relation of value stocks over growth stocks based on EP or DP implies that risk compensation is unlikely to be a compelling rationale behind the profitability of value investment strategy in Taiwan. Our results are robust even after adjusting for data frequency, a sampling method and a sample excluding financial services. The value premium is likely to reflect the missing behavioral components from investors.

Our results have important implications for investors in the Taiwanese stock market. As the EP or DP ratio is a superior value-growth proxy, it is important to apply

**Table VIII.** Stochastic dominance tests of value vs growth portfolios based on the cash-flow-to-price (CFP) and cash-earnings-to-price (CEP) proxies

| | $H_0^1 : V \succ G$ | $H_0^2 : G \succ V$ |
|---|---|---|
| *CFP* | | |
| FSD | 0.533 | 0.270 |
| SSD | 0.763 | 0.449 |
| *CEP* | | |
| FSD | 0.230 | 0.512 |
| SSD | 0.662 | 0.551 |

**Note:** The size of the sub-sample for computing the $p$-values in the simulation analysis is (6, 7, …, 54)

this useful information for future stock selection and asset allocation to earn higher returns in the Taiwanese stock market. International investors may also want to consider the performance of EP and DP ratios in making portfolio choices by including Taiwanese listed companies.

## Notes

1. Zhang (2005) argues that risk/return dispersions between stocks are lower in good times, and Petkova and Zhang (2005) argue that the value stocks are riskier than the growth stocks in bad times. However, Lakonishok *et al.* (1994) argue that if value stocks are fundamentally riskier than growth stocks, value stocks will be expected to underperform growth stocks in bad states where the marginal utility of wealth is high, and therefore value stocks will be unattractive to risk-averse investors.
2. The stochastic dominance approach has been used in the context of value/growth in the early literature (see Best *et al.*, 2000; Chou and Liao, 1996), but the earlier stochastic dominance rules in general do not account for statistical significance.
3. The Taiwan stock market is highly concentrated. The percentage for the number of electronic manufacturers in Taiwan is more than 50 percent. In addition, as of April 2014, the percentage of the market value for electronics manufacturers is also more than 50 percent. Thus, Taiwan is an interesting concentrated market for value-growth analysis.

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