Equity Duration Puzzle and Investor's Demand : Evidence from Korea

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Purpose, Contribution

- **Purpose**
  - examine the equity price sensitivity to the interest rate in the Korea Market
- **Contribution**
  - contributes to the literature by empirically investigating the sensitivity of stock prices to changes in interest rates and provides plausible explanation of the equity duration puzzle i.e., the longer equity duration with the higher dividend stocks
  - reinforce the validity of equity duration puzzle in the global context, since Korean market's characteristics and the dividend policy is different from that in the U.S. market.
  - cast an interesting future insight concerning the investors' behavior across long-term bonds and high dividend stocks

Literature review

1) Equity Duration

- **Weinstein (1981), Leibowitz (1986), Elyasiani and Mansur(1998), Cornell(1999), and Kang, Nam, Han(2013))** : The early literature attempted to extend the concept of bond duration to equities/ Take note of the importance of the equity duration on the aspect of the element of stock portfolio management

2) **The potential determinants of the equity duration**

Gould and Sorensen (1986): using the dividend discount model, high growth stocks are more sensitive to interest rates than low growth stocks.

Tessaromatis(2003): Government regulation, cyclicality of future cash flows and equity style (growth vs. value of stocks) can explain the differences in the equity duration

Literature review

2) The potential determinants of the equity duration

-Jiang and Sun(2015) : explore the duration of equity stocks on the level of the dividend yield. Find that stocks that pay higher dividends tend to have longer duration

3) The investor's demand and the dividend yields

-Cready(1994) : Institutional investors tend to opt for the stocks of larger firms, S&P 500firms, and firms paying low dividend yields compared to individual investors.

Literature review

- **Jain(2007)** :Individual investors prefer to invest in high dividend yield stocks whereas lower-taxed institutional investors are inclined to low dividend yield stocks

4) The investor's demand and the dividend yields

- **Park and Kim(2010)** :stocks with higher dividend yield earn higher risk-adjusted returns for five portfolios ranked by the long-term dividend yield.

- **Kim(2009), and Kim(2013)** : the investment performance of high dividend portfolio shows superior management achievements in down markets.

Main Findings

- The equity duration is longer as the dividend yield of stocks increases except the period affected by the Global financial crisis, which is known as "Equity Duration Puzzle."

- This phenomenon persist for the 30 chaebol group companies as well.

- The equity duration of stocks that pays high dividends statistically decreases as interest rate decline slows.

Main Findings

- the equity duration puzzle exists even after controlling for the distance to default and the cash flow volatility, implying that these factors cannot explain the puzzle.
- the investor's demand shift for high dividend stocks is observed when the interest rate decrease.
- The increase of money flow leads to the increase the excess returns of the high dividend stocks.

Data

- uses KOSPI data from Fn-Guide
- Study period : From May 1995 to December 2015

  on total 248months.
- (stock returns, price of KOSPI, the monthly net purchase amount of each stock for institutional investors and individuals groups as well accounting data such as EPS, BPS.
- collect macroeconomic data such as monthly 1 year and 5 year interest rates from Economic Statistics System.
- collect daily 5 year interest rates from Korean Statistical Information Service.

-exclude KOSPI with zero dividend and below ninety-ninth percentiles.

Hypothesis / Methodology

<Hypothesis 1>

H_0: The stocks with higher dividend yields have a shorter duration.

$$R_{i,t} - R_{f,t} = \alpha + Duration(-\Delta Interest_t) + \beta_1 \times (R_{m,t} - R_{f,t}) + \beta_2 \times SMB$$
$$+\beta_3 \times HML + \beta_4 \times \mathrm{MOM} + \epsilon_{i,t}$$

-Hao and Zheng(2015) methodology

Ri,t : the return on the asset *i* in month t

Rf,t : the interest rate on 1-month Treasury Bill in month *t*

Interest : the change in long-term interest rates on 5-year Treasury Bill in month *t*.

SMB, HML : firm size, the book-to-market ratio (the Fama and French(1993) model)

MOM : the momentum (the Jegadeesh and Titman(1993))

Hypothesis / Methodology

<Hypothesis 2>

H0: The probability of default given by the distance to default model can fully explain the equity duration puzzle.

$$naive\ DD = \frac{ln\left[\frac{(E + naive\ D)}{naive\ D}\right] + (r_{it-1} - 0.5 \times naive\sigma_V^2) \times T}{naive\,\sigma_V \times \sqrt{T}}$$

$$naive\ \sigma_v = \frac{E}{E + naive\ D}\sigma_E + \frac{naive\ D}{E + naive\ D}(0.05 + 0.25 \times \sigma_E)$$

E : the market value of the firm's equity
σE : The volatility of equity value
naïve D : the market value of each firm's debt constructed by Bharath and Shumway(2008)

Hypothesis/Methodology

<Hypothesis 3>

H0: The equity duration puzzle is due to stocks' lower cash flow volatility.

- The idiosyncratic volatility is calculated as the standard deviation of the residuals from the traditional CAPM regression with daily stocks every month.

- Double-sort stocks into four quartile portfolios based on the monthly rebalanced firm's dividend to price ratios and idiosyncratic volatilities rebalanced.
- Sixteen portfolios emerged

Hypothesis / Methodology

<Hypothesis 4>

H0: The level of interest rate affects the investor demand of high dividend stocks.

$$NP_{i,t} = \alpha + \beta_1 \times DY_{i,t} + \beta_2 \times DY_{i,t} \times Interest_t + \beta_3 \times Size_{i,t} + \beta_4 \times Profit_{i,t}$$
$$+\beta_5 \times r_{i,t-1} + \beta_6 \times Kospi200_{\,i,t}$$

NP : the logarithm of the net purchase of amounts of stock *i* in month *t*
DY : the dividend to price ratio of stock *i* in month *t*
Interest : the level of 5 year interest rates
Size : the logarithm of the book value per share
Profit : the logarithm of the earning per share
r : the return of stock *i* in month *t-1*
KOSPI200 : the membership in the KOSPI200

- Examine how different types of institutional and individual investors prefer high dividend stocks according to the level of the interest rates? (Cready(1994), Jain(2007))

Hypothesis / Methodology

<Hypothesis 5>

H0: The increase in the investor demand of the high dividend stocks leads to the increase in the excess returns in the decline of interest.

$$r_{i,t} - r_{f,t} = \alpha + \beta_1 \times NP_{i,t} + \beta_2 \times DY_{i,t} + \beta_3 \times DY_{i,t} \times Interest_t + \beta_4 \times NP_{i,t} \times Interest_t + \beta_5 \times DY_{i,t} \times Low\ Interest_t + \beta_6 \times NP_{i,t} \times Low\ Interest_t$$

$$+\beta_7 \times r_{i,t-1} + \beta_8 \times NP_{i,t-1}$$

Low Interest : the dummy variable which is 1 if the interest rate is in 4th quartile over the total study period.

Duration Estimates for Different Periods

	Low Dividends			High Dividends
Duration(Period A: 199505-199809)				
Model¹	0.3295***	0.3756***	0.3652***	0.5143***
	(5.92)	(7.54)	(8.76)	(12.2)
Model²	0.1804**	0. 2215 ***	0. 1976***	0.2937***
	(2.04)	(3.7)	(3.95)	(4.4)
Duration(Period B: 199810-200411)				
Model¹	0.1978***	0.2494***	0.2431***	0.2738***
	(5.46)	(8.1)	(8.12)	(9.97)
Model²	0.0255	0.0751**	0.0534*	0.1143***
	(0.66)	(2.31)	(1.7)	(3.96)
Duration(Period C: 200412-200809)				
Model¹	-0.2508***	-0.2874***	-0.3331***	-0.3589***
	(-5.18)	(-7.4)	(-9.19)	(-9.29)
Model²	0.0059	0.0646	-0.0807**	-0.0833**
	(-0.11)	(-1.52)	(-2.05)	(-1.99)
Duration(Period D: 200810-201512)				
Model¹	0.0226	0.0373*	0.0297	0.0691***
	(0.85)	(1.72)	(1.48)	(3.77)
Model²	0.0295	0.0418*	0.0306	0.06463 ***
	(1.11)	(1.95)	(1.54)	(3.59)
Duration(All Period)				
Model¹	0.0205	0.0387*	0.0353*	0.0643***
	(0.77)	(1.77)	(1.74)	(3.56)
Model²	0.0276	0.0441**	0.0352 *	0.0597 ***
	(1.04)	(2.04)	(1.76)	(3.36)

-The sample period :

the rise(Period A, C) and decline(Period B, D) of interest rate conditions.

- In the overall period except period C, the equity duration is longer as the dividend yield increases

(statistically positive)

- About period C,

although the change in interest rates increases, the excess return of the high dividend stocks also increases compared to the low dividends

Duration Estimates for the 30 Chaebol Companies

	Low Dividends			High Dividends
Duration(Period: 200810-201512)				
Model¹	-0.0267	-0.0398	0.1416**	0.2112***
	(-0.41)	(-0.57)	(2.48)	(3.23)
Model²	-0.0346	-0.0427	0.1465**	0.2138***
	(-0.53)	(-0.61)	(2.55)	(3.21)

- About period C,

the stock investor's behavior in the poor economic situation.

In the crisis of the stock markets, there seemed to exist the investor's desire which they were likely to select a safer asset in that period

(flight to quality, Lee and Jang(2015))

Distance to Default and Equity duration

- The stocks with high dividend yields keep on having the longer duration in the all groups

CAN NOT BE EXPLAINED

	Distance to Default (DD)			
	Low DD	3	2	High DD
Low Dividends	0.15217***	0.15087***	0.12163***	0.16791***
	(5.82)	(6.45)	(5.01)	(6.02)
3	0.08838**	0.05110**	0.11877***	0.10652***
	(2.36)	(1.97)	(4.76)	(3.51)
2	0.21532***	0.16479***	0.13314***	0.09108***
	(9.19)	(6.36)	(4.39)	(2.90)
High Dividends	0.27455***	0.23232***	0.14928***	0.27721***
	(12.73)	(7.88)	(4.30)	(8.18)

The Cash Flow Volatility and Equity duration

- The stocks with high dividends continue to have LONG duration

in the the lowest and 2th low IV portfolios.

CAN NOT BE EXPLAINED

	Idiosyncratic Volatility (IV)			
	Low IV			High IV
Low Dividends	0.2138***	0.1091**	0.1847***	0.1962***
	(8.45)	(2.41)	(4.69)	(6.83)
	0.2893***	0.1214***	0.0982***	0.0647***
	(22.22)	(3.47)	(3.64)	(2.62)
	0.1855***	0.1132***	0.0391*	0.0975***
	(8.95)	(2.58)	(1.72)	(5.10)
High Dividends	0.3330***	0.1743***	0.1468***	0.1273***
	(42.37)	(3.32)	(6.44)	(8.19)

Valuation Spread Between High and Low Dividend Stocks

	$Model^1$	$Model^2$
5 Year Treasury Bond Yield	-0.7885***	-0.5889***
	(-5.80)	(-3.77)
Stock Vol		-224.7851***
		(-4.78)
Bond Vol		1.46232*
		(1.84)
Intercept	10.022***	15.6774***
	(10.42)	(10.57)
Adj R^2	0.117	0.188

- the relative valuation spread between high and low dividend stocks on the 5 year treasury bond yield.
- negative and statistically significant at 1% level.
- the spread between price of the high dividend stocks and the low dividend stocks goes larger as the interest rate decreases.

Different Types of investors' Preference for High Dividend Stocks

	Security Companies		*Insurance Companies*		*Mutual Funds*	
D/P	-0.2082***	-0.1646***	-0.1933***	-0.1589***	-0.1681***	-0.1559***
	(-8.89)	(-6.97)	(-8.04)	(-6.52)	(-6.29)	(-5.73)
*D/P*Interest*		-0.6096***		-0.4821***		-0.1704**
		(-9.61)		(-7.38)		(-2.33)
BPS	0.2919***	0.2701***	0.2327***	0.2155***	0.2175***	0.2115***
	(6.44)	(6.01)	(5.00)	(4.65)	(4.20)	(4.08)
EPS	0.0955***	0.1027***	0.2127***	0.2183***	0.223***	0.225***
	(4.17)	(4.52)	(9.03)	(9.32)	(8.51)	(8.59)
P_return	-0.001	-0.0043	-0.0124	-0.0154	0.0029	0.0017
	(-0.02)	(-0.22)	(-0.61)	(-0.76)	(0.13)	(0.08)
Kospi200	5.9516***	5.9634***	5.9200***	5.9294***	6.2889***	6.2922***
	(49.23)	(49.80)	(47.70)	(48.04)	(45.55)	(45.59)
Adj R^2	0.391	0.402	0.3888	0.3956	0.362	0.363

	Banks		*Pension Funds*		*Individuals*	
D/P	-0.104***	-0.0807***	-0.2272***	-0.1966***	-0.1058***	-0.0763***
	(-4.35)	(-3.32)	(-8.49)	(-7.23)	(-6.92)	(-4.95)
*D/P*Interest*		-0.3265***		-0.429***		-0.4129***
		(-5.01)		(-5.88)		(-9.98)
BPS	0.312***	0.3004***	0.2651***	0.2498***	-0.294***	-0.3088***
	(6.75)	(6.50)	(5.12)	(4.83)	(-9.94)	(-10.54)
EPS	0.0471**	0.0509**	0.2115***	0.2165***	0.1017***	0.1065***
	(2.01)	(2.18)	(8.07)	(8.28)	(6.79)	(7.18)
P_return	-0.0429**	-0.0449**	-0.0025	-0.0051	0.0163	0.0137
	(-2.13)	(-2.23)	(-0.11)	(-0.23)	(1.26)	(1.07)
Kospi200	3.1071***	3.1135***	5.4343***	5.4426***	2.9278***	2.9358***
	(25.17)	(25.28)	(39.32)	(39.52)	(37.11)	(37.59)
Adj R^2	0.1563	0.1605	0.3114	0.3163	0.2527	0.268

- D/P : statistically negative

the institutional and individual investors avoid high dividend stocks.

: consistent with Cready(1994), Jain(2007)

(relative to individual investors, institutional investors prefer the firms paying low dividend yields)

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- D/P* Interest : statistically negative

  : switch more their money into high dividend stocks as the interest rate decreases

- BPS, EPS, and the KOSPI200 membership AS the important factors when select stocks (Lee 2014)

-no related :the past excess return of stocks

Dividend Yield and Competition among stocks

	(1)	(2)	(3)High Div	(4)50%	(5)25%
DY	0.0272***		0.0006		
	(4.77)		(0.36)		
NP	0.1773***		0.0032		
	(20.96)		(0.37)		
DY*Interest		-0.0052***	-0.0111***		
		(-5.38)	(-5.20)		
NP*Interest		0.0123***	0.0064***		
		(10.18)	(3.28)		
DY*Low Interest				0.016*	0.0608***
				(1.70)	(3.89)
NP*Low Interest				0.01094***	0.01093***
				(9.25)	(9.24)
P_NP	-0.1366***	-0.0321***	0.0258***	-0.03***	-0.0298***
	(-16.27)	(-4.87)	(7.86)	(-4.49)	(-4.53)
P_Return	0.0648***	0.0633***	0.0614***	0.0633***	0.0633***
	(14.45)	(14.06)	(13.05)	(14.04)	(14.05)
Intercept	-0.0337	0.4998***	0.0784	0.5075***	0.5628***
	(-0.30)	(4.14)	(0.67)	(4.20)	(4.62)
# of Obs	49446	49446	11323	49446	49446
Adj R^2	0.1123	0.1062	0.1099	0.1058	0.1060

-NP/ NP*Interest/NP*Low Interest: statistically POSITIVE

: Increase in the net purchase amount of stocks would statistically increase the excess return of stocks

-DY : statistically POSITIVE

-DY*Interest: statistically NEGATIVE

-DY*Low Interest : POSTIVE

: between the dividend yield and the excess return for the low interest rates.