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THE EFFECT OF VALUATION RATIOS, GOLD PRICE, AND PETROLEUM PRICE ON EQUITY RETURNS: A COMPARISON OF STATIC PANEL AND QUANTILE REGRESSIONS

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ABSTRACT

The purpose of this paper is to investigate to impact of valuation ratios, oil price changes and gold price changes on equity returns using static panel regression and quantile regression for 25 industrial firms at ISE (Istanbul Stock Exchange). Data periods includes from 1st quarter of year 2005 to 1st quarter of year 2011. As a result of LLC, IPS, Breitung test, variables are stationary at level. White procedure has been used to correct serial correlation and heterogeneity problems. Asset pricing model estimated using random and fixed panel data models and quantile regression model. Results of Hausman test indicated that fixed effect model (OLS) is valid. In general we find strong evidence that OLS estimation difference from quantile regression (QR) estimation at the most points of the distribution for ISE.

Keywords: Quantile regression, Panel data, Asset pricing.

JEL Codes: C31, C33, G12.

1. INTRODUCTION

The financial literature contains numerous studies asset pricing models. Sharpe (1964) and Lintner (1965) examined CAPM using linear regression model. Basu (1983) shows that effect of price to earnings ratios on equity return on US stocks. Fama and French (1992; 1993) noted, using the characteristics of the firms, that CAPM did not account fully for the expected returns, and that additional factors were required in the analysis. It was also found that the price to earnings ratio improved returns in smaller stocks. Fama and French (1995), on the other hand, identified the correlation between the expected returns and the book to market value. Fama and French (1996) represent that only beta cannot explain equity returns. This study shown that equity return explained by price to earnings, price to cash flow and sales growth.[1]Chan and Lakonishok (2004) provided same evidence. Chang *et al.* (2008) analyzed the relationship between the returns on

[1]Fama and French, (1996b).

stocks and the price to earnings ratio, and found price to earnings ratio an important factor in accounting for the return on stocks with a high growth rate. Merton (1973) investigated effect of macro economics variables on equity returns. Chen *et al.* (1986) usedto some economic variable as industrial production, inflation and growth to explain effect of stock return on the US stock market by interest rate.[2]

Huang *et al.* (1996) examine the relationship between petroleum price and equity price. Jones *et al.* (2004) represent that effect shocks of petroleum price on return at the equity market. Basher and Sadorsky (2006) found that changes in the petroleum price impacted returns. According to study, petroleum is highly important raw material to product so many goods and services. Movement of oil price directly effect on input cost. Therefore, oil price positively affect to market return. Park and Ratti (2008) represent that oil price shocks has a negative effect on equity return on US. Nandha (2011) examined on 29 stocks at the China stock market and represent that oil price has a positive effect on equity returns. Boyer and Filion (2007) and Sadorsky (2001) studies shows same results. As a result of this, high energy demand present high economic development. Gold price is independent from macro economic factors. Gold price has low correlation with equity, at the same time it's a good hedging tool. The gold which is the first form of the money has been known safest investment tool. According to Sumner *et al.* (2010) gold has been seen as a good hedging tool against stock market. Finally, he concluded that gold is a good portfolio diversifier. Mishra *et al.* (2010) used to explain relation between gold price and equity returns to Granger causality for India and found that gold price returns can use to predict equity prices.

Chan and Lakonishok (2004) estimated Fama and French (1992) three factor model using quantile regression. Allen *et al.* (2009) 30 equity on Dow Jonesfor the period of 2002:01-2009:05 estimated effect of Fama-French factors using quantile regression, and finally, found that coefficient shows significantdifferences between quantiles.

Ma and Patterson (2013) investigated to the relation between gold price, macroeconomic indicators and stock market using quantile regression. Lee and Zeng (2011) analyzed the impact of oil price on equity return using quantile regression for G7 countries. According to the study, oil price has a adverse effect on equity price and quantile regression results different from OLS regression results.

We compare the difference between results of static panel regression and quantileregression on ISE. Thereof, in implication, panel data model and quantile regression model will be firstly estimated and then compared. Variables consist of valuation ratios, oil price return, gold price returnand equity returns for 25 industrial firms at ISE (Istanbul Stock Exchange) and ISE-100 return. Data periods includes from 1st quarter of year 2005 to 1st quarter of year 2011. Asset pricing model estimated using static panel model and quantile regression model. Stationary investigated using Levin *et al*. (2002), Im *et al.* (2003) and Breitung (2000) panel unit root tests.

[2] Roll and Ross, (1986).

2. DATA AND METHODS

Asset pricing models generally estimated using OLS method. But, extreme values of observed variables can distort OLS estimation. Quantile regression method is more efficient than OLS method. OLS estimator calculated minimizing mean, QR estimator calculated for 25^{th}, 50^{th} and 75^{th}quantiles. The coefficients estimated using quantile regression are the most robust, namely it is not sensitive to the impact of outlier on dependent variable. Quantileregression effectively explainedto movements on tails in the distribution. (Koenker and Bassett, 1978) The quantile regression method has been widely used in economics and survival analysis. In study, static panel model and quantile regression model are considered to investigate and compare effect of market return, oil prices, and gold price return on equity return. Panel unit-root tests proposed by Levin *et al.* (2002), Im *et al.* (2003) and Breitung (2000) is used to test the stationarity of each variable in level.

This study pointed 25 industrial firms at ISE-100 (Stock Exchange Istanbul). Financial reporting frequency is quarterly. Therefore, quarterly returns of equity, ISE-100, petroleum price and gold price calculated using daily close price. Price to earnings ratios and market value to book value variables calculated using quarterly financial reports and close price of last work day of quarter period. Financial ratios and equity prices collected from FINNET financial analysis software and MATRIKS data provider. Gold price provided from New York Mercantile Exchange and Commodity Exchange (COMEX), Brent petroleum price found London International Petroleum Exchange (IPE). Data period covered for the first quarter of 2005 to the first quarter of 2011. R Project and STATA software are used to econometric analysis.

3. MODEL

There is a great number of study investigated effect of firm characteristics Fama and French (1996b), Fama and French (1992; 1993), Chan and Lakonishok (2004)), petroleum price Huang *et al.* (1996), Jones *et al.* (2004), Basher and Sadorsky (2006), Nandha (2011) and gold price Sumner *et al.* (2010), Mishra *et al.* (2010)) on equity returns. Allen *et al.* (2009) investigated to effect of Fama-French factors on equity returns using quantile regression for the period of 2002:01 to 2009:05 for 30 Dow Jones stocks. Lee and Zeng (2011) investigated effect of petroleum prices on equity returns using panel model and quantile regression for the period of 1968:01 to 2009:11 for G7 countries. Static panel model described as:

$$RETURN_{it} = \alpha_{it} + \beta_{0i} ISE100G_{it} + \beta_{1t} PE_{it} + \beta_{2t} BM_{it} + \beta_{3t} GOLD_{it} + \beta_{4t} PETROLEUM_{it} + u_{it} \quad (1)$$

i=25, t=25, $RETURN_{it}$ represent i. equity return on t. period, $ISE100G_{it}$ represent ISE-100 return on t. period, PE_{it} i. equity's price to book value on t. period, BM_{it}, represent i. equity's book to market value on t. period, $GOLD_{it}$, gold price return on t. period, $PETROLEUM_{it}$, represent gold price return on t. period. α_{it}, represent constant term, β_0, β_1, β_2, β_3, β_4, represent variable sensitivity, u_{it}, represent i. equity's error term on t. period. Quantile regression model described as:

$$RETURN_i = \alpha + \beta_1 ISE100G_1 + \beta_2 PE_2 + \beta_3 BM_3 + \beta_4 GOLD_4 + \beta_5 PETROLEUM_5 + u \quad (2)$$

α_{it}, represent constant term, β_0, β_1, β_2, β_3, β_4, represent variable sensitivity, u_{it}, represent i. equity's error term on t. period.

Stationarity investigated using panel unit-root tests conducted by Levin *et al.* (2002),Im *et al.* (2003) and Breitung (2000). Result of tests shown at Table 1. Null hypothesis represent series are stationary, alternative hypothesis represent series are non-stationary, and namely, series has a unit root. Results of panel unit root tests presented Table 1 shows that all variables are stationary at level.

Table-1. Panel Unit Root Tests

Variables	Levin *et al.* (2000) t-test	Im*et al.* (2003) t-bar test	Breitung (2000) t-test
Equity Return	-14.440* (0.000)	-14.688* (0.000)	-16.316* (0.000)
ISE-100 Return	-18.118* (0.000)	-12.743* (0.000)	-19.864* (0.000)
Price to Earning Ratio	-8.930 * (0.000)	-12.174* (0.000)	-10.399* (0.000)
Book to Market Ratio	-0.516 (0.303)	-0.225 (0.411)	-5.540* (0.000)
Gold Price Return	-24.077* (0.000)	-17.437* (0.000)	-16.553* (0.000)
Brent Petroleum Price Return	-18.253 * (0.000)	-14.849* (0.000)	-13.927* (0.000)

Note: *, represent %1 statistical significant, (), represent p value.

Autocorrelation test developed by Wooldridge (2002) is used to investigate serial correlation. F statistics is 7.162 and p probability is 0.010. As a result of this, null hypothesis "no serial correlation" can be rejected, and namely, error term has a serial correlation.

Table-2. Heterogeneity Tests

	Breusch-Pagan LM	Breusch Pagan/ Cook-Weisberg LM	White's Test
Chi-Square	8752.793* (0.0000)	1803.840* (0.0000)	204.979* (0.0000)

Note: *, represent %1 statistical significant, (), represent p value. Ho: homoscedasticity.

It is used to heterogeneity tests introduced by Breusch and Pagan (1979), Breusch Pagan/Cook-Weisberg and White (1980). The null hypothesis of Breusch-Pagan/Cook-Weisberg test presented that the error variances are all equal versus the alternative that the error variances are a multiplicative function of one or more variables. As a result of tests shown in Table 2, null hypothesis presented homoscedasticity can be rejected. White's cross section coefficient covariance method used to correct autocorrelation and heterogeneity problems. Therefore, to estimate the fixed effect model used Driscoll and Kraay (1998) standard error calculated by "xtscc, fe" STATA code. (Hoechle, 2007).

4. EMPIRICAL RESULTS

Table 3 includes estimation of random and fixed effect panel models (Model 1) and quantile regression model (Model 2). Table 3 represents Hausman (1979) and Hausman and Taylor (1981) test statistics, F statistics, coefficients and p values. Driscoll-Kraay p value calculated using White's correction for fixed effect model shown in Table 3.

Tablo-3. Estimation of Static Panel Model and Quantile Regression Model

Dependent Variable: Equity Return	**Random Effect (GLS)**	**Fixed Effect (OLS)**	**Fixed Effect (Driscoll-Kraay)**	**Quantile Regression**		
Explanatory Variables:				25^{th}	50^{th}	75^{th}
Constant	-0.007 (0.559)	-0.056* (0.000)	-0.056 (0.137)	-0.120* (0.000)	-0.019 (0.132)	0.086* (0.000)
ISE-100 Return	0.902* (0.000)	0.898* (0.000)	0.898* (0.000)	0.799* (0.000)	0.803* (0.000)	0.897* (0.000)
Price to Earnings Ratio	0.001* (0.000)	0.001* (0.000)	0.001* (0.037)	0.000 (0.661)	-0.000 (0.702)	0.001 (0.220)
Book to Market Ratio	0.024* (0.000)	0.054* (0.000)	0.054* (0.014)	0.012* (0.000)	0.016* (0.002)	0.022* (0.000)
Gold Price Return	-0.352* (0.000)	-0.387* (0.010)	-0.387* (0.007)	-0.117 (0.178)	-0.247* (0.065)	-0.464* (0.006)
Brent Petroleum Price Return	0.193* (0.000)	0.184* (0.000)	0.184* (0.008)	0.143* (0.000)	0.210* (0.000)	0.273* (0.000)
R^2 within	0.403	0.414	0.414			
R^2 between	0.360	0.248	0.248			
R^2 overall	0.395	0.373	0.373			
Hausman Test	39.740* (0.0000)					
F	1.390* (0.042)	165.8* (0.000)	64.330* (0.000)			

Note: *, represent %1 statistical significant, (), represent p value.

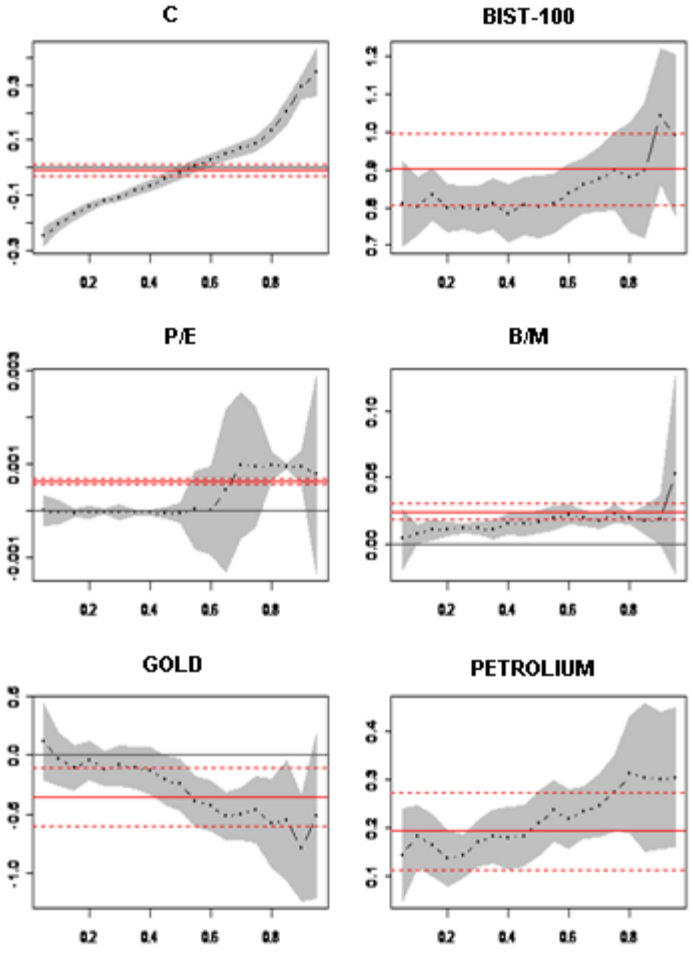
Hausman test is used to select either fixed or random effects models.(Greene, 2008) The null hypothesis of the Hausman tests hows that coefficients of random and fixed effect models are equals,difference between GLS and OLS estimator close zero, and GLS and OLS estimator is unbiased. Alternative hypothesis represent that estimator of fixed and random effect model is difference, there is no random effect, GLS estimator is bias, OLS estimator is unbiased, and fixed effect model is valid. As a result of Hausman test statistics represented Table 4, null hypothesis can be rejected, and namely, fixed effect model is valid. Fixed effect model estimated using "xtscc, fe" STATA code and calculated Driscoll and Kraay (1998) standard error term for White's correction. (Hoechle, 2007)

Panel data analysis shows that sensitivity of equity return onISE-100 return has positive and statistical significant at 1% level. As a result of panel model presented in Table 3, the estimated coefficient is 0.10, implying that 1 percent increase in the ISE-100 return brings about over 0.89 percent increase in the equity return. Price to Earnings and Book to Market ratios are positive and statistical significant. Equities selected from ISE-100 which are the big company. This result

supported by Fama and French (1996) study claimed high valuation ratio represent that positive expectation about to the future of the firm. Effect of gold return on equity return is negative and statistical significant. This result based on using gold as a good hedging tool. The impact of Brent petroleum return on equity return is positive and statistical significant. Petroleumis highly important raw material for the economy. This result supported by Nandha (2011)study.

Quantileregression model estimated for 25th, 50thand 75thquantiles. As a result of quantile regression model estimation presented Table 3, price to book value is statistical insignificant at the all points of the distribution. Book to market value, ISE-100 return and Brent petroleum return are statistical significant at the all points of the distribution. Coefficient of gold return is statistical significant for the 25thquantile, but insignificant 50th and 75thquantiles.

Graph-1. Quantile and OLS Estimation Results



Note: Quantile and OLS estimation results of the explanatory variable on equity return forthe period of 2005Q1-2011Q1. Grey area represent QR estimation, red line represent OLS estimation at the 90% confidence interval.

At the Graph 1, beta represented effect of ISE-100 return on equity return changed interquantiles. Coefficient of market return remained over 0-0.50 quantiles, but it's increased over 0.50-1. Coefficient of gold return is statistical insignificant at the lowest point of the distribution and it is statistical significant at the 50^{th} and 75^{th}quantiles. Coefficient of gold return has been gone to negative from positive over the all quantiles. Coefficient of price to earnings ratio remained from 0^{th} up to 50^{th}quantiles, but it is fluctuated among 50^{th} and 100^{th}quantiles. Coefficient of book to market value ratio is positive and remained over the all quantiles excepted for highest quantile. Coefficient of Brent petroleum changed interquantiles, and increased. This result showed that OLS estimation different from quantile estimation at the all points of the distribution.

5. CONCLUSION

As a result of OLS and QR, coefficient of ISE-100 return, book to market value, petroleum return on equity return is positive and statistical significant at the all points of quantiles. But, gold return coefficient is negative. This result supported by Sumner *et al.* (2010) examine. Positivecoefficient of petroleum return has been explained increasing energy demand of Turkey. Same result is to be seen Nandha (2011) study. As a result of OLS, coefficient of price to book ratio is positive and statistical significant. But, as a result of QR, coefficient of price to book ratio is statistical insignificant. Although coefficient of gold return is statistical insignificant at the lowest point of the distribution, it is statistical significant at the 50^{th} and 75^{th}quantiles. Statistical significant increased at the higher points of distribution. This study exhibited importance of petroleum price movement to manage of portfolio contained industrial firms equity. Otherwise, results showed that quantileregression estimation different from OLS estimation at the all points of the distribution. This results represented that can be effective using quantile regression for asset pricing and risk modeling.

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APPENDIX

Table-A.1. Selected Companies

Exchange Code	Companies
AKENR	AkEnerji
ASELS	Aselsan
AYGAZ	Aygaz
BANVT	Banvit
BIMAS	BIM A.Ş.
BOYNR	Boyner
DOAS	DoğuşOtomotiv
EGGUB	EgeGübre
EGSER	EgeSeramik
ENKAI	EnkaİnşaatEreğliDemirÇelik
EREGL	Ford Otomotiv
FROTO	HürriyetGazetecilik
HURGZ	İzmir DemirÇelik
IZMDC	KozaAltın
KOZAA	Kardemir (D)
KRDMD	PetkimPetrokimya
PETKM	Park Elektrik
PRKME	Petrol Ofisi
PTOFS	SasaİplikTüpraş
SASA	ÜlkerBisküvi
TUPRS	
ULKER	