

Internet Appendix to:

Estimating Oil Risk Factors Using Information  
from Equity and Derivatives Markets

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# 1 Proof that the ‘Y-representation’ and the ‘X-representation’ are equivalent

Given a state vector  $X$  that satisfies

$$\begin{aligned} \log S_t &= X_{1,t} + X_{3,t} \\ dX_t &= (A^* + B^* X_t)dt + \Sigma_t dW_t^* \\ A^* &= \begin{bmatrix} 0 \\ \mu_1 \\ 0 \\ \mu_2 \end{bmatrix}, \quad B^* = \begin{bmatrix} -\kappa_1 & 0 & 0 & \kappa_5 \\ 0 & -\kappa_2 & \kappa_4 & \kappa_1 \kappa_5 \\ 0 & 1 & 0 & -\frac{1}{2} - \kappa_5 \\ 0 & 0 & 0 & -\kappa_3 \end{bmatrix} \\ \Sigma_t \Sigma_t' &= \Omega_0 + \Omega_1 X_{4,t} \end{aligned}$$

where  $X_{4,t}$  is the spot price volatility, consider the transformation

$$Y_t = \Psi + \Phi X_t$$

where

$$\Psi = \begin{bmatrix} 0 \\ 0 \\ \mu_1 \\ 0 \end{bmatrix}, \quad \Phi = \begin{bmatrix} 1 & 0 & 1 & 0 \\ -\kappa_1 & 1 & 0 & 0 \\ \kappa_1^2 & -\kappa_2 & \kappa_4 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}.$$

The evolution of  $Y_t$  is

$$\begin{aligned} dY_t &= \Phi dX_t \\ &= \Phi(A^* + B^* X_t)dt + \Phi \Sigma_t dW_t^* \\ &= (\Phi A^* - \Phi B^* \Phi^{-1} \Psi + \Phi B^* \Phi^{-1} Y_t)dt + \Phi \Sigma_t dW_t^*; \end{aligned}$$

now compute these terms in the drift and dispersion to find

$$dY_t = \left( \begin{array}{c} \begin{bmatrix} 0 \\ 0 \\ u_1 \\ u_2 \end{bmatrix} + \begin{bmatrix} 0 & 1 & 0 & -\frac{1}{2} \\ 0 & 0 & 1 & 0 \\ k_{31} & k_{32} & k_{33} & k_{34} \\ 0 & 0 & 0 & -\kappa_3 \end{bmatrix} Y_t \end{array} \right) dt + \tilde{\Sigma}_t dW_t^*,$$

where

$$\begin{aligned} u_1 &= \mu_1 \kappa_1, & k_{31} &= \kappa_1 \kappa_4, & k_{32} &= \kappa_4 - \kappa_1 \kappa_2, \\ k_{33} &= -\kappa_1 - \kappa_2, & k_{34} &= \kappa_1^2 \kappa_5 - \kappa_1 \kappa_2 \kappa_5 - \kappa_4 \kappa_5 - \kappa_4/2, \end{aligned}$$

and

$$\tilde{\Sigma}_t \tilde{\Sigma}_t' = \tilde{\Omega}_0 + \tilde{\Omega}_1 Y_{4,t}$$

where  $\tilde{\Omega}_0(1, 1) = 0$ ,  $\tilde{\Omega}_1(1, 1) = 1$ , and the fourth row and column of  $\tilde{\Omega}_0$  are zero. Q.E.D.

## 2 More detailed derivation of $\Omega_0$

Because its fourth row (and column) must be zero for the model to be admissible,  $\Omega_0$  is of the form

$$\Omega_0 = \begin{bmatrix} s_{11} & s_{12} & s_{13} & 0 \\ s_{12} & s_{22} & s_{23} & 0 \\ s_{13} & s_{23} & s_{33} & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix};$$

and since  $X_{v,t}$  is the instantaneous variance of  $\log S_t = X_{1,t} + X_{3,t}$ , the restriction  $s_{11} + 2s_{13} + s_{33} = 0$  obtains. The  $2 \times 2$  submatrix  $\begin{bmatrix} s_{11} & s_{13} \\ s_{13} & s_{33} \end{bmatrix}$  has a negative eigenvalue, and hence  $\Omega_0$  will not be positive semidefinite, if  $s_{11} \neq s_{33}$ ; therefore  $s_{11} = s_{33}$  and  $s_{13} = -s_{11}$ . Now consider the characteristic polynomial of  $\Omega_0$ ,  $\det(\lambda I - \Omega_0) = \lambda p(\lambda)$  where

$$p(\lambda) = \lambda^3 - (s_{22} + 2s_{11})\lambda^2 + (-s_{12}^2 - s_{23}^2 + 2s_{11}s_{22})\lambda + s_{11}(s_{12} + s_{23})^2.$$

Because  $p$  is a cubic function, it will have a negative root if  $p(0) = s_{11}(s_{12} + s_{23})^2 > 0$ ; on the other hand  $p(0) \geq 0$  with equality if and only if either  $s_{11} = 0$  or  $s_{23} = -s_{12}$ . If  $s_{11} = 0$ , then  $\Omega_0$  is positive semidefinite only if  $s_{12} = s_{23} = 0$ , which is overly restrictive. Therefore we must have  $s_{23} = -s_{12}$ . Note that  $p'(0) = -s_{12}^2 - s_{23}^2 + 2s_{11}s_{22} = 2(s_{11}s_{22} - s_{12}^2) \geq 0$  and that  $p''(0) = -2(s_{22} + 2s_{11}) < 0$  since the trace of  $\Omega_0$  must be positive. It follows that  $p$  can have no negative root, i.e.,

$$\Omega_0 = \begin{bmatrix} s_{11} & s_{12} & -s_{11} & 0 \\ s_{12} & s_{22} & -s_{12} & 0 \\ -s_{11} & -s_{12} & s_{11} & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

is positive semidefinite. Finally,  $\Omega_0$  and  $\Omega_1$  will have disjoint null spaces if and only if the  $2 \times 2$  submatrix  $\begin{bmatrix} s_{11} & s_{12} \\ s_{12} & s_{22} \end{bmatrix}$  of  $\Omega_0$  is strictly positive definite.

### 3 Implied variance index construction

In the text, we note the implied variance expression,

$$(T-t) \times IV_{t,T} = E_t^* \left[ \int_t^T \left( \frac{dF_{s,T-s}}{F_{s,T-s}} \right)^2 \right] = 2 \int_0^\infty \frac{C_t(T-t, K) e^{y_t, T-t(T-t)} - (F_{t,T-t} - K)^+}{K^2} dK.$$

Using put-call parity, the expression becomes

$$(T-t) \times IV_{t,T} = 2 \int_0^\infty \frac{Q_t(T-t, K) e^{y_t, T-t(T-t)}}{K^2} dK,$$

where

$$Q_t(T-t, K) \equiv \begin{cases} C_t(T-t, K) & K > F_{t,T-t} \\ P_t(T-t, K) & K < F_{t,T-t} \end{cases}$$

and where  $P_t(\tau, K)$  is the date- $t$  price of a European put option with strike price  $K$  and maturity of  $\tau$ . This reduces the calculation of implied variance to an integral over out-of-the-money European options and is important because our data consists of American option prices. The difference between American and European options is smaller when the early exercise premium is small (i.e., when early exercise is less likely). Let  $i = 1, \dots, N$  index the strike prices at which an out-of-the-money contract is observed for maturity  $T-t$  at date  $t$ . Let  $Q_i \equiv Q_t(T-t, K_i)$  be the price of the corresponding out-of-the-money option. We discretize the integral as follows:

$$(T-t) \times IV_{t,T} \approx 2 \sum \frac{Q_i e^{y_t, T-t(T-t)}}{K_i^2} \Delta K_i,$$

where

$$\Delta K_i \equiv \begin{cases} K_2 - K_1 & i = 1 \\ \frac{K_{i+1} - K_{i-1}}{2} & 1 < i < N \\ K_N - K_{N-1} & i = N \end{cases}.$$

The error introduced by ignoring the tails of the integral is small (tail contracts usually trade at about a penny – the tick size).

## 4 Estimation details

One difficulty encountered in the estimation procedure is that the draws of  $X_{v,t}$  would often overfit the implied variance data at the expense of fitting the return data, and consequently, the draws of  $X_{s,t}, X_{l,t}, X_{p,t}$  would overfit the return data at the expense of fitting the futures data. In order to more efficiently extract the information about  $X_{4,t}$  in returns, the following procedure was implemented.

First a preliminary run was performed in which the state variables were drawn altogether (including  $X_{v,t}$ ) using the deJong and Shephard simulation smoother with a modified state space system. The state space system was modified to incorporate additional noise in the return and implied variance observation equations. In particular, a noise term  $q_{v,t}$  was added to  $X_{v,t}$  in the implied variance equation and noise terms  $q_{s,t}, q_{l,t}, q_{p,t}$  were added to  $X_{s,t}, X_{l,t}, X_{p,t}$  (respectively) in the return equation, and then  $q = (q_{s,t}, q_{l,t}, q_{p,t}, q_{v,t})$  was viewed as an additional state variable with ‘trivial’ transition equation  $q_{t+1} = 0 + 0q_t + e_{t+1}$  where  $\text{var}_t(e_{t+1})$  was set equal to a diagonal matrix with diagonal entries  $(1, 1, 2, 5) \times 10^{-4}$ . The addition of noise in this manner essentially functions as a prior on the informational content of futures and options. The root mean squared error of the implied variance is significantly smaller than the bid-ask spread without the noise terms.

The resulting point estimates were then used as starting values in the full MCMC procedure as described in the text. Furthermore, the preliminary estimates were used to form priors for the state variables employed in the full procedure. In particular, the prior distribution for  $X_t$  was chosen to be Gaussian with mean equal to the preliminary point estimate and variance roughly equal to the variance of the noise terms in the preliminary run.

## 5 Parameter estimates

Table 1: **Parameter estimates.** Full sample parameter estimates using the futures and implied variances only (second column) and futures, implied variances, and equity returns (third column). The parameters correspond to the physical process defined by  $dX_t = (A + BX_t) dt + \Sigma_t dW$  and its risk adjusted counterpart  $dX_t = (A^* + B^* X_t) dt + \Sigma_t dW^*$ . The matrix  $\Sigma_t$  is defined by  $\Sigma_t \Sigma_t' = \Omega_0 + \Omega_1 X_{v,t}$  with  $\Omega_0$  and  $\Omega_1$  parameterized by  $\sigma_s, \sigma_l, \sigma_v, \rho_{sl}, \rho_{vp}$ . A “\*” (“\*\*”) corresponds to significance at the 5% (1%) level. Parameters estimated using derivatives and returns that are significantly different from those estimated with derivatives only at 1% level are denoted with †.

Parameter	Derivatives Only	Full Information
$A, A^*$	$\begin{bmatrix} 0.092 \\ -0.154 \\ -0.133^* \\ 0.334^{**} \end{bmatrix}, \begin{bmatrix} 0 \\ -0.057^{**} \\ 0 \\ 0.416^{**} \end{bmatrix}$	$\begin{bmatrix} 0.066 \\ -0.116 \\ -0.135 \\ 0.423^{**\dagger} \end{bmatrix}, \begin{bmatrix} 0 \\ -0.070^{**\dagger} \\ 0 \\ 0.593^{**\dagger} \end{bmatrix}$
$B$	$\begin{bmatrix} -0.286 & -0.157 & 0 & -0.673^* \\ 1.024^{**} & -1.334^{**} & 0 & 0.832 \\ 0.116 & -0.174 & 0 & 1.451^* \\ 0 & 0 & 0 & -3.879^{**} \end{bmatrix}$	$\begin{bmatrix} -0.201 & -0.251 & 0 & -0.510^* \\ 1.103^{**} & -1.270^{**} & 0 & 0.537 \\ -0.333 & 0.048 & 0 & 1.510^* \\ 0 & 0 & 0 & -3.473^{**} \end{bmatrix}$
$B^*$	$\begin{bmatrix} -0.519^{**} & 0 & 0 & 0 \\ 0 & -1.548^{**} & 0 & 0 \\ 0 & 1 & 0 & -\frac{1}{2} \\ 0 & 0 & 0 & -4.073^{**} \end{bmatrix}$	$\begin{bmatrix} -0.522^{**} & 0 & 0 & 0 \\ 0 & -1.548^{**} & 0 & 0 \\ 0 & 1 & 0 & -\frac{1}{2} \\ 0 & 0 & 0 & -4.106^{**} \end{bmatrix}$
$\sigma_s, \sigma_l, \sigma_v$	0.248**, 0.427**, 0.675**	0.226**†, 0.430**, 0.586**†
$\rho_{sl}, \rho_{vp}$	0.303**, -0.173**	0.127**†, -0.003†

## 6 More cross-sectional tests

The following tables provide oil factor loadings and net oil risk premia for individual industry and oil-related sub-industry portfolios. Please refer to the discussion in Section 4.3 of the paper.

Table 2: **Oil risk exposure of Fama-French industry portfolios.** The table reports oil “betas” from regressing each of the FF 49 industry portfolio returns on the oil factors and market excess returns. The oil betas,  $\beta_j$  with  $j = s, l, p, v$ , are the regression coefficients normalized so that the Fama-French oil industry (“FF oil ind”) is defined to have  $(\beta_s, \beta_l, \beta_p, \beta_v) = (1, 1, 1, -1)$ . Means and confidence intervals for the net oil risk premia (reported in the last column) are calculated using the posterior distribution of oil risk premia estimated from the model. A “\*” (“\*\*”) corresponds to significance at the 5% (1%) level.

*Fama-French Industry Portfolios*

Portfolio						Net Oil
	$\beta_M$	$\beta_s$	$\beta_l$	$\beta_p$	$\beta_v$	RP (%)
Agriculture	0.68**	0.22**	0.47**	0.07	-0.39**	1.03
Food Products	0.64**	-0.12**	-0.06	-0.16**	-0.02	-0.51*
Candy & Soda	0.75**	-0.10**	-0.26	-0.14**	-0.03	-0.43
Beer & Liquor	0.65**	-0.23**	-0.28**	-0.28**	0.00	-0.98*
Tobacco Products	0.64**	-0.12**	-0.22	-0.16**	-0.04	-0.51
Recreation	0.95**	-0.03	0.08	-0.11*	0.05	-0.42*
Entertainment	1.15**	0.03	0.26*	-0.02	-0.15**	0.20
Printing & Publishing	0.95**	0.00	-0.03	-0.03	-0.15**	0.18
Consumer Goods	0.75**	-0.21**	-0.17*	-0.19**	0.05*	-0.77
Apparel	0.98**	-0.04*	0.11	-0.16**	-0.08**	-0.38

*Fama-French Industry Portfolios — continued from previous page*

Portfolio	$\beta_M$	$\beta_s$	$\beta_l$	$\beta_p$	$\beta_v$	Net Oil RP (%)
Healthcare	0.78**	0.01	0.08	-0.13**	-0.16**	-0.13
Medical Equipment	0.83**	-0.07**	-0.13	-0.15**	0.01	-0.50*
Pharmaceutical Products	0.85**	-0.20**	-0.20**	-0.19**	0.13**	-0.94*
Chemicals	0.95**	0.24**	0.46**	0.05	-0.44**	1.05
Rubber & Plastic Products	0.85**	0.10**	0.18*	-0.07*	-0.21**	0.18
Textiles	0.93**	0.15**	0.27*	-0.03	-0.31**	0.53
Construction Materials	0.96**	0.14**	0.44**	0.02	-0.29**	0.64
Construction	1.15**	0.41**	0.61**	0.23**	-0.47**	1.72*
Steel Works Etc	1.25**	0.51**	0.81**	0.41**	-0.58**	2.54*
Fabricated Products	0.93**	0.45**	0.69**	0.23**	-0.68**	2.13*
Machinery	1.11**	0.37**	0.36**	0.27**	-0.40**	1.72*
Electrical Equipment	1.16**	0.01	0.25**	0.01	-0.11**	0.22
Automobiles & Trucks	1.14**	0.05*	0.15	-0.06	-0.17**	0.16
Aircraft	0.96**	0.01	0.29**	-0.09*	-0.12**	-0.07
Shipbuilding, Railroad Equipment	0.78**	0.28**	0.59**	0.17**	-0.21**	1.03
Defense	0.66**	0.00	0.12	-0.05	-0.06	-0.03
Precious Metals	0.23**	1.13**	0.88**	1.11**	-0.63**	5.04*
Non-Metallic & Industrial Metal Mining	0.96**	0.82**	1.14**	0.68**	-0.85**	4.00*

*Fama-French Industry Portfolios — continued from previous page*

Portfolio	$\beta_M$	$\beta_s$	$\beta_l$	$\beta_p$	$\beta_v$	Net Oil RP (%)
Coal	1.11**	1.17**	1.39**	1.10**	-1.24**	6.16**
Petroleum & Natural Gas	0.76**	1.00**	1.00**	1.00**	-1.00**	5.34**
Utilities	0.57**	0.16**	0.16*	0.08**	-0.34**	0.93*
Communication	0.98**	-0.15**	-0.14*	-0.04	0.10**	-0.35
Personal Services	0.88**	0.01	0.22*	-0.15**	-0.03	-0.42
Business Services	0.96**	0.01	0.04	-0.05*	-0.05**	-0.07
Computers	1.33**	-0.27**	-0.42**	-0.07	0.46**	-1.15
Computer Software	1.29**	-0.19**	-0.43**	-0.12**	0.38**	-1.14*
Electronic Equipment	1.35**	-0.10**	-0.53**	-0.07	0.43**	-1.05
Measuring & Control Equipment	1.13**	-0.04	0.07	0.03	0.05	0.01
Business Supplies	0.85**	0.02	0.05	-0.12**	-0.14**	-0.12
Shipping Containers	0.91**	0.07**	0.10	-0.08	-0.23**	0.19
Transportation	0.94**	-0.01	0.10	-0.20**	-0.16**	-0.36
Wholesale	0.81**	0.11**	0.25**	-0.02	-0.21**	0.36
Retail	0.98**	-0.25**	-0.12	-0.31**	0.19**	-1.41**
Restaurants, Hotels, Motels	0.82**	-0.14**	-0.07	-0.19**	0.01	-0.65*
Banking	1.20**	-0.01	-0.01	-0.10**	-0.06*	-0.22
Insurance	0.96**	0.03*	0.17*	-0.10**	-0.15**	-0.02

*Fama-French Industry Portfolios — continued from previous page*

Portfolio	$\beta_M$	$\beta_s$	$\beta_l$	$\beta_p$	$\beta_v$	Net Oil RP (%)
Real Estate	0.87**	0.29**	0.30*	0.09*	-0.57**	1.44*
Finance	1.32**	-0.02	0.10	0.00	0.01	-0.03
Other	0.98**	-0.03	-0.10	-0.18**	0.02	-0.61*

Table 3: **Oil risk exposure of Datastream oil-related sub-industry portfolios.** The table reports oil “betas” from regressing each of the Datastream oil-related sub-industry portfolio returns on the oil factors and market excess returns. The oil betas,  $\beta_j$  with  $j = s, l, p, v$ , are the regression coefficients normalized so that the Fama-French oil industry (“FF oil ind”) is defined to have  $(\beta_s, \beta_l, \beta_p, \beta_v) = (1, 1, 1, -1)$ . Means and confidence intervals for the net oil risk premia (reported in the last column) are calculated using the posterior distribution of oil risk premia estimated from the model. A “\*” (“\*\*”) corresponds to significance at the 5% (1%) level.

*Datastream Portfolios*

Portfolio	$\beta_M$	$\beta_s$	$\beta_l$	$\beta_p$	$\beta_v$	Net Oil RP (%)
Airlines	1.24**	-0.60**	-0.89**	-1.45**	0.03	-4.88**
Trucking	0.93**	-0.07	-0.10	-0.29**	-0.12*	-0.75
Delivery Services	0.89**	-0.22**	-0.13	-0.31**	-0.18**	-0.75
Transportation Services	1.17**	0.04	0.28	-0.18	-0.20**	-0.20
Transportation	0.89**	0.02	0.08	-0.11*	-0.24**	0.09
Water	0.47**	0.04	0.23	-0.08	-0.30**	0.29
Railroad	0.89**	0.11**	0.26	0.00	-0.27**	0.50
MultiUtilities	0.67**	-0.07	0.25	0.09	-0.16**	0.55
Convertible Electricity	0.53**	0.06*	0.24	0.01	-0.43**	0.85*

*Datastream Portfolios — continued from previous page*

Portfolio	$\beta_M$	$\beta_s$	$\beta_l$	$\beta_p$	$\beta_v$	Net Oil RP (%)
Utilities	0.54**	0.08**	0.29*	0.04	-0.47**	1.02*
Gas Distribution	0.61**	0.30**	0.38**	0.21**	-0.77**	2.17*
Marine Transportation	0.91**	0.46**	0.54**	0.36**	-0.87**	2.88*
Oil and Gas Pipeline	0.83**	0.73**	0.45*	0.49**	-1.40**	4.34**
Integrated Oil and Gas	0.65**	0.76**	1.00**	0.79**	-0.89**	4.39*
Oil and Gas	0.70**	1.04**	1.25**	1.02**	-1.27**	5.91**
Oil and Gas Exploration and Production	0.69**	1.34**	1.48**	1.24**	-1.78**	7.63**
Oil Equipment and Services	0.81**	1.60**	1.10**	1.38**	-1.82**	8.24**

## 7 Non-oil industry principal components

We extract principal components from industry portfolios (Panel A of Table 4). We then individually regress the principal components on a constant and the market excess return, and term the residuals “CAPM residuals”. This last step is motivated by the intertemporal CAPM, in which wealth can be proxied by the market portfolio. We next regress the “CAPM residuals” on the excess oil factor returns. This allows us to obtain a sense of the total partial  $R^2$  accounted for by our oil factors as follows: We multiply each PC’s explained variation by its regression  $R^2$  and sum over the PCs. This amounts to 10.5%, and characterizes the total amount of oil risk *net of the market* to which non-oil industries are exposed.

Table 4: **Oil risk in CAPM residuals of Fama-French industry principal components.** Panel A reports statistics for 12 highest variance principal components of the non-oil 30 Fama-French industry portfolios. Panel B reports regression coefficients and their  $t$ -ratios (in parentheses) of “CAPM residuals” on the oil risk factors. The CAPM residuals are obtained from regressions of the 12 principal components on a constant and excess market return. The standard errors are due to Newey and West (1987) with 10 lags. Adjusted  $R^2$ ’s are reported under Adj  $R^2$  in percentage points.

*Panel A: Principal components*

Principal Components	Variation Explained (%)	Cumulative Variation Explained (%)	Risk Premium (%)	$t$ -ratio of $RP$
$PC_1$	60.36	60.36	0.03	2.36
$PC_2$	8.18	68.53	0.01	0.69
$PC_3$	4.12	72.65	-0.04	-3.00
$PC_4$	3.80	76.45	-0.01	-1.04
$PC_5$	2.68	79.13	-0.01	-0.41
$PC_6$	2.14	81.27	0.01	0.62
$PC_7$	1.78	83.05	-0.01	-0.92
$PC_8$	1.39	84.43	-0.01	-0.41
$PC_9$	1.29	85.72	-0.01	-0.48
$PC_{10}$	1.22	86.94	-0.01	-1.05
$PC_{11}$	1.16	88.10	0.00	-0.22
$PC_{12}$	1.05	89.15	-0.01	-1.00

Panel B: Regression of CAPM residuals on the oil risk factors

Principal Component	Explanatory Variables				Adj $R^2$ (%)
	$R_s^e$ ( <i>t</i> -ratio)	$R_l^e$ ( <i>t</i> -ratio)	$R_p^e$ ( <i>t</i> -ratio)	$R_v^e$ ( <i>t</i> -ratio)	
$PC_1$	0.05 ( 8.05 )	0.02 ( 5.70 )	0.01 ( 2.96 )	-0.04 (-8.19 )	13.73
$PC_2$	-0.36 (-13.81 )	-0.07 (-6.24 )	-0.14 (-12.54 )	0.14 ( 8.30 )	22.13
$PC_3$	-0.02 (-1.24 )	-0.01 (-0.59 )	0.00 ( 0.29 )	0.06 ( 3.87 )	1.20
$PC_4$	0.20 ( 7.85 )	0.04 ( 4.49 )	0.05 ( 4.77 )	-0.08 (-4.61 )	6.07
$PC_5$	0.02 ( 0.98 )	0.03 ( 2.68 )	-0.03 (-3.04 )	-0.08 (-4.53 )	2.65
$PC_6$	-0.05 (-2.70 )	-0.01 (-0.73 )	-0.01 (-0.56 )	0.02 ( 1.55 )	0.38
$PC_7$	0.03 ( 1.61 )	0.01 ( 1.46 )	-0.01 (-0.79 )	-0.05 (-4.32 )	0.81
$PC_8$	-0.02 (-1.08 )	0.01 ( 0.60 )	0.01 ( 0.46 )	0.01 ( 0.68 )	0.06
$PC_9$	0.05 ( 3.61 )	0.02 ( 1.94 )	0.02 ( 1.98 )	-0.05 (-4.53 )	1.05
$PC_{10}$	0.01 ( 0.38 )	-0.02 (-2.11 )	0.02 ( 1.97 )	0.03 ( 1.90 )	0.60
$PC_{11}$	0.01 ( 0.44 )	-0.02 (-1.67 )	0.02 ( 1.85 )	-0.02 (-1.84 )	0.40
$PC_{12}$	-0.05 (-2.87 )	-0.01 (-1.38 )	-0.01 (-0.54 )	0.00 ( 0.17 )	0.22