ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES
ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2023 Volume 10 Number 3 (March)
http://doi.org/10.9770/jesi.2023.10.3(22)

Publisher
http://jssidoi.org/esc/home

OIL PRICE AND STOCK RETURNS IN EUROPE *

Gábor Bóta [1], Mihály Ormos [2], Imrich Antalík [3*]

[1] Department of Finance and Accounting, Eötvös Loránd University, Rákóczi út 7, 1088 Budapest, Hungary
[2,3] Faculty of Economics and Informatics, J. Selye University, Komárno, Bratislavská cesta 3322, 945 01 Komárno, Slovakia

E-mails: [1]bota@gtk.elte.hu; [2]ormosm@ujs.sk; [3] antaliki@ujs.sk (Corresponding author)*

Received 11 Decemeber 2022; accepted 16 March 2023; published 30 March 2023

Abstract. In this paper we examine the relationship between oil price changes and of European oil and gas companies. We use all the widely known equilibrium models and extend them with the oil price factor as well. We classify the companies according to their location into Western European (WE), Central and Eastern European (CEE) and South Eastern European region (SE). Our results show that oil is a significant factor for most of the Western European, but less than the half of the CEE and SE companies. These results suggest that Western European oil and gas companies have high exposure to oil price changes, while the returns of their CEE and SE counterparts are less influenced by the oil price. When we incorporate oil price changes the explaining power of the models increases substantially for Western European companies but we can detect only a slight change for CEE and South Eastern European oil and gas companies. We also detect regional differences in the sign of the HML factor, which is usually negative for Western European and positive for CEE and South Eastern European companies.

Keywords: asset pricing; oil price; regional differences

Reference to this paper should be made as follows: Bota, G., Ormos, M., Antalík, I. 2023. Oil Price and Stock Returns in In Europe. *Entrepreneurship and Sustainability Issues*, 10(3), 329-339. http://doi.org/10.9770/jesi.2023.10.3(22)

JEL Classifications: G12, G15

Additional disciplines: financial markets

1 Introduction

The relationship between oil price changes and stock returns has been investigated thoroughly (e.g., Chen, Roll and Ross 1986, Basher and Sadorsky 2006, Nandha and Hammoudeh 2007, Fang and You 2014; Masood et al., 2019; Šubová et al., 2021). The results were highly dependent on countries, regions, industries and even periods

* *This research was supported by the project VEGA 1/0568/20 called "Equilibrium modelling of V4 capital markets", which has received funding from Ministry of Education, Science, Research and Sport of the Slovak Republic.*

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2023 Volume 10 Number 3 (March)
http://doi.org/10.9770/jesi.2023.10.3(22)

examined. Aloui et al. (2013) show positive (however varying) dependence between oil price changes and returns of Central and Eastern European stock market indexes. Asteriou and Bashmakova (2013) find that the reaction of CEE stock returns to oil price changes is more significant when oil prices are low. Articles examining stock returns on sectoral level find that oil and gas industry of Australia (Faff and Brailsford, 1999), Canada (Boyer and Filion, 2007), Europe (Arouri and Nguyen, 2010; Mura et al., 2015) and the UK (El-Sharif et al., 2005) has all significant sensitivity to oil price changes. Nandha and Faff (2008) detect a negative impact of oil price increases on returns for all of the examined 35 global sectors except mining, and oil and gas industries. Ramos and Veiga (2011) show that oil price has a positive impact on global oil and gas industry returns, however oil price is a more important factor in developed countries than in emerging markets. Nandha and Brooks (2009) also document substantial differences in the role of oil price changes in determining transport sector returns between developed and emerging countries. Oberndorfer (2009) shows that oil price changes positively related to returns of oil and gas stock returns in the Eurozone. Mohanty et al. (2010) find no significant relation between oil prices and returns of CEE oil and gas companies. Narayan and Sharma (2011) report positive relation between oil price changes and returns of US energy and transportation companies.

We examine the effects of oil price changes on returns of shares of European oil and gas companies. We use the constituents of EUROPE-DS Integrated Oil & Gas and EMERGING EUROPE-DS Integrated Oil & Gas indexes, provided by Reuters. We use monthly total returns measured in US dollars for the period January 2002 and April 2022. For the oil price changes we use the total return of Crude Oil-WTI Spot Cushing measured in US dollars.

2 Methodology and Data

We apply different equilibrium models to capture the excess returns of the examined shares and to calculate the explanatory power of the different models. We run ordinary least squares regressions with different set of explanatory variables.

The first equilibrium model we use is the standard Capital Asset Pricing Model (CAPM) proposed by Sharpe (1964), Treynor (1961), Lintner (1965), and Mossin (1966), and is in the following form, where r_i represents the return of the index; α represents the constant term of the regression, i.e., the abnormal return; represents β a relevant risk parameter that is estimated as the independent variable of the regression; r_M represents the market return; and ε represents the error term of the regression:

$$r_i = \alpha + \beta r_M + \varepsilon \quad (1)$$

The second equilibrium model is the Fama and French (1992, 1993, 1996) three-factor model. The authors extend the explanatory variable using the *SMB* (small minus big) and *HML* (high minus low) factors respectively, to capture the size premium and the value over growth premium. The model is written as follows, where the β variables represent the regression coefficients and r_M, *SMB* and *HML* are the market, size, and value premiums, respectively:

$$r_i = \alpha + \beta_M r_M + \beta_{SMB} SMB + \beta_{HML} HML + \varepsilon \quad (2)$$

Carhart (1997) extends the three-factor model using a momentum (MOM) parameter that measures the tendency for the share price to continue increasing if it was previously increasing and its tendency to continue decreasing if it was previously decreasing. Therefore, the model can be written in the following form, where β_{MOM} captures the excess return gained by the persistency of the previous month's return and *MOM* stands for the momentum factor:

$$r_i = \alpha + \beta_M r_M + \beta_{SMB} SMB + \beta_{HML} HML + \beta_{MOM} MOM + \varepsilon \quad (3)$$

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2023 Volume 10 Number 3 (March)
http://doi.org/10.9770/jesi.2023.10.3(22)

Pastor and Stambaugh (2003) used liquidity measure as a new factor and extended the model used by Carhart (1997) using market, size, value and momentum factors:

$$r_i = \alpha + \beta_M r_M + \beta_{SMB} SMB + \beta_{HML} HML + \beta_{MOM} MOM + \beta_{LIQ} LIQ + \varepsilon \quad (4)$$

We also use Fama and French (2015) five-factor model, they extend their three-factor model with profitability (robust minus weak) and investment style (conservative minus aggressive) factors.

We extend all aforementioned capital market equilibrium models by the oil price factor.

We use monthly total return data (in USD) of the examined shares for the period January 2002 and April 2022. The descriptive statistics of the monthly returns are summarized in Table 1.

The oil price is represented by the WTI USD per barrel price (from Reuters). The market, size, value, profitability, investment style and momentum factors are the European factors from Kenneth R. French's data library while as the liquidity factor we use traded liquidity from the website of Pastor Stambaugh.

3 Results

We run the equilibrium linear regression models for the monthly returns of the sample period of January 2002 and April 2022. We use different equilibrium models extended by the oil factor. We divide the examined companies into three different geographic regions: Western (or developed) Europe (Austria, Finland, France, Italy, Norway, Portugal, Spain, United Kingdom); South-East Europe (Cyprus, Greece and Turkey) and Central and Eastern Europe (Croatia, Hungary, Poland, Romania, Slovenia).

If we use CAPM the average determination coefficient (adjusted R^2) for Western European companies is 0.3876, for CEE companies 0.3425 and for South-East European companies 0.2919, while the market factor is significant for all the shares except one company from Turkey. If we extend the standard CAPM by the oil factor we receive average adjusted R^2 s of 0.4358, 0.3506 and 0.2940 respectively, while the oil factor is significant for 9 (out of 11) Western European, for 3 (out of 8) CEE and 2 (out of 5) SE companies.

ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES
ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2023 Volume 10 Number 3 (March)
http://doi.org/10.9770/jesi.2023.10.3(22)

Table 1. R^2 in Western Europe

MARKET	United Kingdom	Italy	Norway	France	Austria	Spain	France	Finland	United Kingdom	Italy	Portugal
Company	BP	ENI	EQUINOR	ESSO	OMV	REPSOL	TOTAL	NESTE	SHELL	SARAS	GALP
CAPM	0.3685	0.5207	0.3935	0.2418	0.4413	0.4862	0.5102	0.3564	0.4038	0.2300	0.3413
CAPM+Oil	0.4254	0.5916	0.5166	0.2804	0.5152	0.5279	0.5564	0.3573	0.4665	0.2305	0.3827
FF-3	0.4192	0.5964	0.4217	0.3396	0.4700	0.5896	0.5685	0.3634	0.4750	0.2584	0.3756
Carhart	0.4238	0.5997	0.4378	0.3412	0.4743	0.5897	0.5756	0.3673	0.4795	0.2596	0.3858
FF-3+Oil	0.4752	0.6575	0.5218	0.3521	0.5245	0.6173	0.6191	0.3638	0.5370	0.2585	0.4048
FF-5	0.4630	0.6311	0.4515	0.3436	0.4977	0.5946	0.5985	0.3693	0.5234	0.2617	0.3760
FF-5+Oil	0.5023	0.6783	0.5322	0.3534	0.5368	0.6185	0.6374	0.3705	0.5729	0.2619	0.4053
Allfactors+Oil	0.5241	0.6920	0.6017	0.4051	0.5725	0.6344	0.6571	0.3835	0.6238	0.3082	0.4448

Table 2. R^2 in Central and Eastern Europe

MARKET	Hungary	Romania	Slovenia	Poland	Romania	Poland	Poland	Croatia
Company	MOL	OMV PETROM	PETROL	ORLEN	ROMPETROL	LOTOS	POLISH O&G	INA
CAPM	0.4640	0.3484	0.2932	0.4175	0.2792	0.4084	0.3046	0.2492
CAPM+Oil	0.4833	0.3751	0.3277	0.4177	0.2793	0.4099	0.3046	0.2556
FF-3	0.4986	0.3855	0.3509	0.4354	0.3439	0.4161	0.3061	0.2760
Carhart	0.5023	0.3915	0.3629	0.4361	0.3442	0.4162	0.3099	0.2764
FF-3+Oil	0.5076	0.3987	0.3663	0.4354	0.3469	0.4170	0.3061	0.2783
FF-5	0.5138	0.4280	0.3679	0.4476	0.3589	0.4247	0.3105	0.2869
FF-5+Oil	0.5181	0.4321	0.3776	0.4486	0.3623	0.4249	0.3105	0.2908
All factors+Oil	0.5363	0.4466	0.3849	0.4557	0.3691	0.4358	0.3384	0.2959

Table 3. R^2 in South-East Europe

MARKET	Greece	Turkey	Greece	Cyprus	Turkey
Company	HELLENIC	KOC	MOTOR OIL	PETROLINA	TUPRAS
CAPM	0.3191	0.2563	0.4283	0.2255	0.2450
CAPM+Oil	0.3230	0.2571	0.4355	0.2348	0.2489
FF-3	0.3429	0.2623	0.4712	0.2476	0.2568
Carhart	0.3472	0.2735	0.4737	0.2478	0.2706
FF-3+Oil	0.3434	0.2627	0.4722	0.2507	0.2588
FF-5	0.3446	0.2735	0.4715	0.2536	0.2658
FF-5+Oil	0.3450	0.2735	0.4723	0.2575	0.2691
All factors+Oil	0.3481	0.2998	0.4804	0.2645	0.3001

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2023 Volume 10 Number 3 (March)
http://doi.org/10.9770/jesi.2023.10.3(22)

Table 4. Average R^2 in three Regions

MARKET	WE	CEE	SEE
CAPM	0.3903	0.3456	0.2948
CAPM+Oil	0.4410	0.3567	0.2999
FF-3	0.4434	0.3766	0.3162
Carhart	0.4486	0.3799	0.3225
FF-3+Oil	0.4847	0.3820	0.3176
FF-5	0.4646	0.3923	0.3218
FF-5+Oil	0.4972	0.3956	0.3235
All factors+Oil	0.5316	0.4078	0.3386

The average determination coefficients of the Fama-French 3 factor model are 0.4357, 0.3678 and 0.3076 for Western European, CEE and SE shares, when we involve the oil price change as well we receive 0.4751, 0.3703 and 0.3061 average adjusted R^2s respectively. In the latter case oil factor is significant for 9 (out of 11) Western European, for 3 (out of 8) CEE and 0 SE shares (see Table 1, 2, 3, 4). So, the return of oil price is relevant for most of the Western European companies, while the return of shares of CEE and SE oil companies is not sensitive to oil price.

In FF3+oil model market is a significant factor for 11 Western, 8 CEE and 4 SE European companies. SMB factor is significant for 6 WE, 4 CEE and 2 SE companies, it is significantly positive for only 1 WE and 4 CEE and 2 SE companies. HML is a significant factor for 9 WE, 2 CEE and 3 SE companies, and it is positive in all the aforementioned cases.

The average determination coefficients of Fama-French 5 factor model are 0.4520, 0.3778 and 0.3075, when the oil factor is taken into consideration the average adjusted R^2s are 0.4830, 0.3783 and 0.3063 for Western, CEE and SE companies. Oil is a significant factor for 9 Western European, 2 CEE and 0 SE oil companies.

In FF5+oil model SMB factor is significant for 6 WE (for 5 of them negatively), 4 CEE and 2 SE companies (all positively). HML factor is significant for 8 WE, 4 CEE and 1 SE, while RMW factor is significant for 6 WE, 4 CEE and 0 SE companies. Both HML and RMW factors are positively significant in all the previous cases. CMA factor is significant only for 3 Western European and 2 CEE companies, and it is not significant for any SE companies, but while in case of WE companies it is positively for CEE companies it is negatively significant.

The average adjusted R^2s of the model that involves market, size, value, profitability, investment style, momentum and liquidity factors and the oil factor as well are 0.5123 for Western European, 0.3831 for CEE and 0.3144 for South Eastern European companies. In this setting oil factor is significant for 8 out of 11 Western European oil companies and none CEE and SE companies.

Market factor is significant and positive for all but one (SE, Turkey) companies.
SMB factor is significant for 6 Western European, 3 CEE and 2 SE companies, but while for most of the cases (5 out of 6) it is significantly negative for Western European companies it is significantly positive for all 3 CEE and 2 SE companies. HML factor is significant for 8 Western European, 4 CEE and 1 SE companies and all in these cases it is significantly positive (see Table 5,6,7).

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2023 Volume 10 Number 3 (March)
http://doi.org/10.9770/jesi.2023.10.3(22)

Table 5. Parameter Estimation for Western European Oil Companies in Different Model Settings

Market / Company	United Kingdom BP		Italy ENI		Norway EQUINOR		France ESSO		Austria OMV		Spain REPSOL		France TOTAL		Finland NESTE		United Kingdom SHELL		Italy SARAS		Portugal GALP	
□	-0.3292		-0.0527		0.4543		-0.5852		0.2122		-0.3767		0.0297		0.5241		-0.0547		-1.3868	*	0.0540	
Mkt-RF	0.8758	***	0.9524	***	0.9993	***	0.9493	***	1.2688	***	1.1662	***	0.8909	***	1.1512	***	0.8307	***	1.0406	***	1.0755	***
□	-0.3392		-0.0629		0.4381		-0.5962		0.1971		-0.3867		0.0219		0.5336		0.0115		-1.3766	*	0.1002	
Mkt-RF	0.7052	***	0.7782	***	0.7225	***	0.7615	***	1.0116	***	0.9971	***	0.7581	***	1.1150	***	0.6260	***	1.0086	***	0.8399	***
WTI	0.1764	***	0.1800	***	0.2863	***	0.1942	***	0.2659	***	0.1749	***	0.1373	***	0.0306		0.1734	***	0.0274		0.1996	***
□	-0.2265		0.0114		0.3116		-0.8927		0.0444		-0.3290		0.1636		0.4292		0.1694		-1.2669	*	0.1908	
Mkt-RF	0.7481	***	0.8024	***	0.9234	***	0.7704	***	1.1747	***	0.9416	***	0.7830	***	1.1749	***	0.6889	***	0.8728	***	0.9135	***
SMB	-0.3808	*	-0.2423		0.5133	**	1.1049	***	0.6033	**	-0.1875		-0.4928	***	0.4127		-0.3785	*	0.5753		0.4216	
HML	0.6782	***	0.8006	***	0.4174	**	0.9822	***	0.5169	**	1.2030	***	0.5701	***	-0.1643		0.7084	***	0.7186	**	0.7094	***
□	-0.3776		-0.1058		-0.0007		-0.7738		-0.1511		-0.3009		0.0006		0.2604		0.0522		-1.1697		0.4260	
Mkt-RF	0.7902	***	0.8351	***	1.0104	***	0.7373	***	1.2291	***	0.9337	***	0.8283	***	1.2107	***	0.7149	***	0.8472	***	0.8512	***
SMB	-0.4204	**	-0.2730	*	0.4315	*	1.1360	***	0.5521	**	-0.1802		-0.5354	***	0.4158		-0.3758	*	0.5655		0.3958	
HML	0.7504	***	0.8566	***	0.5668	***	0.9254	***	0.6104	***	1.1896	***	0.6480	***	-0.0227		0.8129	***	0.6247	*	0.4806	*
WML	0.1547		0.1201		0.3198	***	-0.1217		0.2001		-0.0288		0.1669	**	0.2133		0.1554		-0.1392		-0.3377	*
□	-0.1695		0.0659		0.3957		-0.8566		0.1188		-0.2825		0.2104		0.4370		0.2444		-1.2726	*	0.2320	
Mkt-RF	0.5937	***	0.6549	***	0.6956	***	0.6728	***	0.9730	***	0.8156	***	0.6561	***	1.1525	***	0.5065	***	0.8886	***	0.7363	***
SMB	-0.6240	***	-0.4747	***	0.1544		0.9512	***	0.2857		-0.3859	**	-0.6926	***	0.3866		-0.5924	***	0.5942		0.2096	
HML	0.5516	***	0.6796	***	0.2305		0.9022	***	0.3515	*	1.0998	***	0.4661	***	-0.1768		0.6093	***	0.7277	**	0.6058	**
WTI	0.1831	***	0.1750	***	0.2702	***	0.1157	**	0.2392	***	0.1494	***	0.1504	***	0.0218		0.1776	***	-0.0156		0.1729	***
□	-0.7612	*	-0.4275		-0.1478		-1.0288	*	-0.3406		-0.5286		-0.2222		0.6999		-0.3201		-1.4158	*	0.1774	
Mkt-RF	0.8443	***	0.8931	***	0.9748	***	0.7533	***	1.1438	***	0.9641	***	0.8640	***	1.1698	***	0.7916	***	0.9526	***	0.8901	***
SMB	-0.4655	**	-0.2963	*	0.3993	*	1.0286	***	0.4104		-0.2367		-0.5384	***	0.3484		-0.1614		0.6860		0.4009	
HML	1.0972	***	1.0874	***	0.9296	***	1.2913	***	1.3061	***	1.4243	***	0.8153	***	-0.5187		1.0136	***	0.6124		0.8190	*
RMW	1.3017	***	1.0340	***	1.2106	***	0.4541		1.2325	***	0.5252	*	0.9046	***	-0.8304		1.3395	***	0.2781		0.0948	
CMA	0.2760		0.3326		-0.0451		-0.3049		-0.7054	*	-0.0173		0.3049		-0.1078		0.8663	***	0.6078		-0.1644	
□	-0.6078		-0.2739		0.0949		-0.9262		-0.1382		-0.3901		-0.0904		0.7335		-0.1636		-1.4324	*	0.3158	
Mkt-RF	0.7120	***	0.7606	***	0.7655	***	0.6648	***	0.9692	***	0.8446	***	0.7503	***	1.1332	***	0.6307	***	0.9704	***	0.7186	***
SMB	-0.6332	***	-0.4643	***	0.1340		0.9164	***	0.1891		-0.3882	*	-0.6826	***	0.3010		-0.3712	*	0.7095		0.1731	
HML	0.8075	***	0.7970	***	0.4712	*	1.0975	***	0.9237	***	1.1626	***	0.5662	***	-0.5724		0.7826	***	0.6401		0.5511	
RMW	0.9889	***	0.7206	***	0.7157	**	0.2449		0.8198	**	0.2427		0.6357	***	-0.8961		1.0526	***	0.3099		-0.2130	
CMA	0.4050		0.4620	**	0.1592		-0.2186		-0.5351		0.0994		0.4159	*	-0.1048		0.8762	***	0.6032		-0.1232	
WTI	0.1587	***	0.1590	***	0.2511	***	0.1062	*	0.2095	***	0.1434	***	0.1365	***	0.0368		0.1613	***	-0.0185		0.1761	***
□	-0.8328	**	-0.3790		-0.4193		-1.2632	**	-0.3321		-0.3729		-0.2308		0.8560		-0.4475		-1.5517	*	0.5155	
Mkt-RF	0.7868	***	0.7888	***	0.8621	***	0.7249	***	1.0093	***	0.8950	***	0.8153	***	1.0823	***	0.7460	***	1.0618	***	0.7725	***
SMB	-0.6565	***	-0.4641	***	0.0222		1.1095	***	0.1241		-0.3996	**	-0.6734	***	0.1245		-0.4583	**	0.4800		0.0774	
HML	0.7219	***	0.6985	***	0.4730	*	0.7364	**	0.8398	***	1.1015	***	0.4865	**	-0.0706		0.6496	**	0.1679		-0.3859	
RMW	1.3409	***	0.8459	***	0.7982	**	0.6592		0.9563	**	0.5542	*	0.8300	***	-0.5531		1.2639	***	0.6625		-0.2223	
CMA	0.5804	*	0.5819	**	0.1935		0.0730		-0.4019		0.0660		0.4312	*	-0.2031		1.2204	***	1.1921		0.5208	
WTI	0.1170	***	0.1384	***	0.2044	***	0.0322		0.1566	***	0.1345	***	0.1067	***	0.0016		0.0842	**	-0.0812		0.1694	***
WML	-0.0578		-0.0488		0.1661		-0.2696	*	0.0832		-0.1150		0.0106		0.1443		-0.0134		-0.3304		-0.5413	**
LIQ	0.1734		0.1335		0.3186	***	0.3318	**	0.4145	***	-0.1037		0.1127		0.2407		0.3955	***	0.3743		0.2049	

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2023 Volume 10 Number 3 (March)
http://doi.org/10.9770/jesi.2023.10.3(22)

Table 6. Parameter Estimation for Central and Eastern European Oil Companies in Different Model Settings

Market	Hungary	Romania	Slovenia	Poland	Romania	Poland	Poland	Croatia
Company	MOL	OMV PETROM	PETROL	ORLEN	ROMPETROL	LOTOS	POLISH O&G	INA
□	-0.0917	0.2923	0.5315	-0.0815	-1.0386	-0.5722	-0.1593	-0.1805
Mkt-RF	1.3239 ***	1.3885 ***	0.7743 ***	1.3066 ***	1.1476 ***	1.6403 ***	0.9801 ***	0.8663 ** *
□	-0.0995	0.2812	0.5237	-0.0824	-1.0411	-0.5526	-0.1607	-0.1650
Mkt-RF	1.1905 ***	1.1981 ***	0.6427 ***	1.2916 ***	1.1592 ***	1.5772 ***	0.9842 ***	0.7792 ** *
WTI	0.1380 ***	0.1968 ***	0.1361 ***	0.0155	-0.0101	0.0534	-0.0035	0.0736
□	-0.2147	-0.0471	0.2758	-0.0559	-1.3405 **	-0.4570	-0.1764	-0.2922
Mkt-RF	1.1930 ***	1.3505 ***	0.7422 ***	1.1936 ***	1.1317 ***	1.5308 ***	1.0116 ***	0.8527 ** *
SMB	0.4383 *	1.2297 ***	0.9262 ***	-0.1002	1.6233 ***	0.0258	-0.1082	0.8585 **
HML	0.7118 ***	0.2280	0.1903	0.6050 ***	-0.1514	0.5048	-0.1324	-0.0174
□	-0.3986	-0.3272	0.0344	-0.1364	-1.2870 *	-0.4810	-0.3225	-0.3328
Mkt-RF	1.2442 ***	1.4284 ***	0.8094 ***	1.2160 ***	1.1213 ***	1.5360 ***	1.0449 ***	0.8640 ** *
SMB	0.3902	1.1564 ***	0.8630 ***	-0.1213	1.6236 ***	0.0263	-0.1028	0.8638 **
HML	0.7998 ***	0.3619	0.3058 *	0.6435 ***	-0.1935	0.5259	-0.0018	0.0237
WML	0.1883	0.2868	0.2471 **	0.0825	-0.0642	0.0314	0.1952	0.0606
□	-0.1839	-0.0020	0.3053	-0.0571	-1.3611 **	-0.4403	-0.1746	-0.2831
Mkt-RF	1.1096 ***	1.2284 ***	0.6622 ***	1.1969 ***	1.1946 ***	1.4891 ***	1.0071 ***	0.8057 ** *
SMB	0.3070	1.0375 ***	0.8002 ***	-0.0950	1.6966 ***	-0.0232	-0.1133	0.8020 **
HML	0.6435 ***	0.1279	0.1247	0.6078 ***	-0.1141	0.4821	-0.1349	-0.0449
WTI	0.0989 **	0.1448 **	0.0949 **	-0.0040	-0.0636	0.0406	0.0044	0.0457
□	-0.5147	-0.6608	-0.0530	-0.3056	-1.1344 *	-0.7112	-0.2809	0.0536
Mkt-RF	1.1746 ***	1.3163 ***	0.7992 ***	1.1631 ***	0.9620 ***	1.4167 ***	1.0891 ***	0.7957 ** *
SMB	0.2954	0.9421 ***	0.8714 ***	-0.2392	1.4039 ***	-0.0324	-0.0030	0.7245 **
HML	1.2993 ***	1.4125 ***	0.4582 *	1.1681 ***	0.1907	1.2778 **	-0.2728	-0.2528
RMW	0.9438 **	1.9203 ***	0.8066 **	0.8305 *	-0.3404	1.0105	0.1784	-0.8984
CMA	-0.4987	-0.9879 *	0.1507	-0.5523	-1.3132 **	-0.7487	0.5824	-0.4872
□	-0.4464	-0.5800	0.0226	-0.3410	-1.1953 *	-0.6889	-0.2783	0.0989
Mkt-RF	1.1157 ***	1.2467 ***	0.7340 ***	1.1936 ***	1.0242 ***	1.3935 ***	1.0864 ***	0.7363 ** *
SMB	0.2208	0.8538 **	0.7887 ***	-0.2005	1.4844 ***	-0.0626	-0.0065	0.6455 *
HML	1.1704 ***	1.2599 ***	0.3154	1.2349 ***	0.3020	1.2445 **	-0.2768	-0.3456
RMW	0.8046 **	1.7557 ***	0.6524 *	0.9026 **	-0.2158	0.9692	0.1735	-1.0044
CMA	-0.4412	-0.9200 *	0.2144	-0.5821	-1.3452 **	-0.7472	0.5827	-0.4721
WTI	0.0706	0.0836	0.0783 *	-0.0366	-0.0684	0.0232	0.0028	0.0608
□	-0.6074	-0.7998	-0.2482	-0.3822	-1.3738 *	-0.8346	-0.4445	-0.0168
Mkt-RF	1.1935 ***	1.3020 ***	0.7621 ***	1.1948 ***	1.0715 ***	1.3451 ***	1.0562 ***	0.7687 ** *
SMB	0.2237	0.7839 **	0.7663 ***	-0.2805	1.5409 ***	-0.0456	-0.0011	0.6063
HML	1.2441 ***	1.5432 ***	0.2977	1.4001 ***	0.3622	2.0227 ***	0.4452	-0.3838
RMW	0.9343 **	1.8593 ***	0.5519	1.0593 **	-0.2059	1.4779 *	0.6066	-1.1158
CMA	-0.6240	-1.2737 **	0.2171	-0.7636	-1.7619 **	-1.4693 *	-0.2083	-0.3657
WTI	0.0511	0.0457	0.0560	-0.0615	-0.0861	0.0398	0.0358	0.0477
WML	0.1217	0.2209	0.1405	0.0403	0.1250	0.2181	0.2415	0.0945
LIQ	-0.0001	0.1011	0.1442	0.0047	-0.0651	-0.4270 *	-0.5021 ***	0.1586

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2023 Volume 10 Number 3 (March)
http://doi.org/10.9770/jesi.2023.10.3(22)

Table 7. Parameter Estimation for South-Eastern European Oil Companies in Different Model Settings

Market	**Greece**		**Turkey**		**Greece**		**Cyprus**		**Turkey**	
Company	**HELLENIC**		**KOC**		**MOTOR OIL**		**PETROLINA**		**TUPRAS**	
□	-0.1956		-0.3913		-0.0291		0.4542		0.1354	
Mkt-RF	1.0877	***	1.2935		1.3066	***	0.8058	***	1.1560	***
□	-0.1991		-0.3933		-0.0341		0.4494		0.1312	
Mkt-RF	1.0278	***	1.2583		1.2223	***	0.7250	***	1.0840	***
WTI	0.0620		0.0364		0.0872	*	0.0836	*	0.0744	
□	-0.3127		-0.3589		-0.1892		0.2728		0.1265	
Mkt-RF	0.9852	***	1.2121		1.1628	***	0.7724	***	1.0503	***
SMB	0.4184		-0.1227		0.5720	**	0.6564	**	0.0256	
HML	0.5587	**	0.4347		0.7835	***	0.1923		0.5679	*
□	-0.5069		0.0594		-0.3435		0.3054		0.5487	
Mkt-RF	1.0393	***	1.0957		1.2057	***	0.7633	***	0.9328	***
SMB	0.3675		-0.0132		0.5316	**	0.6650	**	0.1362	
HML	0.6516	***	0.2347		0.8573	***	0.1766		0.3660	
WML	0.1989		-0.4283		0.1580		-0.0335		-0.4323	**
□	-0.3055		-0.3504		-0.1788		0.2886		0.1439	
Mkt-RF	0.9657	***	1.1890		1.1345	***	0.7296	***	1.0032	***
SMB	0.3876		-0.1591		0.5275	*	0.5891	**	-0.0487	
HML	0.5427	**	0.4158		0.7603	***	0.1572		0.5293	*
WTI	0.0232		0.0274		0.0335		0.0507		0.0559	
□	-0.4290		-0.2798		-0.2199		0.4589		0.4855	
Mkt-RF	1.0326	***	1.0666		1.1559	***	0.6940	***	0.9293	***
SMB	0.4349		-0.2833		0.5508	**	0.6267	**	0.0080	
HML	0.5210		1.0122		0.8680	***	0.2652		0.5616	
RMW	0.2050		0.1948		0.1114		-0.3206		-0.7074	
CMA	0.2989		-1.2266		-0.0962		-0.5018		-0.6952	
□	-0.4078		-0.2712		-0.1897		0.5154		0.5568	
Mkt-RF	1.0143	***	1.0592		1.1298	***	0.6453	***	0.8678	***
SMB	0.4117		-0.2926		0.5178	*	0.5650	**	-0.0699	
HML	0.4810		0.9960		0.8109	**	0.1585		0.4269	
RMW	0.1618		0.1773		0.0498		-0.4357		-0.8528	
CMA	0.3167		-1.2194		-0.0707		-0.4542		-0.6352	
WTI	0.0219		0.0089		0.0313		0.0584		0.0738	
□	-0.5868		-0.0539		-0.2415		0.4378		0.7405	
Mkt-RF	1.0635	***	1.0639		1.1463	***	0.6820	***	0.8046	***
SMB	0.3995		-0.2834		0.5347	*	0.5819	*	-0.0777	
HML	0.5740		0.8668		0.9597	**	0.1464		0.3442	
RMW	0.0537		0.8105		-0.1154		-0.4581		-0.2963	
CMA	0.0519		-0.8517		-0.3394		-0.5233		-0.2790	
WTI	0.0156		-0.0089		0.0335		0.0395		0.0135	
WML	0.1834		-0.4233		0.1884		0.0637		-0.4273	*
LIQ	-0.0536		0.0487		-0.0470		0.0900		0.3938	*

RMW factor is significant (and positive) for 7 Western European, 4 CEE shares and it is not significant for any SE companies. CMA factor is significant for 4 Western and 3 Central Eastern European companies, but while it is significantly positive for all the former it is significantly negative for all the latter cases.

Momentum (WML) factor is significant only for 2 Western European and 1 SE companies, while traded liquidity is significant for 4 Western European, 2 CEE and 1 SE shares, and it is positive for all the 4 Western European and for the 1 SE companies it is negative for the 2 CEE companies.

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2023 Volume 10 Number 3 (March)
http://doi.org/10.9770/jesi.2023.10.3(22)

4 Conclusions

The regression results for the standard CAPM-model and its extended version with the oil price factor show that for Western European oil and gas companies the explanatory power significantly increases when the oil price is taken into consideration, while for CEE and SE companies there is only a slight difference in the R^2s. Oil is a significant factor for most of the Western European, but less than the half of the CEE and SE companies. These results suggest that Western European oil and gas companies have high exposure to oil price changes, while the returns of their CEE and SE counterparts are less influenced by the oil price.

Other model settings give the same result, when we extend the equilibrium model with the oil price factor the average adjusted R2 increases substantially for Western European companies but we can detect only a slight change for CEE and South East European oil and gas companies,

Our results also show that HML factor influences differently the examined Western European oil and gas companies and their CEE and SE counterparts, for WE companies when it is significant it is usually negative, while for CEE and SE companies it is positive (in all the significant cases). We can not detect such differences for other factors.

References

Aloui, R., Hammoudeh, S., & Nguyen, D.K. (2013). A time-varying copula approach to oil and stock market dependence: The case of transition economies. *Energy Economics*, 39, 208-221 https://doi.org/10.1016/j.eneco.2013.04.012

Arouri, H.M.E., & Nguyen, K.D. (2010). Oil prices, stock markets and portfolio investment: Evidence from sector analysis in Europe over the last decade. *Energy Policy*, 38(8), 4528-4539. https://doi.org/10.1016/j.enpol.2010.04.007

Asteriou, D., & Bashmakova, Y. (2013). Assessing the impact of oil returns on emerging stock markets: A panel data approach for ten Central and Eastern European Countries. *Energy Economics*, 38, 204-211. https://doi.org/10.1016/j.eneco.2013.02.011

Basher, S.A., & Sadorsky, P. (2006). Oil price risk and emerging stock markets. *Global Finance Journal*, 17(2), 224-251. https://doi.org/10.1016/j.gfj.2006.04.001

Boyer, M. M., & Filion, D. (2007). Common and fundamental factors in stock returns of Canadian oil and gas companies. *Energy Economics*, 29(3), 428-453. https://doi.org/10.1016/j.eneco.2005.12.003

Carhart, M.M. (1997). On persistence in mutual fund performance. *Journal of Finance*, 52(1), 57-82. https://doi.org/10.1111/j.1540-6261.1997.tb03808.x

Chen, N.F., Roll, R., & Ross, S.A. (1986). Economic forces and the stock market. *Journal of Business*, 59, 383-403. https://doi.org/10.1086/296344

El-Sharif, I., Brown, D. Burton, B. Nixon, B., & Russell, A. (2005). Evidence on the nature and extent of the relationship between oil prices and equity values in the UK. *Energy Economics*, 27(6), 819-830. https://doi.org/10.1016/j.eneco.2005.09.002

Faff, R., & Brailsford, T. (1999). Oil price risk and the Australian stock market. *Journal of Energy Finance & Development*, 4, 69-87. https://doi.org/10.1016/S1085-7443(99)00005-8

Fama, E.F., & French, K.R. (1992). The cross-section of expected stock returns. *Journal of Finance*, 47(2), 427-465. https://doi.org/10.1111/j.1540-6261.1992.tb04398.x

Fama, E.F., & French, K.R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, 33(1), 3-56. https://doi.org/10.1016/0304-405X(93)90023-5

Fama, E.F., & French, K.R. (1996). Multifactor explanations of asset pricing anomalies. *Journal of Finance*, 51(1), 55-84. https://doi.org/10.1111/j.1540-6261.1996.tb05202.x

Fama, E.F., & French, K.R. (2015). A five-factor asset pricing model. *Journal of Financial Economics*, 116(1), 1-22. https://doi.org/10.1016/j.jfineco.2014.10.010

Fang, C.R., & You, S.Y. (2014). The impact of oil price shocks on the large emerging countries' stock prices: Evidence from China, India and Russia. *International Review of Economics and Finance*, 29, 330-338. https://doi.org/10.1016/j.iref.2013.06.005

Lintner, J. (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *The Review of Economics and Statistics*, 13-37. https://doi.org/10.2307/1924119

Masood, O., Tvaronavičienė, M., & Javaria, K. (2019). Impact of oil prices on stock return: evidence from G7 countries. *Insights into Regional Development*, 1(2), 129-137. https://doi.org/10.9770/ird.2019.1.2(4)

Mohanty, S., Nandha, M., & Bota, G. (2010). Oil shocks and stock returns: The case of the Central and Eastern European (CEE) oil and gas sectors. *Emerging Markets Review*, 11(4), 358-372. https://doi.org/10.1016/j.ememar.2010.06.002

Mossin, J. (1966). Equilibrium in a Capital Asset Market. *Econometrica*, 34(4), 468-483. https://doi.org/10.2307/1910098

Mura, L., Buleca, J., Hajduová, Z., & Andrejkovič, M. (2015). Quantitative Financial Analysis of Small and Medium Food Enterprises in a Developing Country. *Transformation in Business & Economics*, 14, 1(34), 212 - 224

Nandha, M, & Brooks, R. (2009). Oil prices and transport sector returns: an international analysis. *Review of Quantitative Finance and Accounting*, 33(4), 393-409. https://doi.org/10.1007/s11156-009-0120-4

Nandha, M., & Faff, R. (2008). Does oil move equity prices? A global view. *Energy Economics*, 30(3), 986-997. https://doi.org/10.1016/j.eneco.2007.09.003

Nandha, M., & Hammoudeh, S. (2007). Systematic risk, and oil price and exchange rate sensitivities in Asia-Pacific stock markets. *Research in International Business and Finance*, 21(2), 326-341. https://doi.org/10.1016/j.ribaf.2006.09.001

Narayan, P.K, & Sharma, S.S. (2011). New evidence on oil price and firm returns. *Journal of Banking and Finance*, 35(12), 3253-3262. https://doi.org/10.1016/j.jbankfin.2011.05.010

Oberndorfer, U., (2009), Energy prices, volatility, and the stock market: Evidence from the Eurozone. *Energy Policy*, 37(12), 5787-5795. https://doi.org/10.1016/j.enpol.2009.08.043

Pastor, Ľ., & Stambaugh, R. F. (2003). Liquidity risk and expected stock returns. *Journal of Political Economy*, 111(3), 642-685. https://doi.org/10.1086/374184

Ramos, S.B., & Veiga, H. (2011). Risk factors in oil and gas industry returns: International evidence. *Energy Economics*, vol. 33(3), pp. 525-542. https://doi.org/10.1016/j.eneco.2010.10.005

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *Journal of Finance*, 19(3), 425-442. https://doi.org/10.1111/j.1540-6261.1964.tb02865.x

Šubová, N., Mura, L., & Buleca, J. (2021). Determinants of Household Financial Vulnerability: Evidence from Selected EU countries. *E & M Economics and Management*, 24(3), 186-207. https://doi.org/10.15240/tul/001/2021-3-011

Treynor, J.L. (1962). Toward a Theory of Market Value of Risky Assets. Unpublished manuscript. Subsequently published in Korajczyk, R. A. (1999). Asset Pricing and Portfolio Performance: Models, Strategy and Performance Metrics, Risk Books pp. 15-22

ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES
ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2023 Volume 10 Number 3 (March)
http://doi.org/10.9770/jesi.2023.10.3(22)

Funding: This paper was supported by the Ministry of Education, Science, Research and Sport of the Slovak Republic, Scientific grant agency VEGA 1/0568/20 called "Equilibrium modelling of V4 capital markets "

Author Contributions: Conceptualisation: *Bóta*, *Ormos*, *Antalític* methodology: *Bóta*, *Ormos* data analysis*: Bóta*, *Ormos* writing—original draft preparation: *Bóta*, *Ormos* writing; review and editing: *Bóta, Ormos*, *Antalík,* visualisation: *Ormos*, *Antalític.* All authors have read and agreed to the published version of the manuscript.

Gábor BÓTA is an Associate Professor at the Department of Finance and Accounting, Faculty of Economics, Eotvos Lorand University, Budapest, Hungary. His area of research is financial economics especially asset pricing. He served as vice dean for econoic affairs at Budapest University of Technology and Economics at the Faculty of Economic and Social Sciences. He published his research result among others in Acta Oeconomica, Emerging Markets Review, Empirica, Eastern European Economics.
ORCID ID: https://orcid.org/0000-0002-3720-757X

Mihály ORMOS is a Professor of Finance at the Department of Economics at J. Selye University, Komarno, Slovakia and at the Department of Finance and Accounting, Faculty of Economics, Eotvos Lorand University, Budapest, Hungary. His area of research is financial economics especially asset pricing, risk measures, risk perception and behavioral finance. He serves as one of the contributing editors at Eastern European Economics published by Taylor and Francis. His teaching activities concentrate on financial economics, investments and accounting. Prof. Ormos published his research results in Journal of Banking and Finance, Quantitative Finance, Finance Research Letters, Economic Modelling, Empirica, Eastern European Economics, Baltic Journal of Economics, PLoS One, Acta Oeconomica and Economic Systems amongst others.
ORCID ID: https://orcid.org/0000-0002-3224-7636

Imrich ANTALÍK is a Vice Dean for Science at the Faculty of Economics and Informatics at J. Selye University (FEI UJS) and an associate professor at the Department of Economics of FEI UJS. His area of research is financial literacy, corporate finance and competitiveness of SMEs. He teaches following subjects: Economics of SMEs, Corporate Finance, Financial Analysis, Financial Markets and Investments, Financial Literacy.
ORCID ID: https://orcid.org/0000-0001-7060-6567