










“Forecasting the net investment position based on conventional and ESG stock market indices: The case of Ukraine and Austria”

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FORECASTING THE NET INVESTMENT POSITION BASED ON CONVENTIONAL AND ESG STOCK MARKET INDICES: THE CASE OF UKRAINE AND AUSTRIA

Abstract

This paper examines the relationship between traditional and ESG stock market indices and the net international investment position for the case of Austria and Ukraine. For these purposes, the following methods are used: variance analysis, ANOVA analysis, correlation analysis, VAR analysis, R/S analysis, and Granger causality test. According to the results, ESG indices are less volatile than conventional ones. Based on the correlation analysis, it is concluded that there is a significant direct connection between ESG indices and their traditional counterparts (0.98 for Austria and 0.68 for Ukraine). A substantial level of persistence in Austria's investment position indicates the possibility of using autoregression models for forecasting. The results of the net investment position modelling for the case of Austria showed a statistically significant impact of stock market indices on the net investment position. But for the case of Ukraine, this impact is insignificant. This is indirect evidence in favor of poor performance of the Ukrainian stock market. Further development of Ukrainian stock market is required, because Austrian experience showed that stock market can be used as a transmission mechanism in boosting investment position both within conventional approach and ESG.

Keywords

environmental, social, and governance (ESG) criteria,
responsible investment, net investment position, stock
market

JEL Classification

F21, G11, E44

INTRODUCTION

Investment climate worldwide has changed dramatically as a new wave of COVID-19 and war in Ukraine resulted in a triple crisis of high food and fuel prices combined with the tighter financing conditions. According to the World Investment Report (UNCTAD, 2022), foreign direct investment (FDI) flows recovered to pre-pandemic levels in 2021, hitting nearly USD 1.58 trillion. However, in 2022, a significant decrease is expected. Total global investment flows in 2022 and beyond will be affected by macroeconomic shocks set off by the conflict, pandemic, and increased investor uncertainty, threatened the net investment positions of developed and emerging countries. Visvizi and Tokarski (2014) showed that the net international investment position is vulnerable to external shocks.

“Marshal Plan” for Ukraine was presented on the joint Switzerland-Ukraine Recovery Conference (Ukraine Recovery Conference, 2022) in Lugano on the 4-5th of July and prescribed the huge investment support of Ukrainian after war recovery and sustainable economic

growth of USD 750 billion (Ukraine Recovery Conference, 2022). Possible improvement of Ukraine's net investment position is expected during three periods of investment resources supply – in 2022, 2023–2025, 2026–2032 with a strong focus on ESG (Environmental, social, and governance) and sustainability criterion.

Stock market architecture can be used as a good transmission mechanism for allocating the investment resources. For Ukraine, it can be a good chance to re-build a stock market infrastructure and reanimate the main functions of narrow, uncompetitive and low-volume market (Plastun, Makarenko, Yelnikova et al., 2018; Plastun, Makarenko & Balatskiy, 2018), create new market indices and benchmarks (both ESG and conventional). Historically, conventional stock market indices describe the situation with investment in the country, and as well as situation in the capital markets (Baumohl, 2012; Thalassinos et al., 2015). Currently, developed countries are trying to improve their investment positions by using ESG investments instead of traditional ones. Comparing both stock market indices is a rather unexplored area (Caporale, 2022; Durán-Santomil et al., 2019; Junkus & Berry, 2015), as well as an impact of the stock market on net investment position of a country.

Modelling of interdependencies of net investment position and stock market indices in this regard is related to Financial System Functioning, Reform and Development Pillar of Ukraine Recovery Plan (Financial System Functioning, Reform and Development Pillar, 2022). This pillar is strongly oriented towards the integration of the Ukrainian capital markets into the European financial space, legislation, and benchmarks for long-term ESG investment support of Ukrainian sustainable recovery towards euro integration and estimated in USD 75 billion, 1/10 of the total amount of the investment plan.

Austria was chosen for comparison with Ukraine because this country is one of the top 7 EU countries with good dynamics of the net investment position and has strong ESG stock market focus. For instance, dynamics of Austria's net investment position is constantly positive from 2013, and in June 2020 it reached a record high of 15.30% of GDP (Austrian National Bank, 2022). Moreover, the main reason of the Austria's net investment position positive dynamic might be active emission of green and social bonds in the beginning of 2020s on Vienna Stock Exchange. This also may be caused by the rise in the VÖNIX index as one the oldest European ESG index at this exchange (calculated since 2005, Vienna Stock Exchange, 2022). Austrian experience in net investment position improvement and ESG achievements is valuable in the context of Ukraine – EU stock market integration process and strong focus on ESG investment in recovery process of Ukraine.

1. LITERATURE REVIEW

Despite the importance and crucial role of the net international investment position in the economic development of a country, the academic literature mostly ignores this issue. Results of a bibliometric analysis of the net international investment position in terms of key search queries for the period 2000–2021 (using the built-in tools Scopus from Elsevier, Web of Science from Clarivate Analytics, and Publish or Perish from Google Scholar) showed that most searches are related to the “net international investment position” term. Aspects related to the mutual influence of stock indices on the international investment position are discussed in less than 2.5% of articles (out of the to-

tal number). The same applies to the number of citations worldwide. The query “net international investment position AND responsible investment” is characterized by insignificant number of results: only 29 publications. The most significant number of publications on the topic “net international investment position” is presented in Google Scholar. However, even in this database, there is an insignificant number of academic papers related to the influence of traditional and responsible stock market indices on the international investment position.

Siemiatkowski (2017) investigates the impact of the global crisis (in 2008) on the EU country's net investment position. Bruna (2013) analyzed

the Czech economy and its relationship with the net international investment position. Lane and Milesi-Ferretti (2007) showed that open countries with more developed domestic stock markets tend to hold more significant quantities of foreign assets and liabilities in net investment positions.

Only a small number of academic papers study the impact of stock indices on the net international investment position. Jackson (2013) examines the net international investment position of the US through the lens of foreign investors' actions in stock markets. Nguyen and Whitaker (2018) defined the change in the investment position as a consequence of the change in the exchange rate of foreign stocks. Alberola et al. (2020) noted the importance of finding out the impact of the stock market on a country's international position.

Gamba-Santamaria et al. (2017) investigated the influence of stock indices on the international investment position of several countries (Australia, Canada, China, Germany, Japan, Great Britain, and the USA). The authors showed that the net position of each country (transmitter or receiver) is not influenced by stock indices.

Zhong and Liu (2021) used multivariate GARCH models to illustrate dynamic conditional correlations and volatility effects between Chinese and five Southeast Asian stock markets. The authors proposed to include an indicator of China's international investment position in one of the models. However, they further noted that this model was not adequate.

Śliwiński (2018) analyzed factors determining changes of the net international investment position of the euro area countries and found that it was largely driven by current account surpluses. Additional factors of influence are exchange rates and prices movements.

Knap (2019) evaluated the relationship between the investment position in Poland and population ageing and claimed to found a negative impact of ageing on the international net investment position.

Bleys (2008) analyzed the Index of Sustainable Economic Welfare (ISEW) in Belgium, emphasizing the importance of considering its interaction

with the net international investment position of the country; Donlagić and Moskalenko (2020) did the same for the case of The Baltic-Black Sea region countries.

A review of scientific works directly related to the impact of stock indices and responsible investments (including ESG indices) on Ukraine and Austria's net international investment position showed their absence. The only exception is the article by Slepecký et al. (2022), which examines the impact of stock indices from Finland, Sweden, France, Spain, and Ukraine on the net international investment position.

The case of Ukraine is mostly unexplored yet. Papers mainly contain studies of general aspects of the country's investment position and internal and external factors that impact it. Klymenko et al. (2018) suggested that improving fiscal policy, including tax legislation, would enhance Ukraine's investment position. The RI context is mostly not used in the works mentioned above. Yelnikova and Kuzior (2020) and Yelnikova and Miskiewicz (2020) investigate the role of RI in the post-conflict regions of Ukraine, but do not analyze its role for supporting Ukraine's net investment position.

The vast majority of scientific research on Austria's net international investment position is devoted to studying its components (usually foreign direct investment). For example, Musil (2009) and Lomachynska et al. (2018) analyzed the dynamics of Austrian foreign direct investments and their role in the development of the Austrian economy. Chetverikova (2018) evaluated Austrian-Czech investment relations, focusing on the dynamics of foreign direct investments. The author revealed the limitations of Czech FDI in Austria and their instability.

There are almost no studies on the influence of stock and responsible indices on Austria's international investment position. An exception is a study by Neher (2015) who studied the impact of RI on German-speaking countries; the author noted that RI positively impacts the country's investment position.

Thus, the impact of the stock market on the net international investment position is not widely discussed in the academic literature, thus it needs

further development. This paper aims to fill existing gaps in the net investment position modelling based on information from the stock markets (both conventional and ESG) for the case of Ukraine and Austria. This is important for justifying further Ukrainian stock market recovery directions after the war and more strict regulation on the Austrian stock market.

2. DATA AND METHODOLOGY

In this study, three arrays of quarterly data both for Ukraine and Austria are used:

- net investment position of a country;
- ESG stock market indices; and
- traditional stock market indices.

For the case of Austria, the VÖNIX index (capitalization-weighted price index calculated by the Vienna Stock Exchange and consisting of those Austrian companies that are leaders in ESG achievements) is used as the ESG index. The source of information is the website of the Vienna Stock Exchange (<https://www.wienerbourse.at/>). For the case of Ukraine – the WIG Ukraine index (since there is no specialized ESG index in Ukraine, an index calculated by the Warsaw Stock Exchange for the leaders of the ESG segment in Ukraine: Kernel Holding, Astarta Holding, Milkiland, etc.) is used as the ESG index. The information source is the Warsaw Stock Exchange website (<https://www.gpw.pl/>).

As a traditional index for Ukraine, the PFTS index (one of the key and oldest, so it provides the most comprehensive data) is used. The source of information is the website of the PFTS exchange (<https://www.pfts.com.ua>). For Austria – the Austrian Traded Index (ATX is the stock index of the 20 most capitalized Austrian companies traded on the Vienna Stock Exchange) is used. The source of information is the website of the Vienna Stock Exchange (<https://www.wienerbourse.at/>).

The data period for Austria starts from the third quarter of 2005 to the first quarter of 2021; for Ukraine – quarterly data, from 2010 to 2020.

This paper uses descriptive statistics to analyze the differences between data sets and their behavior,

and characteristics; variance analysis to define whether or not differences between data sets are statistically significant; correlation analysis to determine interdependencies between data sets; R/S analysis to analyze data persistence (methodology is similar to Plastun, Makarenko, Yelnikova et al., 2018); Granger causality test to determine whether one data set can be useful in forecasting another; regression analysis and VAR modelling to forecast the net investment position.

The relationship between the net investment position and stock market indices is investigated here by running the following regressions (see equations 1 and 2):

$$Y_t = a_0 + a_1 Conv_t + \varepsilon_t, \quad (1)$$

where Y_t – net investment position at period t ; b_n – net investment position mean; a_1 – coefficients on conventional stock market index; $Conv_t$ – conventional stock market index at period t ; ε_t – Random error term at period t .

$$Y_t = a_0 + a_1 ESG_t + \varepsilon_t, \quad (2)$$

where Y_t – net investment position at period t ; b_n – net investment position mean; a_1 – coefficients on ESG stock market index; $Conv_t$ – ESG stock market index at period t ; ε_t – Random error term at period t .

In this paper, forecasting a country's investment position involves three different models.

The lagged variable of the investment position acts as an independent variable for model 1 (see equation 3). The optimal lag is determined based on the autocorrelation function analysis.

$$y_t = a_0 + \sum_{i=1}^p A_i y_{t-i} + \varepsilon_t, \quad (3)$$

where $y_t = (y_t^1, y_t^2, \dots, y_t^k)$ – is a time series vector; A_i is a time-invariant matrix; a_0 is vector of constants; ε_t – is a vector of error terms.

Models 2 and 3 (see equations 4 and 5) use the ESG and traditional indices as essential variables.

$$y_t = a_0 + \sum_{i=1}^p A_i y_{t-i} + \sum_{i=1}^p A_i Conv_{t-i} + \varepsilon_t, \quad (4)$$

where $y_t = (y_t^1, y_t^2, \dots, y_t^k)$ – is a time series vector; A_t is a time-invariant matrix; a_0 is vector of constants; y_{t-i} – net investment position at period $t-i$; $Conv_t$ – conventional stock market index at period t ; ε_t – is a vector of error terms.

$$y_t = a_0 + \sum_{i=1}^p A_i y_{t-i} + \sum_{i=1}^p A_i ESG_{t-i} + \varepsilon_t, \quad (5)$$

where $y_t = (y_t^1, y_t^2, \dots, y_t^k)$ – is a time series vector; A_t is a time-invariant matrix; a_0 is vector of constants; y_{t-i} – net investment position at period $t-i$; $Conv_t$ – conventional stock market index at period t ; ε_t – is a vector of error terms.

These models aim to determine the possibility of using stock market indices (conventional or ESG) as critical factors affecting the investment position.

3. EMPIRICAL RESULTS

Descriptive statistics for the first differences (Table 1) of ESG and traditional indices indicates lower volatility of ESG indices than their traditional counterparts because the standard deviation of ESG indices, both for Ukraine and Austria, is smaller than traditional indices. Therefore, ESG indices are less risky for investors in both countries. In Austria, ESG indices are also more profitable for investors. However, in Ukraine, traditional indices are more profitable, this can be explained by the fluctuations of the hryvnia (since the ESG index is formed from the prices of shares denominated in euros, and the traditional index is in hryvnia).

Table 1. Descriptive statistics of conventional and ESG indices: the case of Ukraine and Austria

Parameter	Austria		Ukraine	
	ESG	Traditional	ESG	Traditional
Mean	1.25%	1.02%	-2.48%	30.34%
Standard error	1.60%	1.69%	10.58%	16.16%
Median	2.59%	1.11%	-11.01%	23.78%
Standard deviation	12.72%	13.41%	33.47%	68.56%
Sample variance	1.62%	1.80%	11.20%	47.01%
Excess	81.18%	135.89%	-44.15%	118.31%
Asymmetry	-52.02%	-72.50%	62.08%	91.29%
Interval	60.86%	69.05%	106.93%	278.82%
Minimum	-32.15%	-37.19%	-50.54%	-74.33%
Maximum	28.71%	31.85%	56.39%	204.49%
Sum	78.66%	64.36%	-24.79%	546.18%
Observations	63	63	10	18

Based on the ANOVA analysis (Table 2), it can be concluded that the null hypothesis is not rejected (the absence of statistically significant differences between the data sets), so the investment position of the country, the ESG index, and the traditional index behave typically.

Table 2. Variance analysis of the investment position, ESG index and conventional indices: the case of Ukraine and Austria

Country	The net investment position and ESG index	The net investment position and conventional index	ESG index and conventional index
Austria	2.71 (0.10)*	2.77 (0.10)	0.01 (0.92)
Ukraine	0.00 (0.98)	2.08 (0.16)	0.01 (0.90)

Note: * p -values are shown in parentheses.

The next stage is correlation analysis (Table 3). The results indicate a high degree of correlation between conventional and ESG indices. The value of the correlation index for Austria is 0.98, which shows an almost functional relationship between conventional and ESG indices. For Ukraine, the correlation index is 0.65, which means a close direct connection between the indicators. The correlation between the investment position and conventional and ESG indices for Ukraine is very low (almost absent). The correlation index for the investment position and the traditional index for Austria indicates the presence of inverse, medium-strength relations.

Table 3. Analysis of correlations: the case of Ukraine and Austria

Country	The net investment position and ESG index	The net investment position and conventional index	ESG index and conventional index
Austria	-0.25	-0.41	0.98
Ukraine	-0.03	-0.08	0.65

Granger tests were conducted to verify causal relations between the stock indices and the investment position. Note that to obtain a reliable result, the absolute values of the indicators and their first differences were analyzed (Table 4). Results indicate the absence of mutual influence of the investment position on the stock market indices for

Table 4. Granger causality tests for the case of Ukraine and Austria

Country	Parameter Type of dependence	The net investment position (X) and ESG data (Y)		The net investment position (X) and traditional data (Y)		ESG data (X) and conventional data (Y)	
		F	p	F	p	F	p
Austria	Y = f(X)	0.46	0.50	1.14	0.29	1.39	0.24
	X = f(Y)	0.01	0.93	0.04	0.85	0.90	0.35
Austria (returns)	Y = f(X)	0.25	0.61	0.53	0.47	0.01	0.92
	X = f(Y)	0.41	0.52	0.02	0.88	0.09	0.76
Ukraine	Y = f(X)	2.53	0.16	1.60	0.25	0.07	0.80
	X = f(Y)	5.27	0.05	0.77	0.41	0.23	0.65
Ukraine (returns)	Y = f(X)	0.13	0.73	0.29	0.61	1.23	0.31
	X = f(Y)	6.64	0.04	0.05	0.82	0.01	0.94

both countries, and vice versa. The only exception is the results of the impact of the ESG index on Ukraine's international investment position.

To define the possibility of forecasting data based on their previous values, an R/S analysis was conducted (Table 5). R/S analysis of data sets for Ukraine is not possible due to insufficient data. A significant level of persistence of Austria's investment position indicates the "long memory" in data set, which signifies the possibility of using autoregression models for forecasting its values. Fluctuations in the Austrian stock indices are close to random, but demonstrate signs of persistence.

The next stage is the construction of the autocorrelation function (Table 6) for the data series "invest-

ment position of the country" (for Ukraine and Austria). As can be seen, lag 1 (the highest values of the autocorrelation function and t-stat parameter) is the most appropriate for the forecasting the investment position based on data from previous values.

Table 8 provides the results of regression analysis, the purpose of which is to clarify the fundamental applicability of forecasting a country's investment position based on stock market indices.

Coefficients of determination (0.96 – in the case of Austria and 0.83 – in Ukraine) show that autoregressive models for the first differences are adequate. That is, previous values significantly influence a country's investment position dynamics.

Table 5. Persistence analysis: the case of Ukraine and Austria

Country	The net investment position	Conventional data	ESG data
Austria	0.95	0.55	0.56
Ukraine	Insufficient data	Insufficient data	Insufficient data

Table 6. Autocorrelation analysis for the case of Ukraine and Austria

Country	Austria			Ukraine			
	Time lag k	ACF(k)	T-STAT	P-value	ACF(k)	T-STAT	P-value
	1	0.9136	7.252	0.00	0.83423	3.8229	0.000496
	2	0.84276	6.6893	0.00	0.619049	2.8368	0.004939
	3	0.79566	6.3154	0.00	0.418732	1.9189	0.034347
	4	0.72125	5.7248	0.00	0.250036	1.1458	0.132382
	5	0.63653	5.0524	0.00	0.080953	0.371	0.357187
	6	0.56478	4.4829	0.00	-0.140343	-0.6431	0.26355
	7	0.51157	4.0605	0.00	-0.331636	-1.5197	0.071744
	8	0.48043	3.8133	0.00	-0.410749	-1.8823	0.036864
	9	0.42896	3.4048	0.00	-0.420045	-1.9249	0.033948
	10	0.39502	3.1354	0.00	-0.427993	-1.9613	0.031618
	11	0.35557	2.8223	0.00	-0.411387	-1.8852	0.036657
	12	0.32416	2.573	0.00	-0.366359	-1.6789	0.053998
	13	0.29821	2.367	0.01	-0.254272	-1.1652	0.128497

Table 7. Regression modelling of the investment position: the case of Ukraine and Austria

Country	Austria			Ukraine		
	Model 1	Model 2 ESG	Model 3 Trad	Model 1	Model 2 ESG	Model 3 Trad
R ²	0.96	0.26	0.41	0.83	0.03	0.08
F	217.44 (0.00)	4.53 (0.04)	12.11 (0.00)	5.23 (0.03)	0.01 (0.93)	0.11 (0.74)
α_0	-0.7575 (0.55)	7.67 (0.05)	10.80 (0.00)	1358.10 (0.93)	-37717.2 (0.01)	-29589.8 (0.00)
α_1	0.9061 (0.00)	-0.0075 (0.04)	-0.0039 (0.00)	0.8240 (0.01)	-1.9876 (0.93)	-4.3787 (0.74)
α_2	0.0117 (0.14)	-	-	-34.75 (0.09)	-	-
	-0.004 (0.16)	-	-	24.42 (0.21)	-	-

Note: * p -value is given in parentheses.

For the case of Austria, the results show a statistically significant effect of stock indices (especially traditional ones) on the country's investment position. The results of regression modelling of the impact of traditional and ESG indices on the investment position of Ukraine confirmed the absence of such an impact.

Taking into account the historical development of the stock market of Ukraine, it can be assumed that as the stock market develops, its role in the country's investment position also increases (especially in the case of traditional indices).

Next vector autoregressive modelling is used. It includes the following steps:

- checking data sets for stationarity (and bringing the time series to a stationary form if necessary);
- finding the lags for the model;
- performing the Johansen cointegration and the Granger tests.

Stationarity is one of the key assumptions for the vector autoregressive model. To verify the stationarity of the time series, the Dickey-Fuller test is used (for both countries). Note that the calculations are performed using the specialized STATA/IC 12 software. All critical criteria (Table 8) of the Dickey-Fuller test confirm the non-stationarity of the time series data. To solve the issue of the non-stationarity of time series, their transformation by finding their

first differences is carried out. After that, checking the analyzed data for stationarity shows their basic acceptability for use in autoregressive models.

Table 8. Stationarity test for the case of Ukraine and Austria

Variable	Criteria	Austria	Ukraine
Initial data			
invest pos	Z(t)	-1.972	-0.796
	MacKinnon p-value	0.299	0.820
Esg	Z(t)	0.049	-2.010
	MacKinnon p-value	0.962	0.282
Tradit	Z(t)	-0.471	-2.051
	MacKinnon p-value	0.898	0.265
critical value	1%		-3.562
	5%		-2.920
	10%		-2.595
First differences data			
dinvest pos	Z(t)	-7.339	-10.851
	MacKinnon p-value	0.000	0.000
Desg	Z(t)	-5.815	-6.970
	MacKinnon p-value	0.000	0.000
Dtradit	Z(t)	-7.670	-7.177
	MacKinnon p-value	0.000	0.000

As can be seen, initial data are non-stationarity. Data sets need to be transformed. For these purposes, the first differences method is used. After transformations, data sets are stationary, VAR modelling can be applied.

One of the key stages of VAR analysis is determining the lags for the models. To do this, the following criteria are used: Final Prediction Error (FPE), Akaike's information criterion (AIC), Hannan – Quinn information criterion (HQIC), and Schwarz Bayesian information criterion (SBIC).

Table 9. Definition of lags for the case of Austria

lag	LL	LR	Df	P	FPE	AIC	HQIC	SBIC
Model 1								
0	-569.31				2500000.00	20.40	20.43	20.48
1	-468.10	202.41*	4	0.00	77397.20*	16.93*	17.02*	17.15*
2	-466.39	3.44	4	0.49	84031.20	17.01	17.15	17.38
3	-461.83	9.11	4	0.06	82524.40	16.99	17.19	17.50
...
Model 2								
0	-626.53				19000000.00	22.45	22.48	22.52
1	-525.78	201.51	4	0.00	607137.00*	18.99*	19.08*	19.21*
2	-524.22	3.11	4	0.54	662986.00	19.08	19.22	19.44
3	-519.47	9.49*	4	0.05	646612.00	19.05	19.25	19.56
...
Model 3								
0	-734.46				910000000.00	26.30	26.33	26.37
1	-657.96	153.00	4	0.00	68000000.00	23.71	23.80	23.93*
2	-651.81	12.30	4	0.02	6.3e+07*	23.64	23.78*	24.00
3	-649.58	4.47	4	0.35	67000000.00	23.70	23.90	24.21
4	-645.61	7.93	4	0.09	68000000.00	23.70	23.95	24.35
5	-641.00	9.23	4	0.06	67000000.00	23.68	23.99	24.47
6	-635.75	10.49*	4	0.03	64000000.00	23.63*	24.00	24.57
...

Table 9 provides an example of the definition of lags for Austria. The series with the optimal lags (a significant value of p-statistics and the lowest values of information criteria) are marked with the asterisks. The same approach is applied for the Ukrainian data.

The results of choosing the optimal number of lags for both countries are provided in Table 10. The optimal number of lags is selected by assessing the quality of the VAR model using STATA software.

Table 10. Determining the optimal number of lags: the case of Ukraine and Austria

Country	Optimal lags (bold)		
	model 1	model 2	model 3
Austria	1	1/3	2/6
Ukraine	1	1	2/4

Table 11 provides the results of Johansen’s cointegration test (trace test). Cointegration refers to long-term dynamics or equilibrium. That is, if two (or more) series are related in the form of a long-term equilibrium relationship, they, in any case, have similar dynamics in such a way that the (linear) combination between them is stable (stationary). If no cointegration exists, estimating the VAR is necessary.

Table 11. Results of the Johansen cointegration test: the case of Ukraine and Austria

Model	Cointegration parameters		Austria	Ukraine
1	trace statistic	rank 0	5.86	6.559
		rank 1	0.14	0.854
	max statistic	rank 0	5.72	5.705
		rank 1	0.14	0.854
2	trace statistic	rank 0	5.926	6.866
		rank 1	0.175	0.902
	max statistic	rank 0	5.751	5.964
		rank 1	0.175	0.902
3	trace statistic	rank 0	9.355	10.302
		rank 1	0.863	1.769
	max statistic	rank 0	8.492	8.533
		rank 1	0.863	1.769
Trace statistic critical value (5%)			rank 0 – 15.41; rank 1 – 3.76	
Max statistic critical value (5%)			rank 0 – 14.07; rank 1 – 3.76	

As can be seen, there is no cointegration (cointegration parameters are below critical values).

The next step is VAR analysis. Results are presented in Table 12.

As can be seen, no significant results are found for the case of Model 1 and 2 for both countries. There are no statistically significant interdependencies between the stock market indices and the net in-

Table 12. VAR analysis for the case of Ukraine and Austria

Country	Model 1			Model 2			Model 3		
	Lag/Direct.	Coef.	p	Lag/Direct.	Coef.	p	Lag/Direct.	Coef.	p
Austria	–	–	–	–	–	–	L1/→	5.228	0.014
							L1/→	–6.045	0.016
							L3/←	0.634	0.042
							L2/←	0.528	0.024
							L7/←	–3.117	0.000
Ukraine	–	–	–	–	–	–	L3/→	–6.328	0.016

vestment position of a country. Both for the case of Austria and Ukraine. The only visible dependencies are present for the case of the third model, which shows the impact of the conventional index on the ESG index (for Austria in 1 and 3 years, and Ukraine in one year).

CONCLUSION

This paper explores the effects of traditional and ESG indices on the net international investment position of a country. For this purpose, the net international investment position, as well as traditional and ESG indices quarterly data on over the period 2005–2021 for the case of Austria (developed country) and Ukraine (developing country) are used.

According to empirical results, ESG indices have lower volatility of returns compared with conventional indices. Analyzed indices are highly correlated (0.98 for Austria and 0.65 for Ukraine).

R/S analysis shows the persistence in Austria's investment position data. ESG indices are more persistent than traditional ones. Regression analysis shows that the previous values can be used to model the net international investment position of a country. These results are confirmed by R/S analysis (high values of the Hurst exponent) and autocorrelation function analysis (the optimal lag is 1).

Austrian stock market traditional indices, as well as ESG ones, have influenced net investment position. Both indices are highly correlated. In this regard, in Austria the stock market can be used as a transmission mechanism to boost investment position both under the conventional approach and ESG. RI investing need to be reinforced into the market infrastructure to improve the net investment position.

Overcoming greenwashing issues and facilitating sustainability and ESG disclosure are a crucial step for 19 companies included in VÖNIX and other publicly listed companies in Austria. Under EU Directive 2014/95/EU and Austrian Commercial Code (UBG), after 2017 they have to disclose ESG matters. But in the light of the latest EU Commission's proposal for a new Corporate Sustainability Reporting Directive and adoption of the EU sustainability reporting standard, these disclosures must be more comprehensive, verified obligatory by independent assurance company, and have digital tags and access.

To clearly articulate ESG and prevent greenwashing, further efforts are needed to implement the EU Taxonomy and EU Taxonomy Climate delegated act (applying from January 1, 2022) into Austrian companies reporting process. Taxonomies unify approaches to ESG disclosure, enhance companies' transparency and reflect the true picture of companies' sustainability performance for key stakeholders.

One more important step for the Austrian ESG segment and ESG stock market indices is the introduction of Regulation on a Voluntary European Green Bond Standard (EU GBS). This scheme is significantly important in the context of new ambitious targets of the Austrian government – full coverage of electricity demand from alternative sources to 2030 and climate neutrality to 2040 as part of the Renewable

Energy Extension Law. All compliance steps mentioned are intended to create a clear presentation of companies' ESG performance, reflected in ESG indices and strengthened the influence on the Austrian net investment position and positive inflows from RI investment.

Austrian experience in investment position improvement might be useful for Ukraine, where neither conventional nor ESG indices affected countries' net investment position because of the weak and uncompetitive stock market without ESG segment. After-war recovery and Recovery plan underline the importance of the Ukrainian – EU stock market integration. The Austrian achievements in the stock market regulation is a good example of EU sustainability, ESG disclosure and implementation of green bond legislation for Ukrainian stock market.

The contribution of this paper is that it is one of the first attempts to analyze the impact of traditional and ESG indices on the net international investment position of Ukraine and Austria, and also presents several models for forecasting the net international investment position.

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REFERENCES

- Alberola, E., Estrada, Á., & Viani, F. (2020). Global imbalances from a stock perspective: The asymmetry between creditors and debtors. *Journal of International Money and Finance*, 107. <https://doi.org/10.1016/j.jimonfin.2020.102206>
- Austrian National Bank. (2022). *Net investment position data*. Retrieved July 8, 2022, from <https://www.oenb.at/isaweb/report.do?sessionid=C96ADBD28A072665A7BA598EDB2B370E?report=9.1.04>
- Baumohl, B. (2012). *The Secrets of Economic Indicators: Hidden Clues to Future Economic Trends and Investment Opportunities* (3rd ed.). Pearson.
- Bleys, B. (2008). Proposed changes to the index of sustainable economic welfare: An application to Belgium. *Ecological Economics*, 64(4), 741-751. <https://doi.org/10.1016/j.ecolecon.2007.10.013>
- Bruna, K. (2013). A concept of sustainability of negative net international investment position and its application to the case of the Czech Republic in 1999-2011. *Politická Ekonomie*, 61(1), 67-90.
- Caporale, G. M., Gil-Alana, L., Plastun, A., & Makarenko, I. (2022). Persistence in ESG and conventional stock market indices. *Journal of Economics and Finance*. <https://doi.org/10.1007/s12197-022-09580-0>
- Chetverikova, A. (2018). Transformatsiya roli Avstrii vo vneshnieekonomicheskikh svyaziakh Chekhii [Transformation of Austria's role in foreign economic relations of the Czech Republic]. *Sovremennaya Yevropa – Contemporary Europe*, 7, 161-171. (In Russian). <https://>

- doi.org/10.15211/soveu-ropce72018165179190
8. Đonlagić, A., & Moskalenko, B. A. (2020). The Impact of FDI Inflow on The Environment: A Case of The Baltic-Black Sea Region Countries. *SocioEconomic Challenges*, 4(4), 151-159. [https://doi.org/10.21272/sec.4\(4\).151-159.2020](https://doi.org/10.21272/sec.4(4).151-159.2020)
 9. Durán-Santomil, P., González, L., Domingues, R., & Reboledo, J. (2019). Does Sustainability Score Impact Mutual Fund Performance? *Sustainability*, 11, 2972. <https://doi.org/10.3390/su11102972>
 10. Gamba-Santamaria, S., Gomez-Gonzalez, J. E., Hurtado-Guarin, J. L., & Melo-Velandia, L. F. (2017). Volatility spillovers among global stock markets: measuring total and directional effects. *Empirical Economics*. <https://doi.org/10.1007/s00181-017-1406-3>
 11. Gladish, B., Mendez-Rodriguez, P., Mzali, B., & Lang, P. (2013). Mutual Funds Efficiency Measurement under Financial and Social Responsibility Criteria. *Journal of Multi-Criteria Decision Analysis*, 20. <https://doi.org/10.1002/mcda.1494>
 12. Gohrband, C. A., & Howell, K. L. (2015). *US International Financial Flows and the US Net Investment Position: New Perspectives Arising from New International Standards*. <https://doi.org/10.7208/9780226204437-010>
 13. Jackson, J. K. (2009). *The United States as a net debtor nation: overview of the international investment position*. Retrieved from http://research.policyarchive.org/2479_Previous_Version_2009-08-03.pdf
 14. Jackson, J. K. (2013). *The United States as a net debtor nation: Overview of the international investment position*. Retrieved from <https://ecommons.cornell.edu/handle/1813/79523>
 15. Junkus, J., & Berry, T. (2015). Socially responsible investing: A review of the critical issues. *Managerial Finance*, 41, 1176-1201. <https://doi.org/10.1108/MF-12-2014-0307>
 16. Klymenko, O., Mala, S., & Matvienko, H. (2018). International investment position of Ukraine: possibilities for improvement in the context of tax policy changes. *Reporter of the Priazovskyi State Technical University*, 36, 144-153.
 17. Knap, R. (2019). Population Ageing and Poland's International Investment Position. *Argumenta Oeconomica Cracoviensia*, 21(2), 129-141.
 18. Lane, P. R., & Milesi-Ferretti, G. M. (2007). The external wealth of nations mark II: revised and extended estimates of foreign assets and liabilities, 1970-2004. *Journal of International Economics*, 73, 223-250. Retrieved from <http://www.imf.org/external/pubs/ft/wp/2006/data/wp0669.zip>
 19. Laura, I. R., Pana, A., Esther, L. E., & Cesar, M. (2021). The Balance of Payments and International Investment Position of Spain in 2020. SSRN. Retrieved from <https://ssrn.com/abstract=3861731>
 20. Lomachynska, I., Yakubovskiy, S., & Plets, I. (2018). Dynamics of Austrian foreign direct investment and their influence on the national economy. *Baltic Journal of Economic Studies*, 4(5), 167-174. <https://doi.org/10.30525/2256-0742/2018-4-5-167-174>
 21. Musil, R. (2009). Global capital control and city hierarchies: an attempt to reposition Vienna in a world city network. *Cities*, 26(5), 255-265. <https://doi.org/10.1016/j.cities.2009.07.002>
 22. Neher, L. A. (2015). Responsible investment in Austria, Germany and Switzerland. *The Routledge Handbook of Responsible Investment*, 11. Retrieved from <https://www.taylorfrancis.com/chapters/edit/10.4324/9780203104415-32/responsible-investment-austria-germany-switzerland-agnes-neher>
 23. Nguyen, E., & Whitaker, E. (2018). *US Net International Investment Position: Fourth Quarter and Year 2018. Survey of Current Business*. Retrieved from <https://www.bea.gov/system/files/2018-01/intinv416.pdf>
 24. Plastun A., Makarenko I., & Balatskiy, E. (2018). Competitiveness in the Ukrainian stock market and local crisis of 2013-2015. *Investment Management and Financial Innovations*, 15(2), 29-39. [http://dx.doi.org/10.21511/imfi.15\(2\).2018.03](http://dx.doi.org/10.21511/imfi.15(2).2018.03)
 25. Plastun, A., Makarenko, I., Yelnykova, Yu., & Sheliuk, A. (2018). Crisis and financial data properties: A persistence view. *Journal of International Studies*, 11(3), 284-294. <https://doi.org/10.14254/2071-8330.2018/11-3/22>
 26. Siemiątkowski, P. (2017). The influence of the global economic crisis on the international investment position of European union member states. *Torun International Studies* [online]. <https://doi.org/10.12775/TIS.2016.009>
 27. Slepecký, J., Vorontsova, A., Plastun, A., Makarenko, I., & Zhyhlei, I. (2022). Net investment position and the stock market: The case of traditional and ESG indices. *Investment Management and Financial Innovations*, 19(2), 51-66. [https://doi.org/10.21511/imfi.19\(2\).2022.05](https://doi.org/10.21511/imfi.19(2).2022.05)
 28. Śliwiński, P. (2018). Short and Long Term Determinants of the Net International Investment Position Resulting from the Balance of Payments of the European Monetary Union Countries. *Acta Universitatis Lodzianis. Folia Oeconomica*.
 29. Thalassinou, I. E., Stamatopoulos, D. T., & Thalassinou, E. P. (2015). The European Sovereign Debt Crisis and the Role of Credit Swaps. Chapter book in *The WSPC Handbook of Futures Markets*. W. T. Ziemba and A. G. Malliaris. *World Scientific Handbook in Financial Economic Series*, 5(20), 605-639.
 30. The National Council for the Recovery of Ukraine from the Consequences of War. (2022). *Ukraine Recovery Plan: Financial System Functioning, Reform and Development*. Retrieved from [https://uploads-ssl.webflow.com/10.21511/imfi.19\(3\).2022.06](https://uploads-ssl.webflow.com/10.21511/imfi.19(3).2022.06)

- com/621f88db25fbf24758792dd8/62c2f176a3ad0f00c716a510_Financial%20System%20Functioning%2C%20Reform%20and%20Development.pdf
31. Ukraine Recovery Conference. (2022). Recovery Plan. Retrieved July 8, 2022, from <https://www.urc2022.com/urc2022-recovery-plan>
 32. Ukrstat. (2020). *International investment position of Ukraine*. Retrieved from http://www.ukrstat.gov.ua/imf/meta/IIP_Dis-semin_notes-ukr.html
 33. UNCTAD. (2022). *Global foreign direct investment recovered to pre-pandemic levels in 2021 but uncertainty looms in 2022*. Retrieved from <https://unctad.org/press-material/global-foreign-direct-investment-recovered-pre-pandemic-levels-2021-uncertainty>
 34. Visvizi, A., & Tokarski, P. (2014). Poland and the euro: Between lock-in and unfinished transition. *Society and Economy*, 36(364), 445-468. <https://doi.org/10.1556/SocEc.36.2014.4.1>
 35. Yelnikova, Y., & Miskiewicz, R. (2020). Implementation mechanism of impact investing in the post-conflict regions. *Financial Markets, Institutions and Risks*, 4(3), 53-62. [https://doi.org/10.21272/fmir.4\(3\).53-62.2020](https://doi.org/10.21272/fmir.4(3).53-62.2020)
 36. Yelnikova, Yu., & Kuzior, A. (2020). Overcoming the Socio-Economic Consequences of Military Conflict in Ukraine And the Impact Investment of Post-Conflict Recovery of Anti-Terrorist Operation. *SocioEconomic Challenges*, 4(3), 132-142. [https://doi.org/10.21272/sec.4\(3\).132-142.2020](https://doi.org/10.21272/sec.4(3).132-142.2020)
 37. Zhong, Y., & Liu, J. (2021). Correlations and volatility spillovers between China and Southeast Asian stock markets. *The Quarterly Review of Economics and Finance*, Elsevier, 81(C), 57-69.