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ESG FUND FLOWS UNDER SHOCKS: ARE THEY MORE RESILIENT AGAINST MACRO-FINANCIAL SHOCKS?

Key Points:

- *Along with the rising prominence of environmental, social and governance (ESG) as an investment attribute, this study contributes to the literature by exploring the effect of the ESG attribute against macro-financial shocks. The findings could have profound policy implications in promoting ESG investment and are critical to the monitoring of financial stability.*

- *By using fund-level data of global equity exchange-traded funds (ETFs), this study estimates the reaction of fund flows with respect to market stress, economic policy uncertainty and global monetary condition. The baseline results show the "stabilising effect" of the ESG attribute, as ESG funds mitigate fund outflows compared to non-ESG funds under all three types of macro-financial shocks. These findings suggest that regional economies could mitigate fund flow volatility in response to macro-financial shocks by promoting the development of ESG funds in the region.*

- *Further estimations reveal the heterogeneous nature of the effect of ESG attribute. The findings show that the "stabilising effect" of the ESG attribute is more pronounced for ETFs when their domicile financial markets are emerging markets or their investment recipient economies are emerging market economies. This suggests that the marginal effect of a more developed ESG ETFs market would be more significant in emerging markets as well as in the*

developed markets that have significant exposure to emerging market economies.

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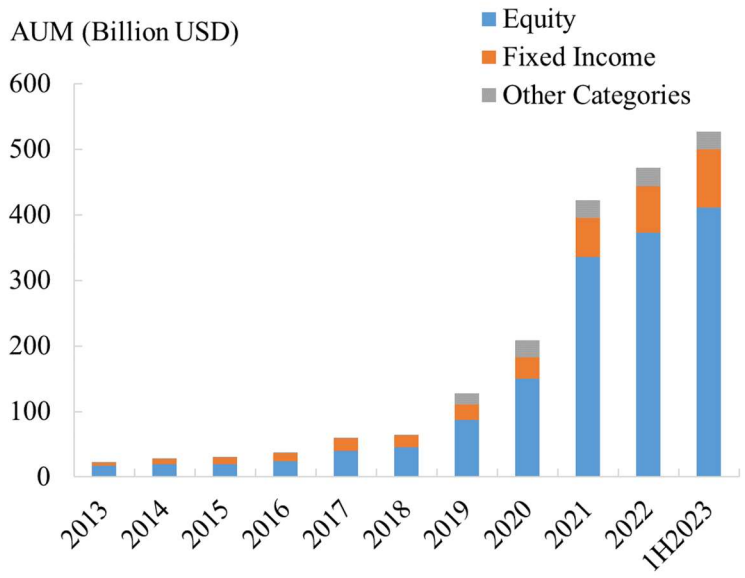
I. INTRODUCTION

As environmental, social and governance (ESG) investing has gained traction since the establishment of the Paris Agreement in 2015, ESG-focused investment products including mutual funds, index funds and exchange-traded funds (ETFs) have become increasingly popular with investors. For example, the total assets under management (AUM) of ESG ETFs have seen a multi-fold increase since 2019 (Chart 1). These products provide different types of investors (e.g. institutional and retail) with exposure to companies that meet certain criteria related to environmental impact, social responsibility and governance practices.

Chart 1. The AUM of Global ESG ETFs by Category



Note: ESG ETFs are classified as alternative, commodity, equity, fixed income, mixed allocation, money market, private equity, real estate and speciality.
Sources: Bloomberg, Authors' calculation.

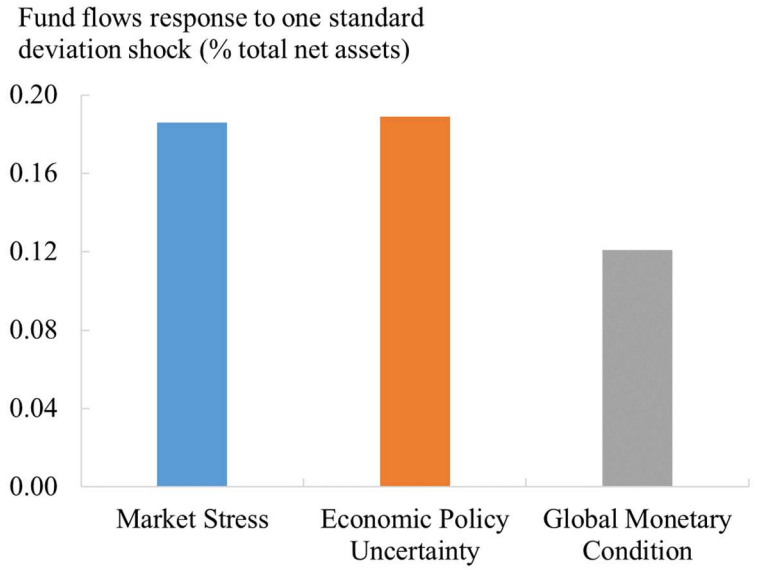
Along with the rising prominence of ESG as an investment attribute, researchers have become more interested in the potential differences that ESG elements could make to investment performance, especially during market turmoil. There is a growing body of evidence that ESG funds performed better than non-ESG funds during the recent market distress episode related to the COVID-19 pandemic (Albuquerque et al., 2020; Pastor and Vorsatz, 2020). In principle, ESG investment involves long-term commitment, and investors with

longer-term investment horizons prefer ESG investment significantly more than short-term investors (Starks et al., 2017). Thus, capital flows into ESG funds are expected to be more stable and more resilient against short-term external shocks. As shown by Albuquerque et al. (2022), ESG funds are relatively resilient during market crashes, directly contributing to the market stabilisation for ESG stocks. However, there is still a relative lack of quantitative assessment that compares the ESG funds' sensitivity to macro-financial shocks to that of non-ESG funds. This question could have profound policy implications in promoting ESG investment and is critical to the monitoring of financial stability.

The objective of this study is to assess the difference between fund flows of ESG and non-ESG funds in response to macro-financial shocks. By using fund-level data of global equity ETFs, we estimate the reaction of fund flows with respect to three types of macro-financial shocks: market stress, economic policy uncertainty and global monetary condition. We find that, when compared to equity ETFs without any ESG attributes versus those with ESG attributes, ESG ETFs experience smaller fund outflows in response to all three types of macro-financial shocks (Chart 2). This echoes one of the key findings of earlier studies that long-term investors, which tend to invest in ESG funds, are less sensitive to macro-financial shocks. These findings suggest that regional economies could mitigate fund flow volatility in response to macro-financial shocks by promoting the development of ESG funds in the region. In addition, we find that such "stabilising effect" of the ESG attribute is more pronounced for ETFs that are domiciled in emerging markets or that have exposure to emerging market economies (EMEs).[1] This suggests that the marginal effect of a more developed ESG ETFs market would be more significant in emerging markets as well as in the developed markets that have significant exposure to EMEs.

[1] As investment vehicle, ETFs connect the financial market and the real economy. The former can be classified as developed market or emerging market, while the latter can be classified as advanced economy or EME. An ETF can be domiciled in either developed market or emerging market and have exposure to advanced economies, EMEs, or even both (i.e. hybrid investment).

Chart 2. The "Stabilising Effect" of ESG ETFs With Respect to Shocks



Note: The chart shows the response of ESG funds to different types of macro-financial shocks compared to non-ESG ETFs. They are derived from the estimated coefficients of a fixed-effect regression.
Source: Authors' estimation.

II. DATA AND METHODOLOGY

a. Data

In this study, we use ETFs to investigate the effect of the ESG attribute on fund flows with respect to macro-financial shocks. Compared to other investment products such as mutual funds, ETFs provide more transparent fund information, have less stringent restrictions to the creation/redemption of units as well as lower transaction costs. These attributes facilitate investors' prompt response to shocks and thus reduce the noise in our empirical assessment that might be caused by transaction frictions.

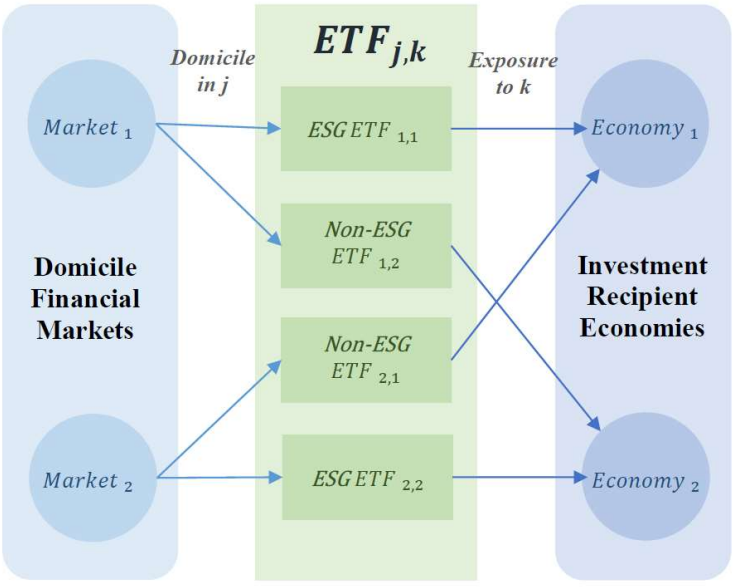
Our sample includes 8,681 global equity ETFs[2] listed on 51 domicile *markets* (developed markets: 73.9%; emerging markets: 26.1%) [3] with

[2] We use equity ETFs rather than fixed income ETFs since the former is more representative of the ETF investment universe. Our sample includes 8,681 equity ETFs with 188.5 trillion USD total assets under management, while there are only 2,644 fixed income ETFs with 37.5 trillion USD total assets under management over the sample period.

[3] Our classification of developed markets follows the definition adopted in Fama and French (2012), which includes Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, the United Kingdom and the United States. This definition has a high degree of overlap with the economy coverage of the MSCI World Index.

exposures to investment recipient economies across a wide spectrum of *economic development* (invest in advanced economies (AEs): 49.1%; invest in EMEs: 16.9%; hybrid investment: 34.0%)[4]. As an investment vehicle, ETFs connect the financial market (i.e. the domicile financial market) with the real economy (i.e. the investment recipient economy). In many cases, an economy's financial market development is aligned to its real sector, e.g. Japan is an AE with a highly developed financial market. But in some cases, the level of development of an economy's real sector is considerably different from that of its financial market, e.g. South Korea is classified as an AE with an emerging financial market. To better ascertain the ESG effect in different types of domicile financial markets (i.e. developed vs. emerging markets) and in different types of investment recipient economies (i.e. AEs vs. EMEs), we follow Fama and French (2012) to classify the domicile financial markets and the International Monetary Fund (IMF) economy classification in its World Economic Outlook to classify the investment recipient economies. Chart 3 depicts the concept.

Chart 3. The Description of ETF Fund Flows



There are only two differences between the two definitions. Greece is covered by Fama and French (2012) but not the MSCI World Index, while Israel is included in the MSCI World Index by not in Fama and French (2012). Our results are robust to the two definitions.

[4] The information on geographical exposure is derived from the ETF prospectus, which describes the geographic area where the fund intends to invest in. Our classification of AEs and EMEs follows the IMF's classification.

According to Bloomberg ESG criteria,[5] there are 1,073 ESG ETFs (12.4%) and 7,608 non-ESG ETFs (87.6%) in our sample. The monthly frequency sample period spans from January 2015 to June 2023.

We retrieve the following ETF characteristics from the Bloomberg Terminal: total net assets (TNA), net asset value (NAV) per share, monthly returns and outstanding shares. We compute monthly fund flows using the following formula:

$$FundFlow(\%)_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1}(1 + Return_{i,t})}{TNA_{i,t-1}}$$

where $TNA_{i,t}$ and $TNA_{i,t-1}$ are the total net assets of fund i in months t and $t-1$, respectively, and $Return_{i,t}$ is the return of fund i in months t.

We consider macro-financial shocks from three dimensions: market stress, economic policy uncertainty and global monetary condition. Market stress is mainly influenced by the sentiment and liquidity of the market in which the fund is domiciled, while economic policy uncertainty is associated with the economic outlook of the region in which the fund invests. To measure *market stress*, we employ the standard deviation of daily return on benchmark equity index of the market in which the fund is domiciled. For example, we use the standard deviation of daily return on the Hang Seng Index as the proxy of market shocks for Hong Kong-domiciled ETFs.

To measure *economic policy uncertainty*, we employ the Economic Policy Uncertainty index (EPU index, a news-based indicator that quantifies economic uncertainty) based on the fund's geographical exposure. More specifically, we match an economy-level EPU index with a fund's geographical exposure if the fund invests in a single region, and use a gross domestic product (GDP)-weighted global EPU index for multi-region-investing ETFs and unmatched single-region-investing ETFs.[6] All EPU indices are standardised by calculating their z-scores

[5] Bloomberg ESG criteria constitute a prospectus-based fund classification that defines an ETF as an ESG ETF if the fund invests in companies compliant with certain ESG criteria.

[6] We employ 24 continually updated economy-level EPU indices and a current-price GDP-weighted global EPU

over the sample period.

We measure the *global monetary condition* by the United States (US) monetary policy stance, which is computed by subtracting the policy rules-implied interest rate from the effective federal funds rate. Following Knotek et al. (2016), we estimate seven simple policy rules for the US and their implied interest rates.[7] Then the US monetary policy stance is calculated by subtracting the median of the seven policy rules-implied interest rates from the effective federal funds rate. A positive value of monetary policy stance represents tight monetary condition as the effective federal funds rate is higher than the median of the seven rules-implied rates. Likewise, a negative value of monetary policy stance indicates accommodative monetary condition. In this vein, a higher/lower value of monetary policy stance implies a tighter/looser global monetary condition (Hofmann and Bogdanova, 2012; Iskrev et al., 2021).

b. The Model

We use a difference-in-differences regression specification (Equation 1) to estimate the effect of the ESG attribute on fund flows with respect to market stress, economic policy uncertainty and global monetary condition for fund i at time t (the fund i is domiciled in market j and exposure to economy k; $t = m \times y$, where m is month and y is year):

$$FundFlow(\%)_{i,t} = \alpha_0 + \beta_1 ESG_i + \beta_2 Shocks_* + \beta_3 ESG_i \times Shocks_* + X_{i,t} + \gamma_i + \gamma_* + \epsilon_{i,t} \quad (1)$$

where $FundFlow(\%)_{i,t}$ is net fund flows of fund i in month t, [in terms of share of the fund's TNA in the last period]; ESG_i is a binary variable equals to one if fund i is classified as an ESG ETF, and equals zero otherwise; $Shocks_*$

index. In total, 5,712 ETFs are associated with economy-level indices and 2,969 ETFs are associated with the global index.

[7] The seven simple rules include the Taylor (1993) rule, core inflation in Taylor (1999) rule, inertial rule, alternative r* rule, forward-looking rule, first-difference rule and low weight on output gap rule. We employ the Survey of Professional Forecasters (SPF) from the Federal Reserve Bank of Philadelphia in the baseline model and use an alternative economic forecast from the Congressional Budget Office (CBO) to test the robustness.

represents three different types of shocks ($MktVol_{i,j,t}$ for market stress, $stdEPU_{i,k,t}$ for economic policy uncertainty, and MPS_t for global monetary condition); and $X_{i,t}$ represents a series of time-varying fund-specific controls, including $\ln(TNA)$, NAV, $Return$, and $\ln(OutShare)$. The model controls for fund fixed effects (γ_i) with the category dummies allowing for unobserved fixed fund attributes, and γ_* that represents three different types of fixed effects ($\gamma_{k,y}$ for market stress, $\gamma_{j,y}$ for economic policy uncertainty, and $\gamma_k + \gamma_j + \gamma_y$ for global monetary condition). The standard errors $\epsilon_{i,t}$ are clustered at the fund level, allowing for potential heteroskedasticity and fund-level serial correlation of unknown form. The key interest is in the coefficient of $ESG_i \times Shocks_*$ (β_3), which indicates the extent to which fund flows respond to funds' ESG attribute with respect to macro-financial shocks. Table 1 and Table 2 provide the detailed descriptions of the variables and their expected signs in Equation 1 respectively. Table 3 provides summary statistics on the main variables in our analysis.

Table 1. Variable Definition and Source

VARIABLE	DEFINITION	SOURCE
$FundFlow(\%)$	$FundFlow(\%)$ is computed based on the change of a fund's total net assets (TNA) adjusted for the fund's return. TNA is the product of net asset value and outstanding shares. The fund's return is calculated based on trading price.	Bloomberg
ESG	Based on the Bloomberg ESG indicator, ESG is defined as a binary variable equal to one if the fund invests in companies compliant with ESG criteria, and equal to zero otherwise.	Bloomberg
$MktVol$	$MktVol$ is the standard deviation of daily return on the benchmark equity index of the market in which the fund is domiciled.	Bloomberg
$stdEPU$	$stdEPU$ is the Z-score of the economic policy uncertainty index of the economy in which the fund invests.	Policy Uncertainty
MPS_{SPF}	MPS_{SPF} is the gap between the federal funds rate and the median of the SPF-estimated seven policy rules-implied interest rates.	Federal Reserve Bank of Philadelphia
$ImpVol$	$ImpVol$ is the implied volatility of the benchmark equity index of the market in which the fund is domiciled.	Bloomberg
EPU	EPU is the economic policy uncertainty index of the economy in which the fund invests.	Policy Uncertainty
MPS_{CBO}	MPS_{CBO} is the gap between the federal funds rate and the median of the CBO-estimated seven policy rules-implied interest rates.	U.S. Congressional Budget Office
$\ln(TNA)$	$\ln(TNA)$ is the natural logarithm of the fund's TNA, which are the product of net asset value and outstanding shares.	Bloomberg
NAV	NAV is the fund's net asset value, which is a per share value determined by subtracting the liabilities from the portfolio value of the fund's securities.	Bloomberg
$Return$	$Return$ is the fund's monthly return and is calculated based on trading price.	Bloomberg
$\ln(OutShare)$	$\ln(OutShare)$ is the natural logarithm of the fund's outstanding shares.	Bloomberg
MKT	MKT is the excess return between a region's value-weight market portfolio and the one-month T-bill rate.	Ken French's Data Library
SMB	SMB is the excess return between small stock portfolios and big stock portfolios.	Ken French's Data Library
HML	HML is the excess return between value portfolios and growth portfolios.	Ken French's Data Library
$Domicile_{EM}$	$Domicile_{EM}$ is a binary variable equal to one if the fund is domiciled in emerging markets, and equal to zero otherwise.	Bloomberg
$Exposure_{EME}$	$Exposure_{EME}$ is a binary variable equal to one if the fund invests in EMEs, and equal to zero otherwise.	Bloomberg
$\ln(FundAge)$	$\ln(Fundage)$ is the natural logarithm of number of months since the ETF was listed.	Bloomberg

Table 2. Expected Signs of Variables and the Rationales

VARIABLE	EXPECTED SIGN	
	Positive	*Negative*
$MktVol$		ETFs experience fund outflows under market stress
$ESG \times MktVol$	ESG mitigates fund outflows experienced by non-ESG ETFs under market stress ("stabilising effect")	
$ESG \times MktVol \times Domicile_{EM}$	ESG has a more pronounced "stabilising effect" for emerging market-domiciled ETFs under market stress	
$ESG \times MktVol \times \ln(FundAge)$		ESG's "stabilising effect" diminishes with more sufficient performance record under market stress
$stdEPU$		ETFs experience fund outflows under economic policy uncertainty
$ESG \times stdEPU$	ESG mitigates fund outflows experienced by non-ESG ETFs under economic policy uncertainty ("stabilising effect")	
$ESG \times stdEPU \times Exposure_{EME}$	ESG has a more pronounced "stabilising effect" for EME-investing ETFs under economic policy uncertainty	
$ESG \times stdEPU \times \ln(FundAge)$		ESG's "stabilising effect" diminishes with more sufficient performance record under economic policy uncertainty
MPS_{SPF}		ETFs experience fund outflows under tighter global monetary conditions
$ESG \times MPS_{\text{SPF}}$	ESG mitigates fund outflows experienced by non-ESG ETFs under tighter global monetary conditions ("stabilising effect")	
$\ln(TNA)_{t-1}$		Larger fund size, lower fund flows
NAV_{t-1}	Higher net asset value, higher fund inflows	
$Return_{t-1}$	Better past performance, higher fund inflows	
$\ln(OutShare)$	More outstanding shares, higher fund inflows	

Table 3. Summary Statistics

VARIABLES	(1) mean	(2) standard deviation	(3) min	(4) median	(5) max	(6) N
$FundFlow(\%)$	0.934	6.701	-12.466	0.000	20.173	564,094
ESG	0.078	0.268	0.000	0.000	1.000	564,094
$MktVol$	0.175	0.825	-1.348	0.025	1.996	564,094
$stdEPU$	0.224	0.828	-1.149	0.110	1.920	564,094
MPS_{SPF}	-0.926	1.943	-6.238	-0.066	1.048	564,094
$ImpVol$	17.531	5.214	9.446	16.297	35.294	390,959
EPU	214.958	88.471	60.206	204.071	501.334	564,094
MPS_{CBO}	-0.799	2.193	-6.315	0.207	0.959	564,094
$\ln(TNA)$	3.833	2.139	0.247	3.582	9.517	564,094
NAV	42.737	60.554	0.105	23.885	365.361	564,094
$Return$	0.002	0.058	-0.182	0.000	0.180	564,094
$\ln(OutShare)$	1.696	1.689	0.009	1.131	7.454	564,094

Note: This table reports summary statistics for the sample of global equity ETFs between January 2015 and June 2023. Statistics are based on fund-month observations. $FundFlow(\%)$ has been winsorised at a 5% level while other continuous variables have been winsorised at a 1% level.
Sources: Bloomberg, Authors' estimation.

Depending on the $Shocks_*$, each estimation includes specific additional fixed effect variables. Chart 3 is a visual illustration of the identification described in Equation 1. Suppose that four ETFs with two distinct geographical exposures (investment recipient economies) are domiciled in two different markets (domicile financial markets), where $ETF_{j,k}$ is domiciled in market j and has exposure to economy k.

- Specification with *market stress* ($MktVol_{i,j,t}$) includes an exposure-year fixed effect to control for time-varying exposure-specific factors, allowing us to compare the reaction of fund flows with respect to *market shocks* between ESG and non-ESG funds that invest in the same economy. It estimates the potential difference(s) in the reaction of fund flows with respect to *market shocks* between *ESG* $ETF_{1,1}$ and *Non-ESG* $ETF_{2,1}$ (or between *ESG* $ETF_{2,2}$ and *Non-ESG* $ETF_{1,2}$).

- Specification with *economic policy uncertainty* ($stdEPU_{i,k,t}$) has a domicile-year fixed effect to control for time-varying domicile-specific factors, allowing us to compare the reaction of fund flows with respect to

economic shocks between ESG and non-ESG funds that are domiciled in the same market. It estimates the potential difference(s) in the reaction of fund flows with respect to *economic shocks* between *ESG* $ETF_{1,1}$ and *Non-ESG* $ETF_{1,2}$ (or between *ESG* $ETF_{2,1}$ and *Non-ESG* $ETF_{2,2}$).

- Specification with *global monetary condition* (MPS_t) has fixed effect variables for exposure, domicile and year to separately control for these factors. It estimates the potential differences in the reaction of fund flows with respect to *monetary shocks* between ESG ETFs ($ETF_{1,1}$ and $ETF_{2,2}$) and non-ESG ETFs ($ETF_{1,2}$ and $ETF_{2,1}$).

III. EMPIRICAL RESULTS

a. Baseline results

Table 4 shows the baseline estimation results of Equation 1. Columns (1), (2) and (3) report results for specifications with $Shocks_*$ represented by (1) the standard deviation of daily return on benchmark equity index ($MktVol$), (2) the standardised EPU index ($stdEPU$) and (3) the SPF-estimated monetary policy stance (MPS_{SPF})[8], respectively.

In the face of macro-financial shocks, ESG attributes mitigate fund outflows.

As reported in Table 4, the coefficients on $MktVol$, $stdEPU$, and MPS_{SPF} are all negative and statistically significant. Consistent with economic prediction, the results suggest that an increase in any type of macro-financial shocks could induce fund outflows, holding other factors constant. In Column (1), the coefficient of $ESG \times MktVol$ is positive and statistically significant, and this indicates the ESG funds could mitigate part of the fund outflows during market stress. A quantitative interpretation is that when $MktVol$ increases by one standard deviation, ESG funds could reduce 0.186% of fund outflows compared to non-ESG funds. In Column (2), the coefficient on $ESG \times stdEPU$

[8] The SPF-estimated monetary policy stance is calculated as the difference between the effective federal funds rate and the rules-implied rate estimated for the SPF forecasts.

is positive and statistically significant, and this shows that ESG funds could mitigate part of the fund outflows experienced by non-ESG funds. When $stdEPU$ increases by one standard deviation, the ESG attribute could reduce fund outflows for ESG funds by 0.189%, compared to non-ESG funds. In Column (3), the coefficient on $ESG \times MPS_{SPF}$ is positive and statistically significant, and this shows that ESG funds could mitigate part of the fund outflows. When MPS_{SPF} increases by one standard deviation, the ESG attribute could reduce fund outflows for ESG funds by 0.121%, compared to non-ESG funds.

In Columns (1) and (2) of Table 4, whilst the coefficients on $MktVol$ and $stdEPU$ are negative and statistically significant, their magnitudes are smaller than the positive coefficients on $ESG \times MktVol$ and $ESG \times stdEPU$. As the "stabilising effect" of the ESG attribute on fund outflows mentioned earlier outweigh the fund outflow effects induced by an unit increase in $MktVol$ or $stdEP$, **an increase in market stress ($MktVol$) or economic policy uncertainty ($stdEPU$) per se could generate fund inflows into ESG funds**. A plausible explanation for this finding is these two types of shocks lead investors to partially substitute ESG funds for non-ESG funds. **In other words, ESG funds may act as safe-haven assets among ETFs during market stress or when economic policy uncertainty rises, holding other factors constant.**

Table 4. Baseline Regression Results

VARIABLE	(1) $FundFlow(\%)$	(2) $FundFlow(\%)$	(3) $FundFlow(\%)$
$MktVol$	-0.021**		
	(0.010)		
$ESG \times MktVol$	0.186***		
	(0.043)		
$stdEPU$		-0.067***	
		(0.018)	
$ESG \times stdEPU$		0.189***	
		(0.070)	
MPS_{SPF}			-0.134***
			(0.009)
$ESG \times MPS_{\text{SPF}}$			0.121***
			(0.026)
$\ln(TNA)_{t-1}$	-5.957***	-5.954***	-5.805***
	(0.134)	(0.135)	(0.135)
NAV_{t-1}	0.060***	0.062***	0.057***
	(0.003)	(0.003)	(0.003)
$Return_{t-1}$	6.042***	6.121***	6.237***
	(0.244)	(0.244)	(0.249)
$\ln(OutShare)$	7.422***	7.536***	7.243***
	(0.189)	(0.189)	(0.191)
Constant	8.618***	8.339***	8.334***
	(0.204)	(0.208)	(0.204)
No. of Observations	564,094	564,094	564,094
No. of ETFs	8,681	8,681	8,681
R-squared	0.168	0.170	0.162
Fund fixed effect	Yes	Yes	Yes
Exposure-year fixed effect	Yes	No	No
Domicile-year fixed effect	No	Yes	No
Exposure fixed effect	No	No	Yes
Domicile fixed effect	No	No	Yes
Year fixed effect	No	No	Yes

Note: Standard errors clustered at the fund level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

Source: Authors' estimation.

b. Robustness checks

To check the robustness of the estimation results based on the three types of macro-financial shocks, we re-estimate Equation 1 with an alternative set of shocks. They are (1) implied volatility of benchmark equity index ($ImpVol$) for market stress, (2) the original EPU index (EPU) for economic policy uncertainty, and (3) the CBO-estimated monetary policy stance (MPS_{CBO})[9] for global monetary condition. Table 5 reports the estimation results for this set of indicators.

In Table 5, the coefficients of (1) $ImpVol$, (2) EPU, and (3) MPS_{CBO} are all negative and statistically significant. This confirms that ETFs would experience fund outflows with respect to an increase in the alternative measures of macro-financial shocks. In Column (1), the new results based on implied volatility are consistent with the baseline results reported in Table 4.[10] Estimates reported in Columns (2) and (3) show that alternative proxies for shocks produce results consistent with the baseline results in Table 4.

Another concern is that the above results might be driven by some time-varying fund-level market factors. To address this concern, we introduce the three Fama-French factors, i.e. MKT, SMB and HML, as control variables in the regression model. More specifically, the three Fama-French factors can be classified as emerging market and developed market, which can further be divided into four areas (i.e. North America, Europe, Japan and Asia Pacific ex Japan).[11] Therefore, we match the five groups (i.e. emerging market plus the four developed markets) of the three Fama-French factors with our ETFs based on their domicile financial markets, and this allows us to control for specific fund-level market factors. As shown in Table 6, the new results are consistent with the baseline results in Table 4.

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[9] The CBO-estimated monetary policy stance is calculated as the difference between the effective federal funds rate and the rules-implied rate estimated for the CBO forecasts.

[10] It is noteworthy that as data on implied volatility is only available for 20 equity markets (this study includes a total of 51 markets, which are listed in Appendix Table A1), the number of observation drops to fewer than 400,000 from more than 560,000 in the original estimations.

[11] See Appendix Table A1 for further details.

Table 5. Robustness Test for Shock Measures

VARIABLE	(1) $FundFlow(\%)$	(2) $FundFlow(\%)$	(3) $FundFlow(\%)$
$ImpVol$	-0.023***		
	(0.004)		
$ESG \times ImpVol$	0.027**		
	(0.012)		
EPU		-0.001***	
		(0.000)	
$ESG \times EPU$		0.002***	
		(0.001)	
MPS_{CBO}			-0.127***
			(0.009)
$ESG \times MPS_{\mathrm{CBO}}$			0.079***
			(0.024)
$\ln(TNA)_{t-1}$	-5.885***	-5.954***	-5.808***
	(0.152)	(0.135)	(0.135)
NAV_{t-1}	0.056***	0.062***	0.057***
	(0.003)	(0.003)	(0.003)
$Return_{t-1}$	7.879***	6.137***	6.201***
	(0.322)	(0.244)	(0.249)
$\ln(OutShare)$	7.627***	7.536***	7.244***
	(0.207)	(0.189)	(0.191)
Constant	10.967***	8.435***	8.365***
	(0.300)	(0.212)	(0.205)
No. of Observations	390,958	564,094	564,094
No. of ETFs	5,820	8,681	8,681
R-squared	0.169	0.170	0.162
Fund fixed effect	Yes	Yes	Yes
Exposure-year fixed effect	Yes	No	No
Domicile-year fixed effect	No	Yes	No
Exposure fixed effect	No	No	Yes
Domicile fixed effect	No	No	Yes
Year fixed effect	No	No	Yes

Note: Standard errors clustered at the fund level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

Source: Authors' estimation.

Table 6. Robustness Test for the Fama-French Factors

VARIABLES	(1) $FundFlow(\%)$	(2) $FundFlow(\%)$	(3) $FundFlow(\%)$
$MktVol$	-0.026**		
	(0.010)		
$ESG \times MktVol$	0.185***		
	(0.043)		
$stdEPU$		-0.068***	
		(0.019)	
$ESG \times stdEPU$		0.195***	
		(0.070)	
MPS_{SPF}			-0.148***
			(0.009)
$ESG \times MPS_{\text{SPF}}$			0.119***
			(0.026)
$\ln(TNA)_{t-1}$	-5.956***	-5.952***	-5.803***
	(0.134)	(0.135)	(0.135)
NAV_{t-1}	0.060***	0.062***	0.057***
	(0.003)	(0.003)	(0.003)
$Return_{t-1}$	6.055***	6.164***	6.274***
	(0.249)	(0.248)	(0.255)
$\ln(OutShare)$	7.421***	7.533***	7.242***
	(0.189)	(0.189)	(0.191)
MKT	0.003	0.006**	0.008***
	(0.002)	(0.003)	(0.002)
SMB	0.004	-0.002	0.015***
	(0.005)	(0.005)	(0.005)
HML	0.028***	0.031***	0.030***
	(0.003)	(0.003)	(0.003)
Constant	8.618***	8.334***	8.316***
	(0.204)	(0.208)	(0.205)
No. of Observations	564,094	564,094	564,094
No. of ETFs	8,681	8,681	8,681
R-squared	0.168	0.170	0.163
Fund fixed effect	Yes	Yes	Yes
Exposure-year fixed effect	Yes	No	No
Domicile-year fixed effect	No	Yes	No
Exposure fixed effect	No	No	Yes
Domicile fixed effect	No	No	Yes
Year fixed effect	No	No	Yes

Note: Standard errors clustered at the fund level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

Source: Authors' estimation.

c. Heterogeneity of the ESG effect?

We also examine the heterogeneity of the ESG effect in terms of funds' (1) domicile financial market and (2) investment recipient economy.

The ESG's "stabilising effect" is more pronounced for emerging market-domiciled or EME-exposed ETFs, which can be explained by the fact that ESG plays a more important role in a market/economy where funds are younger with shorter performance track records.

To examine whether the effect of the ESG attribute varies from those domiciled in developed markets to those domiciled in emerging markets, we introduce a binary variable, $Domicile_{EM}$, which is equal to one if the fund is domiciled in emerging markets, and is equal to zero otherwise. In our sample, 2,270 ETFs are domiciled in emerging markets and 6,411 ETFs are domiciled in developed markets. We add $Domicile_{EM}$ as a triple difference estimator in the regression, and $ESG \times MktVol \times Domicile_{EM}$ indicates the heterogeneous effect of the ESG attribute on fund flows with respect to *market stress* between emerging market-domiciled and developed market-domiciled ETFs.

In Column (1) of Table 7, the coefficient of $ESG \times MktVol \times Domicile_{EM}$ is positive and statistically significant. This confirms the heterogeneous nature of the ESG attribute regarding emerging market-domiciled and developed market-domiciled ETFs in that ESG has a more pronounced "stabilising effect" for emerging market-domiciled ETFs in response to *market stress*. When $MktVol$ increases by one standard deviation, emerging market-domiciled ESG funds mitigate 0.387% of outflows, compared to developed market-domiciled ESG funds.

To examine whether the effect of the ESG attribute varies significantly from AEs to EMEs, we introduce a binary variable, $Exposure_{EME}$, which is equal to one if the fund invests only in EMEs, and is equal to zero otherwise. In our regression, 1,464 ETFs invest only in EMEs, 7,217 ETFs are AE-exposed ETFs (4,261 ETFs invest in AEs and 2,956 ETFs are hybrid investment). We add $Exposure_{EME}$ as a triple difference estimator in the regression, and the triple

interaction term $ESG \times stdEPU \times Exposure_{EME}$ indicates the heterogeneous effect of the ESG attribute on fund flows with respect to *economic policy uncertainty* between EME-exposed and AE-exposed ETFs.

In Column (2) of Table 7, the coefficient of $ESG \times stdEPU \times Exposure_{EME}$ is positive and statistically significant. This confirms the heterogeneous effect of ESG attribute between EME- and AE-exposed ETFs in that ESG has a more pronounced "stabilising effect" for EME-exposed ETFs in response to *economic policy uncertainty*. When $stdEPU$ increases by one standard deviation, EME-exposed ESG funds mitigate 0.617% of outflows, compared to AE-exposed ESG funds.

A plausible explanation for the heterogeneous stabilising effects is that developed market-domiciled (AE-exposed) funds are in general "older" than emerging market-domiciled (EME-exposed) funds. In our sample, developed market-domiciled funds have an average age of about 92 months, compared with emerging market-domiciled funds, which have an average age of about 63 months. Similarly, AE-exposed funds have an average age of 87 months, compared with EME-exposed funds, which have an average age of about 76 months.

Compared to emerging market-domiciled (EME-exposed) funds, developed market-domiciled (AE-exposed) funds generally have longer performance track records with which investors can analyse their investment worthiness, especially their performances in case of an increase in market stress or economic policy uncertainty. As the track record of a fund lengthens with its age, the importance of its actual performance grows in the decision-making processes of investors whereas other attributes, including ESG quality, fade into relative insignificance (Chevalier and Ellison, 1997).

Table 7. Heterogeneity

VARIABLE	(1) $FundFlow(\%)$	(2) $FundFlow(\%)$	(3) $FundFlow(\%)$	(4) $FundFlow(\%)$
$MktVol$	-0.020*		-0.020*	
	(0.011)		(0.011)	
$ESG \times MktVol$	0.155***		0.513***	
	(0.044)		(0.191)	
$MktVol \times Domicile_{EM}$	-0.003			
	(0.026)			
$ESG \times MktVol \times Domicile_{EM}$	0.387**			
	(0.184)			
$stdEPU$		-0.059***		-0.057***
		(0.020)		(0.020)
$ESG \times stdEPU$		0.143*		0.722**
		(0.074)		(0.310)
$stdEPU \times Exposure_{EME}$		-0.047		
		(0.048)		
$ESG \times stdEPU \times Exposure_{EME}$		0.617**		
		(0.246)		
$ESG \times MktVol \times \ln(FundAge)$			-0.089*	
			(0.050)	
$ESG \times stdEPU \times \ln(FundAge)$				-0.157*
				(0.085)
$\ln(TNA)_{t-1}$	-5.957***	-5.954***	-6.103***	-6.072***
	(0.134)	(0.135)	(0.148)	(0.150)
NAV_{t-1}	0.060***	0.062***	0.061***	0.063***
	(0.003)	(0.003)	(0.003)	(0.003)
$Return_{t-1}$	6.040***	6.123***	6.142***	6.209***
	(0.245)	(0.244)	(0.261)	(0.261)
$\ln(OutShare)$	7.422***	7.535***	7.676***	7.757***
	(0.189)	(0.189)	(0.206)	(0.206)
Constant	8.617***	8.340***	8.846***	8.518***
	(0.204)	(0.207)	(0.228)	(0.232)
No. of Observations	564,094	564,094	496,840	496,840
No. of ETFs	8,681	8,681	7,895	7,895
R-squared	0.168	0.170	0.168	0.170
Fund fixed effect	Yes	Yes	Yes	Yes
Exposure-year fixed effect	Yes	No	Yes	No
Domicile-year fixed effect	No	Yes	No	Yes

Note: Standard errors clustered at the fund level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively. In the last two columns, ETFs with no information on listing date or an insufficient record (less than 3 months) have been excluded from the regression.
Source: Authors' estimation.

To test this hypothesis, we introduce two triple interaction terms, $ESG \times MktVol \times \ln(FundAge)$ and $ESG \times stdEPU \times \ln(FundAge)$ to assess how the "stabilising effect" of the ESG attribute changes with the funds' age (i.e. longer track records) in the face of an increase in market stress and economic policy uncertainty. In Columns 3 and 4 of Table 7, **the negative and statistically significant coefficients on the triple interaction terms suggest that the stabilising effect of the ESG attribute would be lessened for the older funds with longer performance track records.**

IV. CONCLUSION AND POLICY IMPLICATION

This study examines the differences between fund flows of ESG and non-ESG funds in response to three types of macro-financial shocks: market stress, economic policy uncertainty and global monetary condition. Our baseline estimations use the standard deviation of daily return on benchmark equity index ($MktVol$), the standardised EPU index ($stdEPU$) and the SPF-estimated monetary policy stance (MPS_{SPF}) to gauge these three types of shocks. The baseline results find the **ESG funds mitigate fund outflows compared to non-ESG funds under all three types of macro-financial shocks**. Further estimations reveal the heterogeneous nature of the effect of the ESG attribute. Regarding market stress, we find that ESG's stabilising effect on shock-induced fund outflows is more pronounced for emerging market-domiciled ETFs than for developed market-domiciled ETFs. With regard to economic policy uncertainty, the stabilising effect of the ESG attribute is stronger for EME-exposed ETFs than for AE-exposed ETFs.

Our findings could have profound policy implications for promoting ESG investment and are critical to the monitoring and strengthening of financial stability. To visually demonstrate the interconnectivity of fund flows via ETFs, Chart 4A and Chart 4B show the networks for all ETFs and ESG ETFs respectively, based on the data in the first half of 2023. The size of a node is proportional to the market capitalisation of a market's ETFs as a percentage of

the total market capitalisation of all ETFs. Each arrowed edge represents a group of ETFs connecting from one domicile financial market to their investment recipient economies. Based on our findings, a higher density of ESG ETFs represents a more resilient network against the macro-financial shocks. Chart 4B exhibits that ESG ETFs across Asia-Pacific economies[12] have a density that is significantly lower than the network of developed markets, i.e. **Asia-Pacific has a lower ESG-derived resilience against macro-financial shocks**. This calls for more policy efforts in promoting ESG development in the region. In addition, as the stabilising effect of the ESG attribute is more pronounced for both emerging market-domiciled and EME-exposed ETFs, and the Asia-Pacific region consists of (1) numerous emerging markets and (2) a developed market that has significant exposure to EMEs,[13] the marginal benefit from ESG investment promotion on financial stability could arguably be even larger for the Asia-Pacific region than for developed markets.

[12] Asia-Pacific economies refer to Australia, China, Hong Kong, Indonesia, Japan, South Korea, Malaysia, New Zealand, the Philippines, Singapore and Thailand.

[13] In our sample, there are 226 Hong Kong-domiciled ETFs, 46.4% of which are EME-exposed ETFs. This proportion is significantly higher than that for Singapore (16.6%), Japan (6.3%), Australia (2.2%) and New Zealand (0%).

Chart 4A. Fund Flow Network for All Equity ETFs in the First Half of 2023

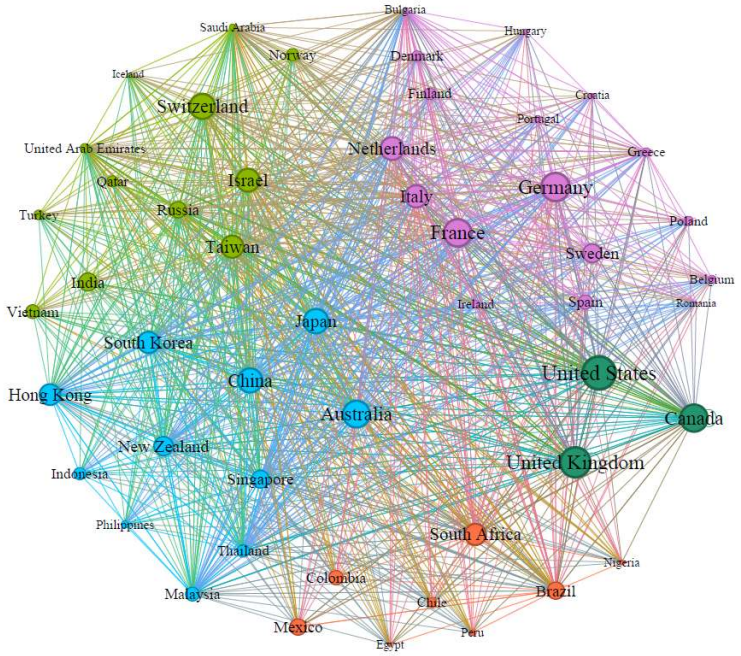
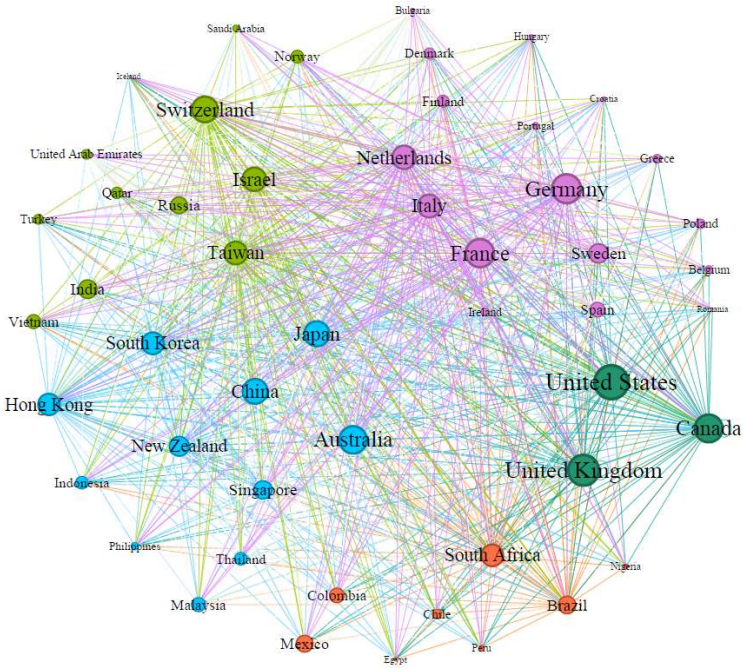


Chart 4B. Fund Flow Network for ESG Equity ETFs in the First Half of 2023



Note: Economies are grouped into five areas: United States-United Kingdom-Canada (in dark green), European Union (in purple), Asia-Pacific (in blue), Eurasia (in yellow green), and Africa and Latin America (in orange).
Sources: Bloomberg, Authors' estimation.

Appendix

Table A1. The Information on Benchmark Equity Index

Domicile	Benchmark Equity Index	Bloomberg Ticker	Implied Volatility	Fama-French Classification
Australia	S&P/ASX 200	AS51 Index	Y	Asia Pacific ex Japan
Belgium	BEL 20 Index	BEL20 Index		Europe
Brazil	Ibovespa Brasil Sao Paulo Stock Exchange Index	IBOV Index	Y	Emerging Markets
Bulgaria	SOFIX Index	SOFIX Index		Emerging Markets
Canada	S&P/TSX Composite Index	SPTSX Index		North America
Chile	S&P/CLX IPSA CLP TR	IPSA Index		Emerging Markets
China	Shanghai Shenzhen CSI 300 Index	SHSZ300 Index		Emerging Markets
Colombia	FTSE Colombia Index	WICOL Index		Emerging Markets
Croatia	Croatia Zagreb Stock Exchange Crobex Index	CRO Index		Emerging Markets
Denmark	OMX Copenhagen 20	KFX Index		Europe
Egypt	Egyptian Financial Group Hermes Stock Market Index	HERMES Index		Emerging Markets
Finland	OMX Helsinki 25 Index	HEX25 Index	Y	Europe
France	CAC 40 Index	CAC Index	Y	Europe
Germany	Deutsche Boerse AG German Stock Index DAX	DAX Index	Y	Europe
Greece	Athens Stock Exchange General Index	ASE Index		Europe
Hong Kong	Hang Seng Index	HSI Index	Y	Asia Pacific ex Japan
Hungary	Budapest Stock Exchange Budapest Stock Index	BUX Index	Y	Emerging Markets
Iceland	OMX Iceland All-Share PI	ICEXI Index		Emerging Markets
India	S&P BSE SENSEX Index	SENSEX Index	Y	Emerging Markets
Indonesia	Jakarta Stock Exchange LQ45 Index	LQ45 Index		Emerging Markets
Ireland	ISEQ All-Share Index	ISEQ Index		Europe
Israel	Tel Aviv Stock Exchange 35 Index	TA-35 Index	Y	Emerging Markets
Italy	FTSE MIB Index	FTSEMIB Index	Y	Europe
Japan	Tokyo Stock Exchange Tokyo Stock Price Index TOPIX	TPX Index	Y	Japan

Malaysia	FTSE Bursa Malaysia Top 100 Index	FBM100 Index		Emerging Markets
Mexico	S&P/BMV IPC	MEXBOL Index		Emerging Markets
Netherlands	AEX-Index	AEX Index	Y	Europe
New Zealand	S&P/NZX All Index	NZSE Index		Asia Pacific ex Japan
Nigeria	NGX All Share Index	NGXINDX Index		Emerging Markets
Norway	Oslo Stock Exchange Benchmark Index	OSEBX Index		Europe
Peru	S&P/BVL Peru General Total Return PEN Index	SPBLPGPT Index		Emerging Markets
Philippines	Philippines Stock Exchange PSEi Index	PCOMP Index		Emerging Markets
Poland	WIG20	WIG20 Index	Y	Emerging Markets
Portugal	PSI 20 Index	PSI20 Index	Y	Europe
Qatar	Qatar Exchange Index	DSM Index		Emerging Markets
Romania	Bucharest Stock Exchange Trading Index	BET Index		Emerging Markets
Russia	MOEX Russia Index	IMOEX Index		Emerging Markets
Saudi Arabia	Tadawul All Share Index	SASEIDX Index		Emerging Markets
Singapore	Straits Times Index STI	STI Index		Asia Pacific ex Japan
South Africa	FTSE/JSE Africa Top40 Tradeable Index	TOP40 Index		Emerging Markets
South Korea	Korea Stock Exchange KOSPI Index	KOSPI Index		Emerging Markets
Spain	IBEX 35 Index	IBEX Index		Europe
Sweden	OMX Stockholm 30 Index	OMX Index	Y	Europe
Switzerland	Swiss Market Index	SMI Index	Y	Europe
Taiwan	Taiwan Stock Exchange Weighted Index	TWSE Index	Y	Emerging Markets
Thailand	Stock Exchange of Thailand SET 50 Index	SET50 Index	Y	Emerging Markets
Turkey	Borsa Istanbul 100 Index	XU100 Index		Emerging Markets
U.K.	FTSE 100 Index	UKX Index	Y	Europe
U.S.	S&P 500 INDEX	SPX Index	Y	North America
United Arab Emirates	FTSE ADX GENERAL INDEX	ADSMI Index		Emerging Markets
Vietnam	Vietnam Ho Chi Minh Stock Index / VN-Index	VNINDEX Index		Emerging Markets

Sources: Bloomberg, Ken French's Data Library.

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