

Tracking Ability of iShares Country ETFs During the Covid–19 Pandemic

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Abstract

This paper explores benchmark tracking behavior of Country ETFs during the US market crash in March 2020, following the Covid–19 pandemic announcement by the World Health Organization (WHO). Using daily data spanning January 22, 2020, through April 17, 2020, we examine the tracking errors of 37 iShare country ETFs, 19 of which track developed markets while the remaining 18 track emerging markets. We run one and two–factor pricing regressions for the country ETFs and measure the tracking errors from the regression residuals. We find that 17 out of 19 developed market ETFs tracked their underlying benchmarks closely during the pandemic, while only 10 out of 18 emerging market ETFs tracked their benchmarks closely during that turbulent market period. The findings indicate that the developed markets country ETFs remained more useful investment vehicles for international diversification during the Covid–19 pandemic than their emerging market counterparts.

Keywords: Country Exchange Traded Funds (ETFs), Covid – 19, Tracking Error, International Diversification

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I Introduction

Country Exchange Traded Funds (ETFs), domiciled in the US, are designed to invest in overseas financial markets. They provide international diversification opportunities in a relatively efficient and cost-effective way, and they attract US investors that are interested in gaining foreign market exposure. Foreign capital markets that are targeted by these ETFs include developed markets, such as Japan and the UK, as well as emerging markets such as Malaysia and South Korea. During periods of low correlation between US and foreign stock markets, these funds offer diversification benefits to US investors. Although the main objective of these funds is to invest in overseas capital markets, they are also exposed to the US market in addition to the underlying foreign markets. Given that ETFs account for approximately half of all US stock trades (Buckle, et al, 2018) and that they have surpassed index futures with regard to price discovery leads (Deville et al, 2014), examination of ETFs is essential for understanding the landscape of current financial markets.

Additionally, emerging and developed market ETF performance warrants further research. Khan et al (2015) find that emerging market ETFs less effectively replicate indices and account for greater tracking errors than developed market ETFs. Similarly, Blitz and Huij (2012) and Neto et al (2021) find higher tracking errors in emerging market ETFs, relative to developed market ETFs. Zawadzki (2020) finds that tracking errors are significantly negative when analyzing ETF performance relative to their benchmark indeces, regardless of geographic location or degree of

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market development. Correspondingly, Shin and Soydemir (2010) find that tracking errors are significantly negative when estimating the tracking errors and performance of ETFs over their benchmark indexes. When considering underlying factors, the authors find that changes in exchange rates significantly impact tracking errors. Geographic location is also found to affect information dissemination and liquidity risk. Consequently, consideration of market conditions, replication techniques, and risk adjusted performance levels necessitate further analysis.

Finally, Covid's impact on market performance is evidenced in the strained performance in European investment funds (Mirza et al, 2020), underperforming mutual funds (Pastor and Vorsatz, 2020), and significant outflows in corporate bond funds (Falato et al, 2021). It stands to reason that other investment vehicles and markets have been impacted by the pandemic.

The objective of this paper is to explore benchmark tracking behavior of Country ETFs during the US market crash in March 2020, following the Covid-19 pandemic announcement by the World Health Organization (WHO). To achieve the objective, we measure and analyze tracking errors of country ETFs before and after the Covid-19 pandemic. The rest of the paper is organized as follows: Section 2 explains measures of tracking errors used in this paper while Section 3 discusses data and estimation methodology. Section 4 presents results and analysis and section 5 concludes the paper.

II Measures of Tracking Errors

Consider an ETF that is domiciled in the US but aims to replicate a foreign benchmark. The relevant pricing equation for the fund is

$$R_{i,t+1} = \alpha + \beta_B R_{B,t+1} + u_{1,it+1} \quad (1)$$

where, R_{it+1} , is the return on a Country ETF domiciled in the US, R_{Bt+1} , is the return on the benchmark index, α and β_B are the estimated coefficients and u_{it} is the error term. In the spirit of mean-variance spanning tests (Huberman and Kandel, 1987, and De Roon and Nijman, 2001), acceptance of the joint null hypothesis that $\alpha = 0$ and $\beta_B = 1$ would mean that the return on the country ETF is explained by the return on the benchmark asset alone.

Measures of tracking error

Petajisto (2013) calculates tracking error, expressed as TE_P in his paper as follows.

$$TE_P \equiv stdev(R_{ETF} - R_B)$$

where, tracking error, TE_P is measured as the standard deviation (*stdev*) of the return differential between a fund and the underlying index. Petajisto (2013) observes that this measure can capture volatility in a fund's return that is not explained by the underlying benchmark return movement. A slightly different version, TE_{CP} , is employed in Cremers and Petajisto (2009),

$$TE_{CP} \equiv stdev(u_{it+1})$$

where, the time series of the error term is obtained from equation (1) and $TE(1)$ will give us the tracking error statistic.

Exposure to the US market and incremental tracking error

Several studies document that country ETFs that are domiciled in the US are also significantly affected by the movements in the US market (Zhong and Yang, 2005; Phengpis, C., & Swanson, P. E., 2009; Levy and Lieberman, 2013). In fact, Yavas and Rezayat (2016) find that there is US market volatility spillover to other countries, and Shum (2010) concludes that a behavioral correlation between international equity ETFs and US stocks exists. Considering this, we extend the definition of the tracking error in the relevant literature and propose a measure of “incremental tracking error” that would capture funds tilting towards the US market.

To this aim, a second two-factor specification is utilized,

$$R_{it+1} = \alpha + \beta_B R_{B,t+1} + \beta_{US} R_{US,t+1} + u_{2,it+1} \quad (2)$$

where, $R_{US,t}$ is return on the US market. As with $TE(1)$ above, we now calculate the tracking error statistic using the formula, $TE_{CP} \equiv stdev(u_{it+2})$ and name it $TE(2)$.

If $TE(2) > TE(1)$, then it would mean that an ETF is more closely following its benchmark country index corresponding to a higher tracking ability. This is because introduction of an additional explanatory variable, namely, return on the US market, has resulted in the error variance to increase reducing the tracking ability. On the other hand, if $TE(2) < TE(1)$, then the ETF is also following the US market index in addition to its underlying country benchmark corresponding to a lower tracking ability. Based on the observations above, the incremental tracking error then can be calculated as the difference between tracking errors obtained from equation (1) and (2)

$$ITE \equiv TE(2) - TE(1)$$

where, $TE(1)$ and $TE(2)$ are tracking errors calculated from the one- and two-factor pricing regressions, respectively. Intuitively, ITE would capture the extent of deviation in risk exposure of the ETFs due to their additional exposure to the US market. For an ETF, a higher value of ITE would occur when it is closely following its underlying benchmark, indicating its higher tracking ability. Conversely, a lower value of ITE would indicate lower tracking ability of an ETF.

A particular problem with the above measure, i.e. ITE , is the tracking ability outlined above would depend on the fund size, investment style, return volatility and other factors. Therefore, comparison of ITE across funds will not be useful. In order to account for these fund related factors, we also use yet another measure, namely, tracking error ratio, TER , which is merely the ratio of ITE to $TE(1)$ for each fund,

$$TER \equiv ITE \div TE(1)$$

TER shows how much incremental tracking error an ETF has as a proportion of its current tracking error (based on a single factor model).

III. Data and Methodology

The objective of this paper is to examine the behavior of country ETFs in relation to their benchmark indexes during the Covid-19 period as compared to the similar period immediately

before Covid–19. The Covid19 period spans March 09, 2020, to March 21, 2021, while the period before Covid–19 spans from March 06, 2019, to March 04, 2020. Table 1 presents a list of country ETFs that are included in our sample along with their details.

There are 19 developed market ETFs (Panel A) and 18 emerging market ETFs (Panel B). The ETF inception dates range from 1996 to as recently as 2015, in the case of Saudi Arabia. The largest ETFs in terms of net assets are predominantly found in Asian countries including Japan, South Korea, Taiwan, and China, while the smallest are in United Arab Emirates, Norway, Finland, and Belgium.

In this paper, we focus on the iShares country ETFs sponsored BlackRock Inc. Daily ETFs and their related data are downloaded from the iShares website. To avoid market microstructure, trading related noise, and time differences between the US and the benchmark country, we choose to use Wednesday (middle of the week) returns. For Return on ETFs and on their benchmark, indeces are calculated as $R_{t+1} \equiv (P_{t+1} - P_t)/P_t$ where, P_t is the market value of an ETF or that of an underlying benchmark at time t .

IV. Results and Analysis

This section presents the main results and their analysis. Table 2 presents the descriptive statistics of the weekly returns for the country ETF (subscript ETF) as well as their underlying benchmarks (subscript B). Mean returns are denoted with μ and their standard deviation with σ over the sample period before and during Covid–19. Panel A reports summary statistics for the developed markets and Panel B for the emerging markets. For both the developed and emerging markets, the ETFs have produced negative average weekly returns for most countries pre- Covid-19, except for Denmark, New Zealand, Switzerland, and Taiwan. During Covid-19, the average weekly return of all country ETFs for the time span is positive.

Next, we run one– and two–factor pricing regressions as given equations (1) and (2), respectively, for both developed and emerging markets. In the unreported results¹, the beta coefficients for the benchmark markets are all highly significant as expected in both regression specifications in both developed and emerging markets. As for the beta coefficients for the US market in the two–factor specification, all are insignificant for both developed and emerging markets. (except for Indonesia and Saudi Arabia during Covid–19).

Table 3 presents the coefficients of correlation between returns on a specific country ETF and the US market. As can be seen from the table, degree of correlations across developed market ETFs and the US market are presented. For example, for Canada ETF, the correlation coefficient before Covid–19 was very high at 0.93, while during Covid – 19, the coefficient has decreased to 0.86. Overall, 15 out of 19 developed market ETFs experienced lower coefficients of correlation during COVID-19 compared with the period before COVID-19. Lower correlations between an ETF and the US market would help investors effectively diversify their portfolio during the volatile COVID-19 period. Now, we turn to our focus of this paper which is tracking errors comparison. Table 3 also presents tracking errors for the developed market ETFs measured based on one–factor and two–factor regression specifications. Tracking errors are presented for the sample period before and during Covid–19 phases. Tracking errors are expressed as a percentage with higher percentage indicating a greater level of tracking errors.

¹ The results are available from the authors upon request.

Table 1: List of Country ETFs

Country	Ticker	Inception	Exp Ratio	Holdings	Net Assets
Panel A: Developed Markets					
Australia	EWA	03/12/1996	0.51%	67	\$1,366,186,358
Austria	EWO	03/12/1996	0.51%	26	\$58,186,963
Belgium	EWK	03/12/1996	0.51%	44	\$37,486,707
Canada	EWC	03/12/1996	0.51%	89	\$3,720,817,656
Denmark	EDEN	01/25/2012	0.53%	46	\$169,735,000
Finland	EFNL	01/25/2012	0.53%	38	\$33,953,356
France	EWQ	03/12/1996	0.51%	73	\$781,823,632
Germany	EWG	03/12/1996	0.51%	63	\$2,651,372,558
Hong Kong	EWH	03/12/1996	0.51%	38	\$1,354,114,835
Italy	EWI	03/12/1996	0.51%	27	\$346,924,834
Japan	EWJ	03/12/1996	0.51%	301	\$12,803,466,724
Netherlands	EWN	03/12/1996	0.51%	56	\$317,639,880
New Zealand	ENZL	09/01/2010	0.51%	25	\$187,832,493
Norway	ENOR	01/23/2012	0.53%	56	\$33,224,074
Singapore	EWS	03/12/1996	0.51%	19	\$721,331,076
Spain	EWP	03/12/1996	0.51%	18	\$515,269,550
Sweden	EWD	03/12/1996	0.38%	38	\$472,486,390
Switzerland	EWL	03/12/1996	0.51%	40	\$1,636,556,853
United Kingdom	EWU	03/12/1996	0.51%	89	\$3,488,841,952
Panel B: Emerging Markets					
Brazil	EWZ	07/10/2000	0.59%	53	\$5,817,145,722
Chile	ECH	11/12/2007	0.59%	31	\$522,040,622
China	MCHI	03/29/2011	0.59%	597	\$6,478,298,025
India	INDA	02/02/2012	0.69%	96	\$5,428,738,787
Indonesia	EIDO	05/05/2010	0.59%	75	\$331,979,197
Malaysia	EWM	03/12/1996	0.51%	38	\$312,066,551
Mexico	EWX	03/12/1996	0.51%	47	\$1,167,219,884
Philippines	EPHE	09/28/2010	0.53%	38	\$132,787,837
Poland	EPOL	05/25/2010	0.59%	35	\$229,222,919
Qatar	QAT	04/29/2014	0.59%	31	\$80,373,331
Russia	ERUS	11/09/2010	0.59%	25	\$483,163,386
Saudi Arabia	KSA	09/16/2015	0.74%	79	\$728,442,470
South Africa	EZA	02/03/2003	0.59%	37	\$363,063,448
South Korea	EWY	05/9/2000	0.59%	106	\$7,577,938,639
Taiwan	EWT	06/20/2000	0.59%	89	\$6,670,504,493
Thailand	THD	03/26/2008	0.59%	119	\$425,044,503
Turkey	TUR	03/26/2008	0.59%	51	\$250,562,287
United Arab Emirates	UAE	04/29/2014	0.59%	32	\$27,857,871

Notes: All iShares country ETFs track related foreign country Index constructed and maintained by MSCI. Fund information valid as of 03/31/2021.

Table 2: Returns Mean and Standard Deviation of Country ETFs and their Benchmarks

Country	Before Covid – 19				During Covid–19			
	μ_{ETF}	σ_{ETF}	μ_B	σ_B	μ_{ETF}	σ_{ETF}	μ_B	σ_B
Panel A: Developed Markets								
Australia	-0.28%	2.61%	-0.20%	2.62%	0.71%	4.44%	0.76%	4.41%
Austria	-0.45%	3.19%	-0.39%	3.19%	0.90%	6.34%	0.92%	6.40%
Belgium	-0.24%	2.56%	-0.18%	2.55%	0.62%	4.85%	0.57%	4.86%
Canada	-0.27%	2.85%	-0.22%	2.87%	0.86%	4.64%	0.90%	4.62%
Denmark	0.01%	2.59%	0.07%	2.57%	0.88%	3.38%	0.90%	3.38%
Finland	-0.39%	2.82%	-0.28%	2.82%	0.78%	3.99%	0.84%	3.95%
France	-0.23%	2.79%	-0.18%	2.80%	0.74%	5.14%	0.77%	5.13%
Germany	-0.26%	2.71%	-0.21%	2.71%	0.79%	5.10%	0.84%	5.10%
Hong Kong	-0.28%	2.77%	-0.21%	2.82%	0.43%	3.05%	-0.48%	3.01%
Italy	-0.32%	3.26%	-0.23%	3.29%	0.74%	4.65%	0.78%	4.64%
Japan	-0.13%	1.56%	-0.08%	1.57%	0.65%	2.90%	0.68%	2.88%
Netherlands	-0.07%	2.59%	-0.01%	2.57%	0.98%	4.11%	1.01%	4.11%
New Zealand	0.11%	1.94%	0.19%	1.92%	0.49%	3.94%	0.54%	3.92%
Norway	-0.65%	3.67%	-0.58%	3.67%	1.01%	5.02%	1.07%	4.99%
Singapore	-0.29%	2.19%	-0.19%	2.24%	0.31%	3.51%	0.37%	3.49%
Spain	-0.43%	2.99%	-0.35%	3.01%	0.48%	4.70%	0.53%	4.67%
Sweden	-0.13%	3.11%	-0.06%	3.10%	1.01%	4.03%	1.03%	4.02%
Switzerland	0.10%	2.01%	0.14%	2.00%	0.42%	2.90%	0.45%	2.87%
UK	-0.42%	2.69%	-0.33%	2.71%	0.47%	4.34%	0.53%	4.32%
Panel B: Emerging Markets								
Brazil	-0.53%	4.71%	-0.46%	4.75%	0.44%	6.84%	0.49%	6.82%
Chile	-1.02%	4.06%	-0.98%	4.05%	0.76%	6.32%	0.81%	6.28%
China	-0.03%	2.83%	0.01%	2.87%	0.72%	3.91%	0.75%	3.90%
India	-0.20%	2.60%	-0.18%	2.69%	0.73%	3.75%	0.78%	3.79%
Indonesia	-0.46%	3.10%	-0.40%	3.12%	0.47%	6.47%	0.50%	6.42%
Malaysia	-0.39%	1.48%	-0.32%	1.52%	0.29%	3.55%	0.33%	3.51%
Mexico	-0.25%	3.66%	-0.19%	3.67%	0.48%	4.57%	0.52%	4.57%
Philippines	-0.35%	2.24%	-0.32%	2.24%	0.19%	4.47%	-0.21%	4.49%
Poland	-0.81%	3.69%	-0.77%	3.73%	0.50%	4.31%	0.53%	4.24%
Qatar	-0.32%	2.15%	-0.24%	2.08%	0.40%	2.39%	0.49%	2.27%
Russia	-0.19%	3.75%	-0.03%	3.81%	0.70%	5.55%	0.79%	5.58%
Saudi Arabia	-0.52%	3.18%	-0.47%	3.19%	0.74%	2.72%	0.79%	2.70%
South Africa	-0.65%	3.63%	-0.39%	3.89%	0.68%	5.60%	0.80%	5.57%
South Korea	-0.28%	3.23%	-0.23%	3.31%	1.11%	4.53%	1.13%	4.52%
Taiwan	0.22%	2.15%	0.28%	2.24%	0.92%	3.20%	0.96%	3.18%
Thailand	-0.54%	2.74%	-0.48%	2.74%	0.53%	4.48%	0.58%	4.40%
Turkey	-0.25%	4.27%	-0.16%	4.27%	0.48%	5.33%	0.50%	5.34%
UAE	-0.59%	2.87%	-0.47%	2.62%	0.54%	4.19%	0.64%	3.98%

Table 3: Tracking Errors Comparisons: Developed Markets

Country	Before Covid – 19			During Covid–19		
	Corr	TE _{CP} (1F)	TE _{CP} (2F)	Corr	TE _{CP} (1F)	TE _{CP} (2F)
Australia	0.79	0.34%	0.33%	0.66	0.07%	0.33%
Austria	0.86	0.47%	0.63%	0.75	0.28%	0.47%
Belgium	0.84	0.34%	0.39%	0.76	0.10%	0.34%
Canada	0.93	0.36%	0.36%	0.86	0.18%	0.36%
Denmark	0.85	0.49%	0.40%	0.69	0.48%	0.49%
Finland	0.80	0.38%	0.23%	0.79	0.16%	0.38%
France	0.92	0.39%	0.49%	0.77	0.27%	0.39%
Germany	0.90	0.62%	0.38%	0.81	0.33%	0.63%
Hong Kong	0.55	0.28%	0.28%	0.64	0.31%	0.32%
Italy	0.89	0.49%	0.50%	0.75	0.19%	0.50%
Japan	0.63	0.21%	0.21%	0.65	0.12%	0.21%
Netherlands	0.92	0.40%	0.30%	0.81	0.23%	0.40%
New Zealand	0.55	0.38%	0.29%	0.59	0.23%	0.38%
Norway	0.89	0.31%	0.34%	0.75	0.66%	0.30%
Singapore	0.78	0.29%	0.38%	0.69	0.23%	0.29%
Spain	0.84	0.38%	0.38%	0.72	0.25%	0.38%
Sweden	0.83	0.35%	0.35%	0.80	0.11%	0.35%
Switzerland	0.91	0.23%	0.47%	0.74	0.22%	0.23%
UK	0.88	0.43%	0.43%	0.76	0.27%	0.43%

Notes: Corr is the correlation coefficient between a Country ETF and the US market. $TE_{CP} \equiv \text{stdev}(u_{it})$ is tracking errors based on the regression errors from one- or two-factor pricing models given in equations (1) and (2), respectively.

Like the previous table, Table 4 begins with reporting coefficients of correlation between emerging market ETFs and the US market. The degree of correlation across emerging market ETFs and the US market varies across countries, both before and after COVID–19. Overall, for 9 out of 17 emerging market ETFs, the correlation coefficients have decreased during COVID–19 compared to the period immediately before COVID-19. Table 4 also presents tracking errors for the emerging markets ETFs. Tracking errors for most ETFs are lower during Covid-19 compared to before Covid-19, but this was more prevalent in developed market ETFs relative to emerging market ETFs.

Table 5 presents ITR and TER for developed market ETFs in our sample. As seen in the last column of the table, 17 out of 19 ETFs experienced an increase in the TER during the covid–19 period. In other words, ETFs tracking the developing countries in our sample were in fact more closely tracking their underlying benchmarks than pre-pandemic period. This finding is not unexpected since almost all developed markets had similar economic and market conditions as in the US during the pandemic. Consequently, ETF managers would not benefit from tracking the US market.

Table 6 presents ITR and TER for emerging market ETFs in our sample. As can be seen, 10 out of 18 ETFs experienced an increase in the TER during pandemic. These include countries like Brazil, Turkey, China, and India. Though considered emerging markets, these nations have a strong economy. In other words, ETF's focusing on such countries were still tracking closely to their underlying benchmark during the Pandemic. For the remaining 8 ETFs, TER fell compared

to the previous period which indicates that they were not tracking their underlying benchmark as closely as before the pandemic.

Table 4: Tracking Errors Comparisons: Emerging Markets

Country	Before Covid – 19			During Covid–19		
	Corr	TE _{CP} (1F)	TE _{CP} (2F)	Corr	TE _{CP} (1F)	TE _{CP} (2F)
Brazil	0.77	0.36%	0.42%	0.77	0.42%	0.37%
Chile	0.47	0.25%	0.20%	0.72	0.20%	0.3%
China	0.66	1.35%	0.62%	0.52	0.61%	1.34%
India	0.48	0.85%	1.02%	0.64	1.05%	0.86%
Indonesia	0.65	0.27%	0.27%	0.45	0.26%	0.27%
Malaysia	0.66	0.10%	4.26%	0.62	0.26%	0.26%
Mexico	0.80	0.31%	0.54%	0.66	0.53%	0.31%
Philippines	0.72	0.31%	0.14%	0.34	0.14%	0.31%
Poland	0.88	0.16%	0.15%	0.71	0.15%	0.16%
Qatar	0.53	0.14%	0.13%	0.44	0.13%	0.14%
Russia	0.77	0.35%	0.26%	0.75	0.26%	0.35%
Saudi Arabia	0.57	0.24%	0.74%	0.62	0.79%	0.24%
South Africa	0.68	0.21%	0.24%	0.73	0.24%	0.21%
South Korea	0.70	0.47%	0.45%	0.62	3.19%	0.47%
Taiwan	0.60	0.29%	0.28%	0.62	0.28%	0.29%
Thailand	0.84	0.26%	0.85%	0.67	0.85%	0.26%
Turkey	0.35	0.40%	0.11%	0.60	0.11%	0.40%
UAE	0.61	0.59%	0.93%	0.61	0.92%	0.58%

Notes: Corr is the correlation coefficient between a Country ETF and the US market. TE_{CP} \equiv stdev(u_{it}) is tracking errors based on the regression errors from one- or two-factor pricing models given in equations (1) and (2), respectively.

Tables 5 and 6 taken together demonstrate that a large number of ETFs in our sample were still available to US investors as vehicles for international diversification. This observation is based on the tracking ability of those country ETFs during the Covid–19 pandemic compared to the period immediately preceding the pandemic

V. Other Measures of Tracking Errors

In order to ensure robustness and comparability of the results presented in this paper, we also use three other measures of tracking errors that have been used in the literature (see, for example, Gallagher and Segara, 2005, Kanuri and McLeod, 2015).

1. The first alternative method of tracking error, TE_1 , is based on the average absolute differences between the returns on ETFs and their benchmark indexes, $TE_1 = \frac{\sum_{t=1}^n |R_{ETF,t} - R_{B,t}|}{n}$, where variables are as defined before in the text.
2. The second alternative method of tracking error, TE_2 , is based on the standard deviation of differences between returns on ETFs and the benchmark indexes, $TE_2 = stdev(R_{ETF} - R_B)$, where variables are as defined before in the text.

3. The third alternative measure of tracking error, TE_3 , is based on the standard errors from the regression analysis using daily return on each ETF and its benchmark index based on regression equations (1) and (2).

Results of additional tracking errors for developed market ETFs and emerging market

Table 5: Incremental Tracking Errors and Tracking Error Ratios (Developed Markets)

Country	Before Covid – 19		During Covid–19		Change in TER
	ITR	TER	ITR	TER	
Australia	0.00%	0.00	0.01%	0.02	Increase
Austria	0.22%	0.58	0.22%	1.38	Increase
Belgium	0.36%	1.16	0.36%	0.55	Decrease
Canada	0.15%	0.39	0.15%	0.65	Increase
Denmark	0.27%	0.79	0.26%	3.71	Increase
Finland	0.17%	0.47	0.18%	1.00	Increase
France	0.24%	0.69	0.24%	2.18	Increase
Germany	0.28%	0.45	0.30%	0.91	Increase
Hong Kong	2.04%	7.29	0.01%	0.03	Decrease
Italy	0.30%	0.61	0.31%	1.63	Increase
Japan	0.09%	0.43	0.09%	0.75	Increase
Netherlands	0.24%	0.71	0.24%	2.40	Increase
New Zealand	0.01%	0.04	0.01%	0.05	Increase
Norway	0.17%	0.43	0.17%	0.74	Increase
Singapore	0.19%	0.40	0.19%	0.68	Increase
Spain	0.13%	0.34	0.13%	0.52	Increase
Sweden	0.12%	0.31	0.12%	0.44	Increase
Switzerland	0.06%	0.21	0.06%	0.26	Increase
UK	0.17%	0.40	0.16%	0.59	Increase

Notes: ITR is Incremental Tracking Error and TER is Tracking Error Ratio as described in the text.

ETFs are represented in Table 7 and Table 8, respectively. Tracking errors have decreased for most of the ETFs during the Covid–19 period compared to the period before the pandemic across all three measures. For example, 16 (TE_1) and 17 (TE_2) out of 19 developed market ETFs, respectively, have experienced lower tracking errors during the Covid–19 pandemic. However, for the emerging markets ETFs, the number of ETFs with lower tracking errors is less than those for developed markets at 11 (TE_1) and 8 (TE_2) out of 18, respectively. A similar pattern is observable from tracking errors based on TE_3 . In summary, the results vary quantitatively across different tracking error specifications, but they are qualitatively similar to the results and analysis presented in the previous section. Overall, the results from the robustness analysis of this section using alternative measures of tracking errors confirm the main findings of the paper that developed market ETFs provided better diversification opportunities for US investors during the Covid–19 pandemic compared to the emerging market ETFs.

Table 6: Incremental Tracking Errors and Tracking Error Ratios (Emerging Markets)

Country	Before Covid – 19		During Covid–19		Change in TER
	ITR	TER	ITR	TER	
Brazil	0.05%	0.20	0.06%	0.30	Increase
Chile	0.00%	0.00	0.01%	0.04	Increase
China	0.01%	0.06	0.01%	0.07	Increase
India	0.01%	0.07	0.01%	0.08	Increase
Indonesia	0.50%	2.08	0.55%	0.70	Decrease
Malaysia	0.23%	0.74	0.22%	0.42	Decrease
Mexico	0.01%	0.03	0.01%	0.04	Increase
Philippines	0.17%	0.55	0.17%	1.21	Increase
Poland	4.16%	41.60	0.00%	0.00	Decrease
Qatar	0.06%	0.17	0.05%	0.12	Decrease
Russia	0.02%	0.04	2.72%	0.85	Increase
Saudi Arabia	0.17%	0.20	0.19%	0.18	Decrease
South Africa	0.03%	0.14	0.03%	0.13	Decrease
South Korea	0.73%	0.54	0.73%	1.20	Increase
Taiwan	0.09%	0.26	0.09%	0.35	Increase
Thailand	0.59%	2.27	0.59%	0.69	Decrease
Turkey	0.29%	0.73	0.29%	2.64	Increase
UAE	0.34%	0.58	0.34%	0.37	Decrease

Notes: ITR is Incremental Tracking Error and TER is Tracking Error Ratio as described in the text.

Table 7: Developed Markets Additional Measures of Tracking Errors

Country	Before Covid – 19				During Covid–19			
	TE ₁	TE ₂	TE ₃ (1F)	TE ₃ (2F)	TE ₁	TE ₂	TE ₃ (1F)	TE ₃ (2F)
Australia	0.091%	0.394%	0.396%	0.399%	0.055%	0.230%	0.230%	0.232%
Austria	0.087%	0.380%	0.382%	0.382%	0.071%	0.167%	0.158%	0.156%
Belgium	0.071%	0.304%	0.307%	0.303%	0.131%	0.659%	0.663%	0.668%
Canada	0.048%	0.225%	0.226%	0.228%	0.049%	0.216%	0.218%	0.220%
Denmark	0.069%	0.336%	0.340%	0.334%	0.022%	0.071%	0.072%	0.072%
Finland	0.146%	0.620%	0.623%	0.627%	0.100%	0.332%	0.334%	0.337%
France	0.064%	0.345%	0.346%	0.350%	0.031%	0.112%	0.113%	0.114%
Germany	0.067%	0.375%	0.379%	0.380%	0.054%	0.225%	0.227%	0.227%
Hong Kong	0.065%	0.285%	0.278%	0.281%	1.912%	13.464%	3.020%	2.324%
Italy	0.105%	0.494%	0.493%	0.497%	0.051%	0.184%	0.185%	0.186%
Japan	0.052%	0.208%	0.210%	0.211%	0.034%	0.120%	0.121%	0.122%
Netherlands	0.065%	0.339%	0.342%	0.336%	0.028%	0.095%	0.096%	0.095%
N. Zealand	0.084%	0.355%	0.358%	0.359%	0.052%	0.183%	0.265%	0.186%
Norway	0.073%	0.385%	0.388%	0.387%	0.065%	0.264%	0.184%	0.268%
Singapore	0.104%	0.479%	0.471%	0.474%	0.065%	0.274%	0.277%	0.279%
Spain	0.087%	0.378%	0.378%	0.382%	0.066%	0.245%	0.246%	0.248%
Sweden	0.120%	0.483%	0.116%	0.489%	0.122%	0.476%	0.481%	0.486%
Switzerland	0.055%	0.284%	0.286%	0.288%	0.051%	0.227%	0.228%	0.226%
UK	0.096%	0.425%	0.427%	0.431%	0.078%	0.266%	0.268%	0.264%

Notes: Definitions and formulas of tracking errors presented above are given in the text in section V. All Tracking Errors are expressed in percentages for easy comparison.

Table 8: Emerging Markets: Additional Measures of Tracking Errors

Country	Before Covid – 19				During Covid–19			
	TE ₁	TE ₂	TE ₃ (1F)	TE ₃ (2F)	TE ₁	TE ₂	TE ₃ (1F)	TE ₃ (2F)
Brazil	0.073%	0.255%	0.254%	0.256%	0.055%	0.197%	0.198%	0.199%
Chile	0.059%	0.265%	0.267%	0.269%	0.061%	0.259%	0.260%	0.262%
China	0.051%	0.165%	0.160%	0.162%	0.060%	0.151%	0.152%	0.154%
India	0.109%	0.167%	0.143%	0.139%	0.097%	0.135%	0.129%	0.130%
Indonesia	0.067%	0.238%	0.238%	0.241%	0.225%	0.781%	0.789%	0.745%
Malaysia	0.067%	0.294%	0.288%	0.291%	0.052%	0.277%	0.278%	0.281%
Mexico	0.068%	0.309%	0.311%	0.312%	0.041%	0.136%	0.137%	0.138%
Philippines	0.032%	0.099%	0.100%	0.100%	7.103%	31.485%	4.470%	4.262%
Poland	0.082%	0.365%	0.364%	0.366%	0.120%	0.422%	0.423%	0.425%
Qatar	0.110%	0.468%	0.472%	0.471%	0.229%	0.450%	0.447%	0.449%
Russia	0.182%	0.858%	0.853%	0.861%	0.344%	1.049%	1.051%	1.018%
S. Arabia	0.056%	0.210%	0.212%	0.212%	0.058%	0.235%	0.237%	0.237%
South Africa	0.256%	1.433%	1.351%	1.337%	0.126%	0.605%	0.611%	0.616%
South Korea	0.058%	0.323%	0.309%	0.306%	0.127%	0.528%	0.532%	0.537%
Taiwan	0.066%	0.364%	0.350%	0.351%	0.049%	0.258%	0.260%	0.263%
Thailand	0.075%	0.260%	0.262%	0.264%	0.216%	0.839%	0.847%	0.852%
Turkey	0.085%	0.394%	0.397%	0.399%	0.033%	0.110%	0.110%	0.109%
UAE	0.154%	0.615%	0.593%	0.581%	0.259%	0.919%	0.922%	0.928%

Notes: Definitions and formulas of tracking errors presented above are given in the text in section V. All Tracking Errors are expressed in percentages for easy comparison.

VI. Conclusion

This paper aims to understand the tracking behavior of a sample of country ETFs during the Covid–19 pandemic as compared to a reasonable period preceding it. More specifically, it investigates the tracking errors of those country ETFs that track their benchmark indices in the developed and emerging markets. Tracking error refers to the deviation of an ETF and its underlying benchmark index in terms of co-movement of their returns. A higher tracking error indicates that return on an ETF is deviating more from the underlying index, potentially leading to greater investment risk. During the Covid-19 pandemic, the volatility of the stock market made it difficult, at least theoretically, for some country ETFs to accurately track their benchmarks, leading to higher tracking errors. Investors needed to be aware of these deviations when selecting a country ETF as an investment vehicle as well as evaluating the performance of their investments.

Investors in the US market were undoubtedly affected by the Covid-19 pandemic, as it caused a widespread economic downturn and increased volatility in the stock market. To manage their risk exposure during this time, many investors turned to country ETFs to diversify their portfolios and potentially mitigate losses. However, the risk exposure and tracking error of these ETFs also varied considerably across different markets. During the Covid-19 pandemic, some country ETFs experienced greater tracking errors than others, depending on the specific country's response to the virus and its economic impact. For example, countries with a heavy reliance on tourism or oil exports may have experienced more significant economic disruptions than those with more diverse economies as documented in the paper. Investors needed to consider these factors when deciding which country ETFs to invest in, as they could impact the potential return on their investment.

The tracking error of country ETFs during the Covid-19 pandemic had implications for investors in the US market. To manage their risk exposure, investors needed to carefully consider the economic impact of the pandemic on the countries they were investing in. Additionally, they needed to monitor the tracking error of their ETFs to ensure that they were accurately tracking their benchmarks. By staying informed and aware of these factors, investors could potentially mitigate losses and capitalize on opportunities during these challenging times.

Based on the results reported in the paper, 17 out of 19 country ETFs in the developed market sample tracked their underlying benchmarks during the Covid-19 pandemic as well as they did during the period immediately preceding it. As a result, developed countries offered international diversification opportunities to US investors. As for the emerging market ETFs sample, 10 out of 18 ETFs were tracking their underlying benchmarks closely during the pandemic. The findings indicate that the developed markets country ETFs remained useful investment vehicles for international diversification during the Covid-19 pandemic.

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