



Do terrorist attacks matter for currency excess returns?

Yiye Liu^a, Liyan Han^{a,d}, You Wu^{b,*}, Libo Yin^c

^a School of Economics and Management, Beihang University, Beijing 100191, China

^b School of Economics, Beijing Technology and Business University, Beijing 100048, China

^c School of Finance, Central University of Finance and Economics, Beijing 102206, China

^d Yanqi Lake Beijing Institute of Mathematical Sciences and Applications, Beijing 101408, China

ARTICLE INFO

JEL classification:

G15

Keywords:

Terrorist attacks

Excess returns

Carry trade

FX markets

ABSTRACT

This paper provides a novel investigation into how currency excess returns react to terrorist attacks. We construct a terrorism risk factor and demonstrate that it significantly matters to excess returns of both carry trade and individual currencies. Furthermore, we form a currency portfolio by simply buying terrorism-sensitive currencies and selling less terrorism-sensitive currencies, which yields economically positive and statistically significant returns. It has shown that this newly proposed terrorism risk factor could provide a marginal improvement for exchange rate pricing facing terrorist attacks.

1. Introduction

The intensifying terrorist attacks (see Fig. 1) affect financial stability globally in many aspects such as stock markets (Papakyriakou et al., 2019; Chen et al., 2020; Narayan et al., 2022), commodity markets (Ramiah et al., 2019; Phan et al., 2021), and mutual funds (Wang and Young, 2020), etc. As a catastrophic risk, the role of terrorist attacks in asset pricing cannot be ignored (Narayan et al., 2018). Nevertheless, there is little study on how foreign exchange (FX) markets react to terrorist attacks. The FX markets, which are deeply influenced by unanticipated events (Sharma et al., 2019; Iyke, 2020), have been the world's largest financial markets with a daily volume of 6.59 trillion dollars.³ According to Abadie and Gardeazabal (2008), increased uncertainty caused by terrorist attacks will induce more frequent capital flows between countries through adjusting foreign direct investment positions. Meanwhile, terrorist attacks have brought a rise in risk aversion (Wang and Young, 2020), which makes investors actively pursue safe-haven currencies. In addition, the abundant and widespread dissemination of information following terrorist attacks induces fear, shock and bad mood among investors through continuous exposure to disturbing news, images and even videos (Papakyriakou et al., 2019; Narayan et al., 2022). And investor sentiment can influence the exchange rates at least in the short run (Shahzad et al., 2021). Given the increased cross-border capital flows, safe-haven demands, and psychological impacts on investors, a strong relationship between terrorist attacks and exchange rates should exist.

In fact, terrorist attacks do affect exchange rate movements but not in the same direction, and these effects vary with individual attacks (Narayan et al., 2018; Park and Newaz, 2018). It is thus so difficult for investors to exactly recognize the appreciation or depreciation of the specific currency following each attack. From the perspective of the investors in FX markets, it is more important to achieve positive excess returns to currency speculation, which are deemed as the compensation for risk associated with currency

* Corresponding author.

E-mail address: btbu_wy@btbu.edu.cn (Y. Wu).

³ Data from the BIS's 2019 Triennial Central Bank Survey.

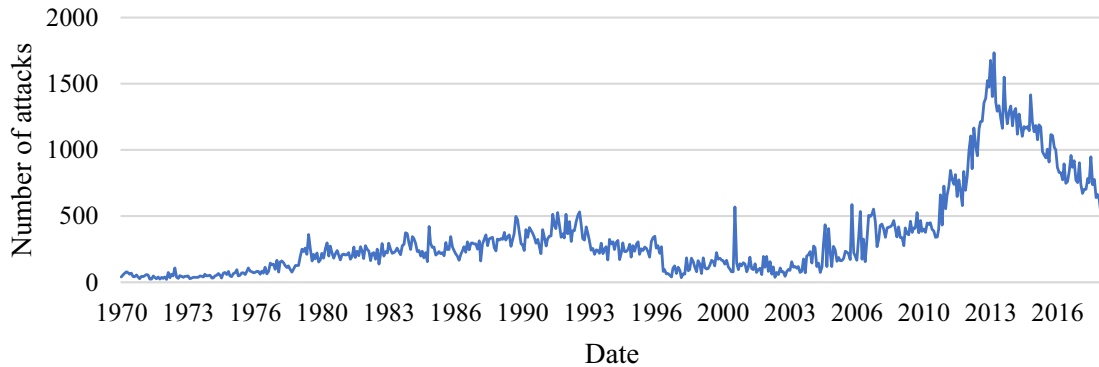


Fig. 1. International terrorism, 1970–2019, number of monthly terrorist attacks.¹¹

holdings (Lustig and Verdelhan, 2007; Menkhoff et al., 2012a; Reitz and Umlandt, 2021). Many studies have attempted to put forward risk factors to explain currency excess returns, such as the dollar risk factor (Lustig et al., 2011), the carry trade risk factor (Lustig et al., 2011), the global FX volatility (Menkhoff et al., 2012a), and the downside risk factor (Jurek, 2014), while they do not consider the extreme risks caused by terrorist attacks. The abundant research on the currency carry trade, which is profitable (Lee and Wang, 2019), easy to implement (Lustig et al., 2011) and can diversify risk (Lustig and Verdelhan, 2007), thus, has proposed the notion that currencies vary in attractiveness in academic studies (Demirer et al., 2022). By investigating excess returns of individual currencies, profitable portfolios are built from a novel and behavioral perspective considering the currency crash risk, the equity tail risk and even the risk aversion (Jiang et al., 2019; Demirer et al., 2022; Fan et al., 2022). However, none of them takes the terrorism risk into account. To thoroughly explain how excess returns react to terrorism risk, our study conducts a comprehensive analysis both at the carry trade and the currency levels.

Following Fama and French (1993) and Lustig et al. (2011), we construct a terrorism risk factor, denoted as *TRF*, to present the terrorism risk premium, which is the return on a mimicking portfolio that goes long in currencies of countries with more terrorist attacks and short in currencies of countries with fewer terrorist attacks. In our empirical analysis, we first focus on the relationship between terrorist attacks and currency carry trade. Our results show that carry trade excess returns can be explained by *TRF* and realized through shorting in low-interest currency portfolios. We then analyze sensitivity to *TRF* at the currency-level and find that *TRF* has a significant impact on excess returns of most currencies statistically. The result remains after considering common risk factors. We then form a zero-investment portfolio based on sensitivity to *TRF* and show that highly terrorism-sensitive assets offer high payoffs. Lastly, our results are robust when using different time horizons, adopting alternative measures of terrorism risk factor, and controlling for endogeneity concerns.

Our paper contributes to the literature in the following ways. First, our paper adds to the research on the effect of terrorism by proposing a terrorism risk factor. Since prior literature shows that terrorism deeply influences financial markets, especially stock markets (Park and Newaz, 2018; Papakyriakou et al., 2019; Narayan et al., 2022), we focus on the importance of terrorism in FX markets and find that our factor significantly explains excess returns of both carry trade and individual currencies, providing a marginal improvement for exchange rate pricing facing terrorist attacks. Second, although Eldor and Melnick (2004); Narayan et al. (2018) and Iyke et al. (2022) have shown that terrorism does influence exchange rates, our paper is the first study to explore the relationship between terrorist attacks and currency excess returns chased by investors instead of the currency returns computed as log differences (Narayan et al., 2018; Iyke et al., 2022). More importantly, our results provide an investment strategy to effectively hedge terrorism risk by holding terrorism-sensitive currency portfolios and shorting less terrorism-sensitive portfolios.

The remainder of this paper is organized as follows. Section 2 introduces our data. Section 3 provides empirical analysis and Section 4 concludes.

2. Data

The monthly terrorist attacks data of the sample countries over the period 1997–2019 are collected from the Global Terrorism Database (GTD),⁴ first described in Lafree and Dugan (2007). The corresponding spot and one-month-forward exchange rates under the US dollar quotation are obtained via Datastream. Following Menkhoff et al. (2012a), Menkhoff et al. (2012b) and Filippou et al. (2018), our sample includes 48 countries (regions). Descriptive statistics on monthly terrorist attacks and currency excess returns of our sample are reported in Table 1.

⁴ <https://www.start.umd.edu/gtd/>

Table 1
Descriptive statistics.

Country	Terrorist attack(monthly)				Currency excess return(monthly)					
	Mean	SD	Skew	Kurt	Startdate	Obs.	Mean	SD	Skew	Kurt
Australia	0.21	0.54	3.21	12.54	1997.1	276	1.28	42.30	-0.47	2.17
Austria	0.08	0.42	10.45	136.49	1997.1	24	-6.04	33.08	-0.22	-0.59
Belgium	0.13	0.58	9.55	119.27	1997.1	24	-6.06	32.93	-0.23	-0.61
Brazil	0.30	1.00	6.18	51.45	2004.4	189	6.41	53.57	-0.50	1.13
Bulgaria	0.09	0.32	3.87	15.54	2004.4	189	-0.72	33.52	-0.32	1.57
Canada	0.28	0.61	2.58	7.73	1997.1	276	0.21	29.74	-0.54	3.36
Croatia	0.07	0.33	5.59	35.25	2004.4	189	0.30	34.52	-0.47	1.23
Cyprus	0.05	0.24	4.87	25.34	2004.4	45	4.78	24.25	-0.14	-0.53
Czech Republic	0.09	0.35	4.05	16.62	1997.1	276	1.39	41.69	-0.24	0.50
Denmark	0.05	0.24	5.64	34.25	1997.1	276	-1.24	33.60	-0.11	0.95
Egypt	7.78	16.90	3.23	12.24	2004.4	189	11.56	53.60	-6.84	81.44
Euro Area	8.34	7.04	1.48	3.12	1999.1	252	-0.88	33.85	-0.13	1.04
Finland	0.07	0.42	10.71	141.71	1997.1	24	-7.03	33.57	-0.23	-0.68
France	2.41	5.29	7.60	81.21	1997.1	24	-5.80	33.15	-0.23	-0.59
Germany	1.00	2.05	3.37	13.35	1997.1	24	-6.13	33.11	-0.22	-0.61
Greece	2.50	3.36	2.73	10.66	1997.1	48	-4.74	37.52	-0.03	0.59
Hong Kong	0.02	0.13	7.19	49.83	1997.1	276	-0.18	2.02	1.67	10.91
Hungary	0.10	0.54	7.23	57.21	1997.11	266	2.56	46.20	-0.98	3.66
Iceland	0.01	0.08	11.56	132.02	2004.4	189	2.06	49.62	-1.20	7.08
India	39.13	30.47	0.60	-0.58	1997.11	266	1.62	24.84	-0.23	2.71
Indonesia	2.57	4.96	7.09	64.80	1997.1	276	14.41	97.57	-2.05	18.28
Ireland	0.70	1.20	1.74	2.43	1997.1	24	-5.87	33.56	-0.21	-0.53
Israel	4.65	11.35	9.10	101.26	2004.4	189	1.78	27.60	-0.26	0.69
Italy	0.61	0.98	1.81	3.34	1997.1	24	-3.52	32.02	-0.24	-0.60
Japan	0.19	0.77	9.14	103.03	1997.1	276	-2.24	36.03	0.40	2.26
Kuwait	0.05	0.22	4.07	14.64	1997.1	276	0.51	7.73	-1.14	15.34
Malaysia	0.26	0.77	5.34	40.75	1997.1	276	3.68	67.12	-3.49	16.80
Mexico	1.00	2.18	4.17	23.00	1997.1	276	3.16	36.35	-0.87	2.36
Netherlands	0.13	0.41	3.56	14.49	1997.1	24	-6.41	33.31	-0.21	-0.59
New Zealand	0.05	0.29	6.82	52.68	1997.1	276	2.11	44.66	-0.28	1.32
Norway	0.04	0.23	6.32	42.84	1997.1	276	-0.64	38.39	-0.15	0.70
Philippines	22.08	23.03	0.98	-0.18	1997.1	276	0.94	27.83	-1.06	6.01
Poland	0.04	0.23	6.32	42.84	2002.3	214	2.71	47.59	-0.76	1.88
Portugal	0.01	0.12	16.43	269.02	1997.1	24	-5.25	31.40	-0.17	-0.67
Russia	7.46	7.45	1.62	3.66	2004.4	189	1.40	49.85	-0.72	3.73
Saudi Arabia	1.82	4.05	3.43	14.77	1997.1	276	0.14	1.23	-5.37	79.78
Singapore	0.00	0.00	0.00	0.00	1997.1	276	-0.53	20.69	-0.26	2.35
Slovakia	0.04	0.21	6.13	41.05	2002.3	82	13.36	40.29	-0.28	0.96
Slovenia	0.01	0.08	11.56	132.02	2004.4	33	2.68	26.10	-0.01	-0.67
South Africa	0.85	1.63	3.19	14.48	1997.1	276	2.11	55.56	-0.42	0.70
South Korea	0.03	0.16	6.00	34.18	2002.3	214	1.54	38.03	-0.37	4.43
Spain	2.09	3.83	3.13	13.23	1997.1	24	-4.87	32.51	-0.22	-0.54
Sweden	0.37	1.46	10.61	141.67	1997.1	276	-1.90	37.68	0.01	0.43
Switzerland	0.08	0.32	4.30	19.13	1997.1	276	-0.56	35.43	0.21	1.64
Taiwan	0.05	0.26	5.11	28.04	1997.1	276	-1.38	18.54	-0.06	3.39
Thailand	14.36	15.61	1.47	2.26	1997.1	276	1.29	36.34	-0.58	18.09
Ukraine	6.38	22.49	4.90	27.02	2010.4	117	12.62	70.55	-4.63	39.34
United Kingdom	5.32	4.98	1.26	2.00	1997.1	276	-0.62	29.69	-0.43	1.39

Notes: This table reports descriptive statistics for monthly terrorist attacks and currency excess returns of 48 countries. The statistics include the mean value (Mean), standard deviation (SD), skewness (Skew) and kurtosis (Kurt). Mean and SD for excess returns are annualized and reported in percent. Moreover, we report the start date and the number of observations (Obs.) for currency excess returns of sample countries. The period of monthly terrorist attacks runs from January 1997 to December 2019. The euro starts in January 1999, and we exclude the Eurozone currencies after their adoption of the euro and keep only the euro. The number of terrorist attacks in the Eurozone is a summary of all Eurozone countries.

¹ Sources: <https://www.start.umd.edu/gtd/>.

Table 2

Portfolios sorted by one-month-ahead numbers of terrorist attacks.

	P _L	P ₂	P ₃	P ₄	P _H	Average	TRF
Mean	1.0739	1.0739	1.3012	2.3255	3.8695	1.9288	2.7956
NW- <i>t</i>	[0.72]	[0.72]	[0.86]	[1.37]	[2.65]	[1.41]	[2.52]
Standard Deviation	24.8644	24.8644	25.1193	28.0845	24.1926	22.6814	18.4146
Sharpe Ratio	0.0432	0.0432	0.0518	0.0828	0.1599	0.0850	0.1518

Notes: This table reports the results for the portfolios sorted by one-month-ahead numbers of terrorist attacks. Mean and standard deviation are annualized and in percentage points. Newey-West *t*-statistics are reported in brackets.

Table 3

Regression results.

	Carry trade strategy	Low-interest portfolio	High-interest portfolio
Constant	0.0247*** [5.02]	−0.0043 [−1.01]	0.0213*** [2.84]
TRF _{<i>t</i>}	0.2911** [1.89]	−0.3638*** [−3.35]	−0.0772 [−0.42]
TED _{<i>t</i>}	−1.6595*** [−3.54]	−0.0887 [−0.18]	−1.8051** [−2.50]
CTR _{<i>t</i>−1}	0.2406*** [3.41]	0.1925** [2.07]	0.1847*** [3.27]
financial_crisis _{<i>t</i>}	0.0103** [1.92]	−0.0050 [−0.66]	0.0053 [0.97]
EPU _{<i>t</i>}	−0.0001*** [−2.62]	0.0000 [0.98]	−0.0001 [−1.20]
adj-R ²	0.132	0.104	0.096
Obs.	274	274	274

Notes: This table reports the regression results for the impact of TRF on excess returns of currency carry trade portfolio, low-interest portfolio and high-interest portfolio. To construct a carry trade portfolio, we allocate currencies to five portfolios and rebalance them at the end of each month based on their forward discounts, which is approximately equal to the interest rate differential since covered interest parity holds at least at the monthly frequency (Akram et al., 2008; Fan et al., 2022). Portfolio 1 contains currencies with the lowest interest rates (denoted as low-interest portfolio) and portfolio 5 contains currencies with the highest interest rates (denoted as high-interest portfolio). The return difference between portfolio 5 and portfolio 1 is the carry trade obtained from borrowing money in low interest rate countries and investing in high interest rate countries. Newey-West *t*-statistics are reported in brackets. *, **, *** indicate significance at 10%, 5% and 1% level, respectively.

3. Empirical analysis

3.1. Preliminary results

We first construct a factor mimicking portfolio to represent the factor information as a traded asset (Byrne et al., 2018). After calculating monthly currency excess returns according to Menkhoff et al. (2012a), We further sort returns by one-month-ahead numbers of terrorist attacks and get a portfolio return as the terrorism risk factor, TRF, by investing in currencies of countries with more terrorist attacks (top 20% of sample countries, P_H) and borrowing in currencies of countries with fewer terrorist attacks (bottom 20% of sample countries, P_L).

According to Table 2, excess returns sorted into portfolios based on exposure to terrorism risk provide a monotonic pattern, suggesting that investors require a higher premium when terrorism risk increases, consistent with the evidence that investors' risk aversion rises following an increase in terrorist attacks (Wang and Young, 2020). The positive and significant returns of the cost-free TRF strategy can properly measure the risk premium of terrorist attacks in FX markets. Terrorism, aiming to "intimidate or create panic", directly influences investor sentiment (Narayan et al., 2022) and thus alters expectations (Benchimol and El-Shagi, 2020), which will affect forward exchange rates and currency excess returns (Ferreira et al., 2019). Also, heterogeneous expectations may influence the FX markets. In addition, there exists safe-haven demand when investors are exposed to terrorism risk since they are more sensitive to losses (Orbaneja et al., 2018). Flights to safe-haven currencies as well as high connectedness of the FX markets may induce changes in currency excess returns of other countries that have not suffered terrorist attacks. Furthermore, terrorism may increase oil market uncertainty (Orbaneja et al., 2018), which can, in turn, affect currency excess returns (Su et al., 2021). In summary, there is a strong relationship between terrorist attacks and currency excess returns. We next examine whether terrorist attacks matter to excess returns of both carry trade and individual currencies based on TRF.

3.2. Impact of terrorist attacks on currency carry trade

We conduct the following regression to estimate the impact of TRF on currency carry trade excess returns. Moreover, we include the TED spread (TED_{*t*}) to represent liquidity, one-month-ahead carry trade excess returns (CTR_{*t*−1}), a dummy for the financial crisis

Table 4Regression results of individual currencies' excess returns on *TRF*.

Panel A: Regression						
	Without controls <i>TRF_t</i>	<i>t</i> -stat	Control for <i>DOL</i> and <i>CARRY</i> <i>TRF_t</i>	<i>t</i> -stat	Control for <i>DOL</i> , <i>CARRY</i> and <i>VOL</i> <i>TRF_t</i>	<i>t</i> -stat
Australia	-0.6382***	-3.58	-0.1957*	-1.87	-0.1966*	-1.87
Austria	-0.6830***	-3.27	-0.1712**	-2.12	-0.1729**	-2.26
Belgium	-0.6898***	-3.38	-0.1838**	-2.21	-0.1857**	-2.33
Brazil	-1.1624***	-2.77	-0.7477***	-3.46	-0.7342***	-3.54
Bulgaria	-0.8976***	-4.41	0.1051**	2.14	0.1082**	2.11
Canada	-0.5251***	-4.65	-0.3003***	-3.60	-0.2989***	-3.55
Croatia	-0.9137***	-4.52	0.0779	1.39	0.0830	1.45
Cyprus	-1.2207***	-4.49	-0.2218**	-2.48	-0.1828	-1.57
Czech Republic	-0.7748***	-4.92	-0.1758**	-2.30	-0.1759**	-2.27
Denmark	-0.5293***	-4.12	0.0192	0.37	0.0187	0.36
Egypt	1.1725	1.32	1.4741	1.37	1.4872	1.37
Euro Area	-0.5151***	-3.72	-0.2192**	-2.73	-0.2117**	-2.81
Finland	-0.7423***	-3.44	-0.2263**	-2.37	-0.2253**	-2.54
France	-0.7263***	-3.28	-0.1729**	-2.14	-0.1743**	-2.29
Germany	-0.6857***	-3.29	0.2258	1.23	0.2056	1.07
Greece	-0.1178	-0.61	-0.0015	-0.24	-0.0020	-0.32
Hong Kong	-0.0078	-1.20	-0.1686	-1.51	-0.1657	-1.47
Hungary	-0.7676***	-4.08	0.1520**	2.15	0.1537**	2.16
Iceland	-0.9116***	-2.75	0.8559	1.33	0.8529	1.35
India	-0.0457	-0.57	-0.2025**	-2.47	-0.1757*	-2.09
Indonesia	0.4906	0.86	0.3273**	2.24	0.3163**	2.10
Ireland	-0.8131***	-3.91	-0.5344**	-2.26	-0.5525**	-2.38
Israel	-0.2619*	-1.90	0.2980***	2.69	0.2912***	2.61
Italy	-0.6949***	-3.40	0.0199	1.16	0.0207	1.18
Japan	-0.0170	-0.14	-0.4502**	-2.01	-0.4434**	-1.97
Kuwait	-0.0681***	-3.09	-0.3370***	-2.71	-0.3332***	-2.63
Malaysia	-0.7983*	-1.75	-0.1719**	-2.28	-0.1731**	-2.30
Mexico	-0.4259**	-2.50	-0.3348***	-5.20	-0.3343***	-5.20
Netherlands	-0.6892***	-3.39	0.2550**	2.09	0.2541**	2.08
New Zealand	-0.6896***	-4.27	-0.4225***	-2.96	-0.4417***	-3.24
Norway	-0.8152***	-5.39	-0.1748**	-2.13	-0.1737**	-2.29
Philippines	0.1269	1.13	-0.6954	-1.63	-0.6620	-1.48
Poland	-1.2977***	-4.48	-0.0042	-0.99	-0.0044	-1.12
Portugal	-0.6700***	-3.39	0.0260	0.61	0.0243	0.59
Russia	-1.1488***	-3.46	-0.0557	-0.45	-0.0738	-0.57
Saudi Arabia	-0.0033	-0.89	-0.0819	-0.97	0.0180	0.14
Singapore	-0.2278**	-2.40	-0.3561**	-2.41	-0.3588**	-2.47
Slovakia	-0.8771**	-2.62	-0.1563	-1.39	-0.1586	-1.38
Slovenia	-1.3098***	-3.88	-0.2033**	-2.25	-0.1912*	-2.02
South Africa	-0.7191***	-3.45	-0.0835	-1.32	-0.0825	-1.30
South Korea	-0.7400***	-2.77	0.0603	0.72	0.0583	0.69
Spain	-0.6946***	-3.20	0.0229	0.45	0.0215	0.43
Sweden	-0.6373***	-4.34	0.2100	1.62	0.2066	1.58
Switzerland	-0.4752***	-3.27	2.1918	1.63	2.2716*	1.76
Taiwan	-0.1473**	-2.21	-0.0273	-0.25	-0.0243	-0.22
Thailand	0.0037	0.03	-0.2093*	-1.84	-0.2091*	-1.80
Ukraine	1.9940*	1.77	0.0361	0.72	0.0366	0.73
United Kingdom	-0.3362***	-3.05	-0.3889***	-4.33	-0.3742***	-4.59
Panel B: Summary						
	Without controls Number of indexes	%	Control for <i>DOL</i> and <i>CARRY</i> Number of indexes	%	Control for <i>DOL</i> , <i>CARRY</i> and <i>VOL</i> Number of indexes	%
(+)significant	1	2.1%	5	10.4%	6	12.5%
(-)significant	38	79.2%	22	45.8%	21	43.8%
(+)insignificant	4	8.3%	12	25.0%	12	25.0%
(-)insignificant	5	10.4%	9	18.8%	9	18.8%

Notes: This table reports the regression results for the impact of *TRF* on excess returns of individual currencies with and without control variables. Newey-West *t*-statistics are reported in the table. *, **, *** indicate significance at 10%, 5% and 1% level, respectively.

(*financial_crisis_t*) to denote the NBER's recession which equals one for the period from the peak to the trough, and US economic policy uncertainty index (*EPU_t*) as control variables (Su et al., 2021).

$$CTR_t = \alpha + \beta_1 TRF_t + \beta_2 TED_t + \beta_3 CTR_{t-1} + \beta_4 financial_crisis_t + \beta_5 EPU_t + \varepsilon_t \quad (1)$$

where *CTR_t* denotes the excess return on currency carry trade, *TRF_t* is the terrorism risk factor.

Also, we analyze low-interest and high-interest portfolios of carry trade strategies separately. Table 3 reports all regression results.

Table 5
Portfolios sorted on *TRF* betas.

Portfolio	1	2	3	4	5	<i>XMI</i>
Panel A: Without controls						
Mean	3.2954	1.9819	0.4922	1.6561	5.8176	3.1798
NW- <i>t</i>	[1.42]	[0.99]	[0.28]	[1.37]	[4.51]	[4.17]
Standard deviation	35.8394	30.8899	27.5247	18.6759	19.9285	11.7934
Pre-beta	−1.438	−0.972	−0.674	−0.295	0.344	
Panel B: Control for <i>DOL</i> and <i>CARRY</i>						
Mean	3.4000	3.3406	2.3046	−0.6629	5.0863	2.5824
NW- <i>t</i>	[1.54]	[2.03]	[1.79]	[−0.42]	[3.04]	[3.11]
Standard deviation	34.1145	25.3943	19.8935	24.3758	25.8378	12.8268
Pre-beta	−0.639	−0.189	−0.005	0.116	0.730	
Panel C: Control for <i>DOL</i> , <i>CARRY</i> and <i>VOL</i>						
Mean	3.6663	2.3299	2.7700	−0.5734	5.2938	2.9713
NW- <i>t</i>	[1.65]	[1.37]	[2.46]	[−0.36]	[3.13]	[3.60]
Standard deviation	34.3283	26.3628	17.4310	24.9373	26.1381	12.7513
Pre-beta	−0.646	−0.191	−0.004	0.123	0.729	

Notes: This table reports the results for the portfolios sorted on regression betas of currency excess returns on *TRF* with and without control variables. Mean and Standard deviations are annualized and in percentage points. Newey-West *t*-statistics are reported in brackets.

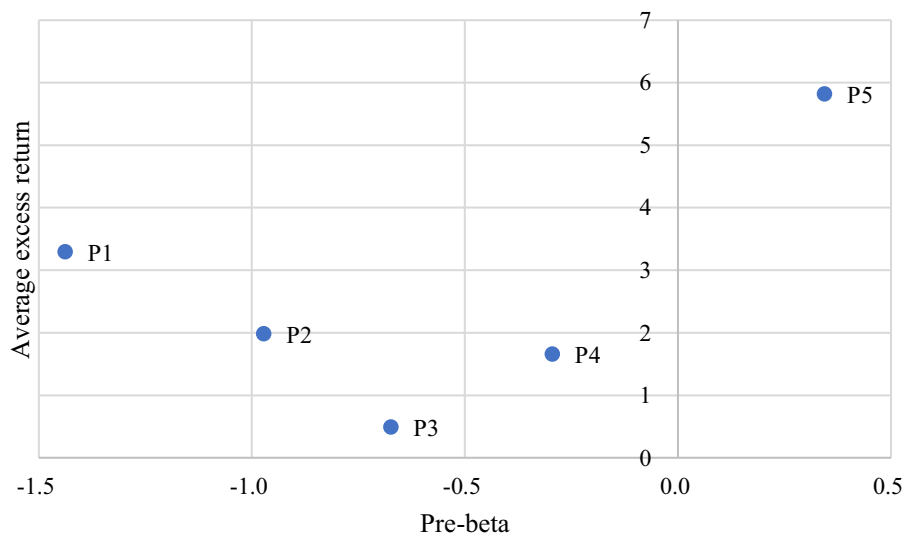


Fig. 2. Terrorism risk sensitive portfolios.

We note that the excess returns of carry trade and low-interest portfolios can be explained by *TRF* with control variables, while the high-interest ones cannot, indicating that the information on terrorism risk does not substantively overlap with traditional information and the main channel through which terrorism risk rationalizes carry trade excess returns is the short leg of the cross-sectional carry trade. It is in line with the conclusion that low-interest currency performs well when the market is volatile (Menkhoff et al., 2012a).

3.3. Currency-level analysis

3.3.1. Impact of terrorist attacks on individual currencies

To illustrate whether the terrorism risk factor can explain excess returns of individual currencies, we run regressions of individual currencies' excess returns on *TRF* with and without control variables. Three variables are considered: the dollar risk factor (*DOL*) and the carry trade risk factor (*CARRY*) in Lustig et al. (2011), and the global FX volatility (*VOL*) in Menkhoff et al. (2012a). These common risk factors can explain variation in the country-level excess returns, in which *DOL* compensates for home country risk and *CARRY* compensates for global risk, while *VOL* is a proxy for unexpected volatility changes.

The regression with control variables is as follows:

$$RX_t = \alpha + \beta TRF_t + bcontrol_t + \varepsilon_t \quad (2)$$

where RX_t is the excess returns of individual currencies, $control_t$ is a vector of common risk factors.

Table 6
Results based on *TRF_YEAR*.

Panel A: Regression results for the impact of <i>TRF_YEAR</i> on currency carry trade.			
	Carry trade strategy	Low-interest portfolio	High-interest portfolio
Constant	0.0238*** [4.35]	−0.0038 [−0.92]	0.0207*** [2.66]
<i>TRF_t</i>	0.5457*** [3.59]	−0.3620*** [−3.08]	0.1866 [1.02]
<i>TED_t</i>	−1.7393** [−3.01]	−0.1251 [−0.28]	−1.8899** [−2.32]
<i>CTR_t − 1</i>	0.2350*** [4.35]	0.1708** [1.97]	0.1960*** [3.46]
<i>financial_crisis_t</i>	0.0127** [2.08]	−0.0054 [−0.68]	0.0074 [1.32]
<i>EPU_t</i>	−0.0001** [−2.35]	0.0000 [0.81]	−0.0001 [−1.19]
adj-R ²	0.218	0.112	0.106
Obs.	274	274	274

Panel B: Portfolios sorted on regression betas of raw excess returns on <i>TRF_YEAR</i> .						
Portfolio	1	2	3	4	5	<i>XMI</i>
Mean	3.5346	1.6922	0.8722	1.1209	5.7297	3.4037
NW-t	[1.55]	[0.82]	[0.53]	[0.90]	[4.31]	[4.57]
Standard deviation	35.3414	31.8835	25.3882	19.2914	20.5350	11.5094
Pre-beta	−1.297	−0.831	−0.555	−0.228	0.445	

Notes: This table reports the results whether *TRF_YEAR* matters to excess returns of carry trade and individual currencies. Mean and Standard deviations are annualized and in percentage points. Newey-West *t*-statistics are reported in brackets. *, **, *** indicate significance at 10%, 5% and 1% level, respectively.

Table 7
Results based on *TRF_DEATH*.

Panel A: Regression results for the impact of <i>TRF_DEATH</i> on currency carry trade.			
	Carry trade strategy	Low-interest portfolio	High-interest portfolio
Constant	0.0237*** [4.89]	−0.0036 [−0.85]	0.0212*** [2.81]
<i>TRF_DEATH_t</i>	0.4281*** [4.04]	−0.3994*** [−3.37]	0.0265 [0.17]
<i>TED_t</i>	−1.6409*** [−3.27]	−0.1169 [−0.27]	−1.8419** [−2.48]
<i>CTR_t − 1</i>	0.2517*** [3.54]	0.2274** [2.49]	0.1872*** [3.30]
<i>financial_crisis_t</i>	0.0122** [2.12]	−0.0062 [−0.85]	0.0061 [1.11]
<i>EPU_t</i>	−0.0001*** [−2.73]	0.0000 [0.89]	−0.0001 [−1.22]
adj-R ²	0.190	0.153	0.094
Obs.	274	274	274

Panel B: Portfolios sorted on regression betas of raw excess returns on <i>TRF_DEATH</i> .						
Portfolio	1	2	3	4	5	<i>XMI</i>
Mean	3.2757	1.5071	1.6550	1.7528	5.3257	2.6624
NW-t	[1.45]	[0.72]	[0.91]	[1.61]	[3.93]	[3.41]
Standard deviation	34.9002	32.4433	28.0715	16.8277	20.9322	12.0850
Pre-beta	−1.191	−0.899	−0.600	−0.262	0.267	

Notes: This table reports the results whether *TRF_DEATH* matters to excess returns of carry trade and individual currencies. Sorting countries by one-month-ahead numbers of fatalities from GTD, the time-series returns of *TRF_DEATH* are generated by holding currencies of countries with more fatalities (top 20% of sample countries) and shorting currencies of countries with fewer fatalities (bottom 20% of sample countries). Mean and Standard deviations are annualized and in percentage points. Newey-West *t*-statistics are reported in brackets. *, **, *** indicate significance at 10%, 5% and 1% level, respectively.

Three regressions are conducted to measure the impact of the *TRF* on currency excess returns with and without control variables. The classification of *TRF* betas is reported in Table 4. Table 4 shows that *TRF* have a significantly negative effect on excess returns for 38 currencies, and a positive effect on one currency, accounting for 81% of our sample. Furthermore, with control variables, *TRF* impacts excess returns for at least 56% (27 currencies) of the sample currencies, denoting that the terrorism risk factor still matters after controlling for common risk factors, not for all currencies but for a reasonable number of currencies. By running individual regressions on each currency, we further show that *TRF* not only can be used as a risk factor explaining the carry trade excess returns

Table 8
Results based on TRF_INJURY .

Panel A: Regression results for the impact of TRF_INJURY on currency carry trade.						
	Carry trade strategy	Low-interest portfolio	High-interest portfolio			
Constant	0.0240*** [4.50]	−0.0032 [−0.82]	0.0213*** [2.85]			
TRF_INJURY_t	0.4059*** [3.88]	−0.4386*** [−4.03]	−0.0307 [−0.19]			
TED_t	−1.5616*** [−2.77]	−0.2357 [−0.58]	−1.8333** [−2.52]			
$CTR_t - 1$	0.2232*** [3.12]	0.1898** [2.17]	0.1876*** [3.30]			
$financial_crisis_t$	0.0089 [1.61]	−0.0032 [−0.47]	0.0058 [1.10]			
EPU_t	−0.0001** [−2.47]	0.0000 [0.87]	−0.0001 [−1.22]			
adj-R ²	0.174	0.164	0.094			
Obs.	274	274	274			
Panel B: Portfolios sorted on regression betas of raw excess returns on TRF_INJURY .						
Portfolio	1	2	3	4	5	XMI
Mean	3.4076	1.0200	1.8385	1.2416	5.7873	3.2307
NW- t	[1.47]	[0.49]	[1.06]	[1.06]	[4.50]	[3.41]
Standard deviation	35.7435	32.1998	26.7943	18.0746	19.8693	11.7414
Pre-beta	−1.242	−0.869	−0.602	−0.264	0.330	

Notes: This table reports the results whether TRF_INJURY matters to excess returns of carry trade and individual currencies. Sorting countries by one-month-ahead numbers of injuries from GTD, the time-series returns of TRF_INJURY are generated by holding currencies of countries with more injuries (top 20% of sample countries) and shorting currencies of countries with fewer injuries (bottom 20% of sample countries). Mean and Standard deviations are annualized and in percentage points. Newey-West t -statistics are reported in brackets. *, **, *** indicate significance at 10%, 5% and 1% level, respectively.

Table 9
2SLS results of currency carry trade excess returns.

	Stage 1	Stage 2 Carry trade strategy	Low-interest portfolio	High-interest portfolio
IV_t	0.8276*** [24.55]			
$\widehat{TRF}_t$		0.5173*** [3.48]	−0.5759*** [−4.14]	−0.0626 [−0.31]
First-Stage F-Statistic	165			
Wu-Hausman F-Statistic		16.9***	18.8***	0.29
Constant	−0.0002 [−0.13]	0.0245*** [4.76]	−0.0042 [−1.02]	0.0213*** [2.84]
TED_t	0.2515 [0.12]	−1.7518*** [−3.22]	0.0156 [0.04]	−1.8082** [−2.51]
CTR_{t-1}	−0.0224 [−0.93]	0.2464*** [3.52]	0.2153** [2.44]	0.1868*** [3.32]
$financial_crisis_t$	−0.0016 [−1.12]	0.0119** [2.01]	−0.0066 [−0.83]	0.0054 [0.98]
EPU_t	0.0000 [−0.10]	−0.0001*** [−2.65]	0.0000 [1.03]	−0.0001 [−1.21]
adj-R ²	0.755	0.172	0.183	0.095
Obs.	274	274	274	274

Notes: This table reports the 2SLS results for the impact of TRF on excess returns of currency carry trade portfolio, low-interest portfolio and high-interest portfolio. The instrument for TRF is a factor constructed based on the numbers of victims in terrorist attacks. We report first-stage F-statistic and Wu-Hausman F-statistic. The instrument is sufficiently relevant and endogenous when first-stage F-statistic is larger than 10 and Wu-Hausman F-Statistic is significant. Newey-West t -statistics are reported in brackets. *, **, *** indicate significance at 10%, 5% and 1% level, respectively.

but also contributes to explaining the excess returns at the currency level. In general, the relationship between excess returns and TRF reflects the sensitivity of currency excess returns to terrorism risk, for which we take the TRF beta (in absolute value) as a proxy for terrorism risk sensitivity. We find that countries whose currencies are more sensitive to terrorism risk (e.g., Ukraine and Russia) face high geopolitical risk. Moreover, the currencies with small absolute betas (e.g., Saudi Arabia and Hong Kong) closely connect with the US dollar.

Table 10
2SLS results of individual currencies' excess returns.

Panel A: Stage 1				
	Without controls		Control for DOL, CARRY, VOL	
IV_t	0.8315***		0.8538***	
	[24.10]		[23.31]	
Constant	0.0004		0.0005	
	[1.00]		[0.29]	
First-Stage	819.5		210	
F-Statistic				
$CARRY_t$			−0.048**	
			[−2.19]	
DOL_t			0.0072	
			[0.28]	
VOL_t			0.1197	
			[0.29]	
Panel B: Stage 2				
	Without controls		Control for DOL, CARRY, VOL	
	$\widehat{TRF}_t$	t-stat	$\widehat{TRF}_t$	t-stat
Australia	−0.7009***	−3.07	−0.1764	−1.36
Austria	−1.2790***	−5.1	−0.4306***	−7.39
Belgium	−1.2905***	−5.16	−0.4602***	−7.17
Brazil	−1.2054***	−2.69	−0.8042***	−3.94
Bulgaria	−1.1528***	−4.09	0.0460	0.66
Canada	−0.5017***	−3.63	−0.2373**	−2.47
Croatia	−1.1775***	−4.15	−0.0015	−0.02
Cyprus	−1.6358***	−5.57	−0.2507	−1.67
Czech Republic	−0.9988***	−4.52	−0.1984**	−1.98
Denmark	−0.7585***	−4.28	−0.0220	−0.41
Egypt	1.3983	1.34	1.7834	1.38
Euro Area	−0.7102***	−3.89	0.0025	0.04
Finland	−1.3259***	−5.27	−0.4442***	−7.53
France	−1.3071***	−5.21	−0.4747***	−6.21
Germany	−1.2844***	−5.09	−0.4365***	−7.44
Greece	−0.7529***	−2.8	−0.1035	−0.59
Hong Kong	−0.0092	−0.96	−0.0004	−0.04
Hungary	−1.0083***	−4.47	−0.2794**	−2.05
Iceland	−1.0293**	−2.39	−0.6823**	−2.44
India	−0.0849	−0.96	0.1296	1.51
Indonesia	0.6086	0.97	0.8461	1.03
Ireland	−1.1256***	−9.03	−0.4590***	−5.13
Israel	−0.3578*	−1.86	0.3432**	2.25
Italy	−1.2698***	−5.44	−0.4638***	−4.71
Japan	−0.1887	−1.24	0.2690*	1.75
Kuwait	−0.1114***	−3.54	0.0057	0.27
Malaysia	−0.5427*	−1.87	−0.0158	−0.04
Mexico	−0.4371**	−2.29	−0.4237***	−3.07
Netherlands	−1.2939***	−5.1	−0.4406***	−7.26
New Zealand	−0.8683***	−4.4	−0.3004***	−2.64
Norway	−0.9474***	−5.48	−0.3290***	−4.55
Philippines	0.1625	1.09	0.2796*	1.85
Poland	−1.4630***	−4.16	−0.4873***	−3.34
Portugal	−1.2493***	−5.12	−0.4422***	−7.07
Russia	−1.0605***	−3.84	−0.4766	−1.16
Saudi Arabia	−0.0019	−0.46	−0.0037	−0.91
Singapore	−0.2785**	−2.49	0.0365	0.71
Slovakia	−0.8764**	−2.19	−0.0603	−0.37
Slovenia	−1.8248***	−6.45	−0.0561	−0.30
South Africa	−0.7998***	−3.3	−0.4436***	−2.77
South Korea	−0.8542**	−2.3	−0.2188	−1.56
Spain	−1.2771***	−5.27	−0.4682***	−6.19
Sweden	−0.7908***	−4.08	−0.0458	−0.59
Switzerland	−0.7351***	−3.77	−0.0043	−0.05
Taiwan	−0.2069***	−2.63	−0.0082	−0.16
Thailand	0.0582	0.34	0.2785*	1.80
Ukraine	2.4214**	1.98	2.8702*	1.72
United Kingdom	−0.4741***	−3.88	−0.0695	−0.62
Panel C: Summary				
	Without controls		Control for DOL, CARRY, VOL	
	Number of indexes	%	Number of indexes	%
(+)significant	1	2.1%	5	10.4%

(continued on next page)

Table 10 (continued)

Panel A: Stage 1				
(-)significant	39	81.3%	20	41.7%
(+)insignificant	4	8.3%	7	14.6%
(-)insignificant	4	8.3%	16	33.3%

Notes: This table reports the 2SLS results for the impact of *TRF* on individual currencies' excess returns with and without common control variables.²¹ The instrument for *TRF* is a factor constructed based on the numbers of victims in terrorist attacks. We report first-stage F-statistic and Wu-Hausman F-statistic. The instrument is sufficiently relevant and endogenous when first-stage F-statistic is larger than 10 and Wu-Hausman F-Statistic is significant. Newey-West *t*-statistics are reported in brackets. *, **, *** indicate significance at 10%, 5% and 1% level, respectively.

3.3.2. Portfolios based on *TRF* betas

Following Menkhoff et al. (2012a), it is reasonable to assume that currencies sorted by their corresponding sensitivities to terrorism risk yield a cross-section of portfolios with a significant spread in mean returns. Currencies with high sensitivity to terrorism risk should be traded at a premium.

We therefore sort currencies into five portfolios depending on their past betas with a rolling window of 36 months. Descriptive statistics for portfolio excess returns are shown in Table 5.

Take the result of panel A for example, the U-shaped relationship between terrorism risk sensitivity (pre-beta) and currency portfolios' excess returns is depicted in Fig. 2, which implies currencies with high (low) sensitivity to terrorism risk yield more (less) excess returns. We then create a zero-investment portfolio by going long in currencies with extremely negative or positive sensitivity to terrorism risk (portfolio 1 and portfolio 5) and short in all other currencies, denoted as *XMI*. This strategy can yield 3.5% per annum. This fact is consistent with arguments that assets provide high payoffs when they are highly sensitive to terrorism risk, and hence that can act as a terrorism risk hedge, trade at a premium and vice versa.⁵

3.4. Robustness

3.4.1. Change time horizon of terrorism risk factor

To check whether our results are robust to a different time horizon of constructing the terrorism risk factor, countries (regions) are sorted by one-year-ahead numbers of terrorist attacks instead of one-month-ahead. Similarly, we yield time-series returns of the terrorism risk factor, denoted as *TRF_YEAR*. We then employ this factor to analyze how excess returns react to terrorist attacks. Detailed results are reported in Table 6. Our results are robust even changing the time horizon of the terrorism risk factor.

3.4.2. Alternative measurements of terrorism risk factor

To check whether our results are robust to different measurements of constructing the terrorism risk factor, we further utilize the numbers of fatalities and injuries from GTD to measure terrorism activities following Younas (2014) and Zheng et al. (2021) and construct two factors similar to *TRF*, denoted as *TRF_DEATH* and *TRF_INJURY*. The results are reported in Tables 7 and 8, respectively. Our results remain robust when changing the measurement of the terrorism risk factor.

3.4.3. Endogeneity

To accommodate endogeneity concerns, we employ two-stage least squares (2SLS) regression with instrumental variables. Specially, we construct a variable similar to *TRF* but based on the numbers of victims in terrorist attacks as an instrument for *TFR*. We report the first-stage F-statistics and the Wu-Hausman F-statistics (Hausman, 1978) to test for the instrument relevance and the exogeneity of the regression. The 2SLS results of carry trade and individual currencies' excess returns are reported in Tables 9 and 10. Our results remain robust when the endogeneity issue is mitigated.

4. Conclusions

This paper explores how FX markets react to terrorist attacks. By going long in currencies of countries with more terrorist attacks and short in currencies of countries with fewer terrorist attacks, we construct a terrorism risk factor that significantly matters to excess returns of both currency carry trade and most individual currencies. More importantly, we propose a currency strategy based on holding terrorism-sensitive portfolios and shorting less terrorism-sensitive portfolios with sound economic significance, which demonstrates that the terrorism risk factor provides a marginal improvement for exchange rate pricing facing terrorist attacks.

CRedit authorship contribution statement

Yiye Liu: Data curation, Formal analysis, Methodology, Software, Visualization, Writing – original draft, Writing – review & editing. **Liyan Han:** Funding acquisition, Investigation, Project administration, Resources, Supervision, Validation, Writing – review & editing. **You Wu:** Conceptualization, Funding acquisition, Investigation, Validation, Writing – original draft, Writing – review &

⁵ Our findings remain similar when analyzing the results of Panel B and Panel C.

editing. **Libo Yin:** Conceptualization, Writing – review & editing.

Acknowledgements

This research is supported by the National Natural Science Foundation of China under project No. 71850007, and the Beijing Technology and Business University under projects No. QNJ2020–36 and No. PXM2020_014213_000017.

References

- Abadie, A., Gardeazabal, J., 2008. Terrorism and the world economy. *Europ. Econ. Rev.* 52 (1), 1–27. <https://doi.org/10.1016/j.eurocorev.2007.08.005>.
- Akram, Q.F., Rime, D., Sarno, L., 2008. Arbitrage in the foreign exchange market: turning on the microscope. *J. Int. Econ.* 76 (2), 237–253. <https://doi.org/10.1016/j.jinteco.2008.07.004>.
- Benchimol, J., El-Shagi, M., 2020. Forecast performance in times of terrorism. *Econ. Model.* 91, 386–402. <https://doi.org/10.1016/j.econmod.2020.05.018>.
- Byrne, J.P., Ibrahim, B.M., Sakemoto, R., 2018. Common information in carry trade risk factors. *J. Int. Financ. Mark. Inst. Money* 52 (JAN), 37–47. <https://doi.org/10.1016/j.intfin.2017.11.003>.
- Chen, Y., Goyal, A., Veeraraghavan, M., Zolotoy, L., 2020. Terrorist attacks, investor sentiment, and the pricing of initial public offerings. *J. Corp. Financ.* 65 <https://doi.org/10.1016/j.jcorpfin.2020.101780>.
- Demirer, R., Yuksel, A., Yuksel, A., 2022. Time-varying risk aversion and currency excess returns. *Res. Int. Bus. Financ.* 59 <https://doi.org/10.1016/j.ribaf.2021.101555>.
- Eldor, R., Melnick, R., 2004. Financial markets and terrorism. *Europ. J. Polit. Econ.* 20 (2), 367–386. <https://doi.org/10.1016/j.ejpoleco.2004.03.002>.
- Fama, E.F., French, K.R., 1993. Common risk factors in the returns on stocks and bonds. *J. Financ. Econ.* 33 (1), 3–56. [https://doi.org/10.1016/0304-405x\(93\)90023-5](https://doi.org/10.1016/0304-405x(93)90023-5).
- Fan, Z., Londono, J.M., Xiao, X., 2022. Equity tail risk and currency risk premiums. *J. Financ. Econ.* 143 (1), 484–503. <https://doi.org/10.1016/j.jfineco.2021.05.020>.
- Ferreira, A., Moore, M., Mukherjee, S., 2019. Expectation errors in the foreign exchange market. *J. Int. Money Finance* 95, 44–51. <https://doi.org/10.1016/j.jimonfin.2019.03.005>.
- Filippou, I., Gozluklu, A.E., Taylor, M.P., 2018. Global political risk and currency momentum. *J. Financ. Quant. Anal.* 53 (5), 2227–2259. <https://doi.org/10.1017/s0022109018000686>.
- Hausman, J.A., 1978. Specification tests in econometrics. *Econometrica* 46 (6), 1251–1271. <https://doi.org/10.2307/1913827>.
- Iyke, B.N., 2020. The disease outbreak channel of exchange rate return predictability: evidence from COVID-19. *Emerg. Mark. Financ. Trade* 56 (10), 2277–2297. <https://doi.org/10.1080/1540496x.2020.1784718>.
- Iyke, B.N., Phan, D.H.B., Narayan, P.K., 2022. Exchange rate return predictability in times of geopolitical risk. *Int. Rev. Financ. Anal.* 81 <https://doi.org/10.1016/j.irfa.2022.102099>.
- Jiang, X., Han, L., Yin, L., 2019. Can skewness predict currency excess returns? *N. Am. Econ. Financ.* 48, 628–641. <https://doi.org/10.1016/j.najef.2018.07.018>.
- Jurek, J.W., 2014. Crash-neutral currency carry trades. *J. Financ. Econ.* 113 (3), 325–347. <https://doi.org/10.1016/j.jfineco.2014.05.004>.
- Lafree, G., Dugan, L., 2007. Introducing the global terrorism database. *Terror. Polit. Violence* 19 (2), 181–204. <https://doi.org/10.1080/09546550701246817>.
- Lee, S.S., Wang, M., 2019. The impact of jumps on carry trade returns. *J. Financ. Econ.* 131 (2), 433–455. <https://doi.org/10.1016/j.jfineco.2018.08.006>.
- Lustig, H., Roussanov, N., Verdelhan, A., 2011. Common risk factors in currency markets. *Rev. Financ. Stud.* 24 (11), 3731–3777. [10.1093/rfs/hhr068](https://doi.org/10.1093/rfs/hhr068).
- Lustig, H., Verdelhan, A., 2007. The cross section of foreign currency risk premia and consumption growth risk. *Am. Econ. Rev.* 97 (1), 89–117. <https://doi.org/10.1257/aer.97.1.89>.
- Menkhoff, L., Sarno, L., Schmeling, M., Schrimpf, A., 2012a. Carry trades and global foreign exchange volatility. *J. Financ.* 67 (2), 681–718. <https://doi.org/10.1111/j.1540-6261.2012.01728.x>.
- Menkhoff, L., Sarno, L., Schmeling, M., Schrimpf, A., 2012b. Currency momentum strategies. *J. Financ. Econ.* 106 (3), 660–684. <https://doi.org/10.1016/j.jfineco.2012.06.009>.
- Narayan, P.K., Narayan, S., Khademalomoom, S., Phan, D.H.B., 2018. Do terrorist attacks impact exchange rate behavior? New international evidence. *Econ. Inq.* 56 (1), 547–561. <https://doi.org/10.1111/ecin.12447>.
- Narayan, P.K., Narayan, S., Phan, D.H.B., 2022. Terrorism and international stock returns. *J. Int. Financ. Mark. Inst. Money* 76. <https://doi.org/10.1016/j.intfin.2021.101467>.
- Orbaneja, J.R.V., Iyer, S.R., Simkins, B.J., 2018. Terrorism and oil markets: a cross-sectional evaluation. *Financ. Res. Lett.* 24, 42–48. <https://doi.org/10.1016/j.frl.2017.06.016>.
- Papakyriakou, P., Sakkas, A., Taoushianis, Z., 2019. The impact of terrorist attacks in G7 countries on international stock markets and the role of investor sentiment. *J. Int. Financ. Mark. Inst. Money* 61, 143–160. <https://doi.org/10.1016/j.intfin.2019.03.001>.
- Park, J.S., Newaz, M.K., 2018. Do terrorist attacks harm financial markets? A meta-analysis of event studies and the determinants of adverse impact. *Glob. Financ. J.* 37, 227–247. <https://doi.org/10.1016/j.gfj.2018.06.003>.
- Phan, D.H.B., Narayan, P.K., Gong, Q., 2021. Terrorist attacks and oil prices: hypothesis and empirical evidence. *Int. Rev. Financ. Anal.* 74 <https://doi.org/10.1016/j.irfa.2021.101669>.
- Ramiah, V., Wallace, D., Veron, J.F., Reddy, K., Elliott, R., 2019. The effects of recent terrorist attacks on risk and return in commodity markets. *Energy Econ* 77, 13–22. <https://doi.org/10.1016/j.eneco.2018.10.025>.
- Reitz, S., Umlandt, D., 2021. Currency returns and FX dealer balance sheets. *J. Int. Econ.* 133. <https://doi.org/10.1016/j.jinteco.2021.103541>.
- Shahzad, S.J.H., Kyei, C.K., Gupta, R., Olson, E., 2021. Investor sentiment and dollar-pound exchange rate returns: evidence from over a century of data using a cross-quantilegram approach. *Financ. Res. Lett.* 38. <https://doi.org/10.1016/j.frl.2020.101504>.
- Sharma, S.S., Bach Phan, D.H., Narayan, P.K., 2019. Exchange rate effects of US government shutdowns: evidence from both developed and emerging markets. *Emerg. Mark. Rev.* 40 <https://doi.org/10.1016/j.ememar.2019.100626>.
- Su, Z., Mo, X., Yin, L., 2021. Oil market uncertainty and excess returns on currency carry trade. *Res. Int. Bus. Financ.* 56 <https://doi.org/10.1016/j.ribaf.2021.101391>.
- Wang, A.Y., Young, M., 2020. Terrorist attacks and investor risk preference: evidence from mutual fund flows. *J. Financ. Econ.* 137 (2), 491–514. <https://doi.org/10.1016/j.jfineco.2020.02.008>.
- Younas, J., 2014. Does globalization mitigate the adverse effects of terrorism on growth? *Oxford Econ. Pap.* 67 (1), 133–156. <https://doi.org/10.1093/oxep/gpu040>.
- Zheng, M., Feng, G.-F., Jang, C.-L., Chang, C.-P., 2021. Terrorism and green innovation in renewable energy. *Energy Econ* 104, 105695. <https://doi.org/10.1016/j.eneco.2021.105695>.

² For brevity, we only report the regression results with all three control variables. And the results controlled for *DOL* and *CARRY* are also robust.