



## Do terror attacks affect the dollar-pound exchange rate? A nonparametric causality-in-quantiles analysis

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### ABSTRACT

While much significant research has been done to study the effects of terror attacks on stock markets, less is known about the response of exchange rates to terror attacks. We suggest a non-parametric causality-in-quantiles test to study whether (relative) terror attacks affect exchange-rate returns and volatility. Using data on the dollar-pound exchange rate to illustrate the test, we show that terror attacks mainly affect the lower and upper quantiles of the conditional distribution of exchange-rate returns, while misspecified (due to nonlinearity and structural breaks) linear Granger causality test show no evidence of predictability. Terror attacks also affect almost all quantiles of the conditional distribution of exchange-rate volatility (except the extreme upper-end), with the significance of the effect being particularly strong for the lower quantiles. The importance of terror attacks is shown to hold also under an alternative measure of volatility and for an important emerging-market exchange rate as well.

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## 1. Introduction

Against the background of geopolitical uncertainty and political disruptions in many parts of the world much significant empirical research has been done to trace out how terror attacks affect financial markets. The majority of studies contributing to this research shed light on the effect of terror attacks on stock markets (see, for example, Arin, Ciferri, & Spagnolo, 2008; Chen & Siems, 2004; Karolyi & Martell, 2010; for a brief literature review, see Balcilar, Gupta, Pierdzioch, & Wohar, 2016). Less is known about how terror attacks affect exchange rates – something we aim to address in this paper, especially given that the foreign exchange market is the largest and most liquid financial market in the world. As reported in the Triennial Survey of Global Foreign Exchange Market Volumes of the Bank of International Settlements (BIS) (2016), the average

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daily turnover was 5.1 trillion of U.S. dollars 2016. In principle, terror attacks can affect exchange rates through their direct effect on macroeconomic fundamentals and by changing market participants' expectations.

As for the effect of terror attacks on macroeconomic fundamentals, [Eckstein and Tsiddon \(2004\)](#) use a Blanchard-Yaari overlapping-generations model to argue that terror attacks increase the risk of death and, thereby, inflate households' subjective discount rate. Their model predicts that a higher discount rate results in less savings such that in the steady state investment, consumption, and output are lower than in a world without terror. [Eckstein and Tsiddon \(2004\)](#) report empirical evidence for Israel that supports this prediction of their model. They also argue that a government, by increasing defense spending, can try to counter the negative macroeconomic effects of terror attacks because spending resources on the production of security increases households' life expectancy and personal safety. One would expect, thus, that terror attacks trigger an increase in government spending.

Evidence documented by [Blomberg, Hess, and Orphanides \(2004\)](#) is consistent with this view. They report that terrorism, in addition to deteriorating growth prospects (see also [Gaibullov & Sandler, 2008](#), who also differentiate between domestic and transnational terrorism), triggers a reallocation of resources because it crowds out investment while it crowds in government spending. Viewed through the lens of a simple textbook Mundell-Fleming open-economy model, higher government spending should result in an appreciation of the exchange rate. At the same time, if terror attacks have an adverse effect on output and consumption, the monetary model of exchange-rate determination predicts that terror attacks should trigger a depreciation of the exchange rate.<sup>1</sup>

Another macroeconomic channel through which terror attacks may affect exchange rates is via the effect on international trade flows. [Eckstein and Tsiddon \(2004\)](#) find for Israel that terrorism has an adverse effect on exports. [Nitsch and Schumacher \(2004\)](#) find for a panel of more than 200 countries that terror attacks reduce trade. The negative effect of terror attacks on international trade may reflect an increase in frictional trading costs due to, for example, tighter security regulations and higher insurance costs (see the detailed analysis by [Walkenhorst & Dihel, 2002](#)). Indirect evidence of increases in frictional trading costs brought about by terror attacks has been reported by [Bensassi and Martínez-Zarzoso \(2012\)](#), who estimate gravity models and find that harmful pirate attacks (hijackings) have a significant adverse impact on international maritime trade (for further evidence, see also the recent study by [Burlando, Cristea, & Lee, 2015](#)).

At higher data frequencies, the immediate implications of terror attacks for the formation of market participants' expectations are likely to be more important for exchange-rate movements than their direct effects on macroeconomic fundamentals. While in a baseline reduced-form macroeconomic rational-expectations model of exchange-rate determination, the former simply reflect the present-discounted value of the expected future path of fundamentals, for our empirical research it is useful to develop a broader view that accounts for market participants' risk reassessments, portfolio-reshuffling effects, contagion, and international volatility transmission.

If terror attacks alter market participants' expectations and trigger reassessments of risks, terror attacks may trigger exchange-rate movements because such attacks cause changes in international capital flows ([Enders, Sachida, & Sandler, 2006](#); [Enders & Sandler, 1996](#)). In the model developed by [Abadie and Gardeazabal \(2008\)](#), terror attacks trigger large international capital flows if attacks alter expected returns on investments. In their model, the nexus between terror attacks and international capital flows rests on the result that investors with a low level of risk aversion will change abruptly their international investment plans in response to a reassessment of expected returns on their investments in a terror-hit country. The resulting international reallocation of capital tends to be larger the more countries are integrated into international capital markets because, in a world of globalized finance, investors can easily diversify risk without investing funds in countries with a high relative risk of terror attacks. [Abadie and Gardeazabal \(2008\)](#) present empirical evidence that supports the predictions of their model. In particular, estimates of cross-country regressions show that terror risk reduces net foreign investment positions.

If the number of countries integrated into international financial markets is large, investments into the "world portfolio" become more sensitive to country-specific news and, even more, the incentives of investors to incur the costs of collecting and verifying country-specific information diminish. As a result, contagion in international financial markets can be the result of portfolio diversification of optimizing investors ([Calvo & Mendoza, 2000](#)). Terror-driven contagion and transmission of volatility in international financial markets, thus, can arise if terror attacks reveal country-specific "news" or if terror attacks give rise to, for example, media speculation about the stability of a countries' political system. If terror attacks trigger contagion effects in international financial markets, in turn, such effects are likely to bring about sharp and abrupt exchange-rate movements, warranting a detailed inspection of the effects of terror attacks across the quantiles of the conditional distribution of exchange rate returns and volatility.

Evidence of terror-induced contagion in international financial markets has been reported by [Hon, Strauss, and Yong \(2004\)](#). They show that, after accounting for heteroskedasticity in their data, the terror attacks of September 11 in the United States resulted in a stronger international correlation of stock markets. [Hon et al. \(2004\)](#) argue that their findings lend support to the view that market participants interpreted these terror attacks as a global shock. Concerning the transmission of volatility in international financial markets, [Chuliá, Climent, Soriano, and Torró \(2009\)](#) find evidence of bidirectional volatil-

<sup>1</sup> The exchange-rate effect of terror attacks that operates through their impact on output growth may depend on the type of attacks and the political system of a country hit by an attack. [Tavares \(2004\)](#) finds that terror attacks seem to have a moderate negative effect on output growth, especially terror attacks on civilians by known terrorist organizations. Moreover, the costs of terror attacks as measured in terms of losses in output growth tend to be smaller the more democratic is a country hit by an attack.

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