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Are US-Dollar-Hedged-ETF Investors Aggressive on Exchange Rates? A Panel VAR Approach

Corey A. Shank ^a Andre C. Vianna ^{a, b, *}

Abstract

Exchange traded funds (ETFs) are a multi-trillion dollar market that epitomizes financialization due to its recent growth. This study examines the behavior of U.S. listed currency hedged ETF investors towards changes in the underlying benchmark and foreign exchange rate from July 2011 to November 2015 using a panel VAR approach. We find that investors are able to anticipate changes in future exchange rates and invest in currency hedged ETFs prior to changes. Granger-causality tests confirm that these investors proactively trade before large real exchange rate movements. These results suggest that the use of financial instruments such as ETFs to hedge against exchange rate volatility may have itself become a source of volatility, which have implications for the further financialization of the ETF industry.

Keywords: ETFs; Financialization; Trading Volume; Exchange Rates; Investor Behavior

JEL Classification: E44; F31; G11; G12;

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1. Introduction

Exchange traded funds (ETFs) are a multi-trillion dollar market that epitomizes financialization. For the first time in history, the global level of assets held under management in ETFs has surpassed those held by hedge funds, with \$2.97 trillion in June 2015 (Rennison, 2015). The ETF market has more than tripled in size since 2007, while the hedge fund industry has grown a little over 50%. Likewise, net inflows are \$152.3 billion for ETFs in the first half of 2015, compared to \$39.7 billion flowing into hedge funds. The ETF market is a perfect example of financialization, because if investors were not putting more importance on the ETF market, it would defy the recent growth. Therefore, the need to examine how investors trade ETFs is self-evident.

Ramaswamy (2011) explains the operation structure of ETFs by showing that market makers buy shares of stock from the market. Market makers then build a basket of securities through an ETF sponsor who creates shares for the ETF. These shares are provided to the stock exchange which then offers the ETF to investors in the secondary market. The cash from investors' purchases is given to the market maker through the exchange, who purchases more securities from the market to continue the cycle¹.

Traditionally, ETFs look to replicate a targeted index². Currency hedged ETFs have an additional feature besides holding the underlying assets, which is the use of derivatives such as forwards to hedge against future changes in exchange rates. This allows investors who want to

¹ ETFs are not considered to be mutual funds in the United States because of the limited redeem ability of ETF shares. They are open ended funds that can be traded throughout the day similarly to a closed end fund (Ramaswamy, 2011).

² For example, Elton et al. (2002) observe investors' most popular index to replicate is the S&P 500.

own a foreign asset but are worried about exchange rates to hold a fund that is hedged against exchange rates.

1.1. Financialization

There is an emergent field of literature about financialization since the 1990's (Engelen, 2008). Epstein (2001) defines financialization as:

“Financialization refers to the increasing importance of financial markets, financial motives, financial institutions, and financial elites in the operation of the economy and its governing institutions, both at the national and international level” (Epstein 2001, p1).

Lagoarde-Segot (2016) describes how financialization research is widespread in a plethora of social sciences, but argues for the basis of incorporating it into the finance literature. He connects financialization with the related development of cyberspace, global deregulation of financial markets, and rise in shareholder governance to show the need to examine it in finance research.

Cloke (2010) and Cloke (2013) analyze the recent outlook in the international financial, economic, and political system and coin the term ultra-capital (new hybrid forms of capital)³, proposing it evolves from within the global financial services' sector as a relational space for actants, networks and processes. The example of the securitization boom of 2003-2007 is provided where special purpose vehicles act as financial service entities with the purpose of invisibility, mobility and the concealment of ownership.

1.2. Previous studies on ETFs

³ Ultra-capital can also be defined as capital that in certain critical areas is created by complex social and relational aspects that put it outside, beyond capital (Cloke, 2010).

Most research in ETFs examines the ETF instrument itself. For example, research analyzes how effectively ETFs track their benchmark indices (Aber et al. 2009; Johnson 2009; Charupat and Miu 2013). Svetina (2010) finds that ETFs track as well as comparable index mutual funds, similar to Poterba and Shoven (2002), adding that ETFs underperform their benchmark indexes, and are not immune from tracking error. Ben-David et al. (2014) find that ETFs increase stock volatility because they attract a new layer of demand shocks to the stock market due to their high liquidity.

ETF market quality, measured by liquidity and spreads, has improved since 2001 due to tick sizes changing from fractional to decimal (Chou and Chung 2006) and increased competition from new ETFs entering the market (Boehmer and Boehmer 2003). Nguyen et al. (2007) debate that multimarket trading improves the liquidity of most popular ETFs. Agapova (2011) finds that index mutual funds and ETFs are imperfect substitutes.

One concern for investors is that ETF prices can deviate from its net asset value (NAV). Engle and Sarkar (2006) indicate that the average premium is 1.1 basis points over NAV for domestic ETFs and 35 basis points for foreign ETFs. ETFs' price changes are due to variations in the underlying shares and are not high-frequency traded assets. However, some research focuses on arbitrage opportunities. Marshall et al. (2013) use high-frequency data from the Thomson Reuters Tick History (TRTH) database to analyze two extremely liquid S&P 500 ETFs and find that spreads increase just before arbitrage opportunities and price deviations are followed by a tendency to quickly correct back towards parity.

The current paper analyzes investor trading behavior on currency hedged ETFs, in the light of financialization, since these financial instruments have been discussed by market

analysts as a way for investors to hedge their exposure to foreign exchange rates while taking advantage of international markets' performance.⁴ There is large evidence of financialization in the commodities (Aboura and Chevallier 2015; Huchet and Fam 2016) and securitization (Buchanan, 2016) markets. In turn, we provide an insight into how investor's trade currency hedged ETFs that provides important implications to the financialization of the ETF industry.

The rest of the paper proceeds as follows. Section 2 describes the data and methodology. Section 3 presents the results. Section 4 provides the conclusions.

2. Data and Methodology

Two separate panel vector autoregression models are used. The first, XTVAR, uses a least squares dummy variable (LSDV) estimator, as described by Cagala and Glogowsky (2014). The second, PVAR, runs on a generalized method of moments (GMM) framework following Abrigo and Love (2015).

Three U.S. listed currency-hedged ETFs are examined, as these funds are the only such funds with at least three years of data. The three ETFs are: DXJ (WisdomTree Japan Hedged Equity ETF), which hedges the Japanese Yen against the U.S. dollar; HEDJ (WisdomTree Europe Hedged Equity ETF), which provides U.S. dollar hedging for the Euro stock benchmark index; and DBBR (Deutsche X-trackers MSCI Brazil Hedged Equity ETF), which hedges the Brazilian stock market benchmark index against the local currency exchange rate fluctuations towards the U.S. dollar.

⁴ See, for example, Pisani (2015).

Monthly data is collected from July 2011 to November 2015 to perform a strongly-balanced regression for the three ETFs. The variables trading volume and ETF index price are collected from DataStream, while real effective exchange rates is collected from Bank for International Settlements (BIS).

Panel-data VAR methods combine the traditional VAR approach, which considers all the variables in the structure as endogenous, with the panel-data technique, which allows for explicit inclusion of a fixed effect in the model. The model can be written as:

$Z_{it} = \Gamma_0 + \Gamma_1 Z_{it-1} + f_i + d_t + e_{it}$, where Z_{it} is a three-variable vector: DVO, DRI and DREER.⁵ DVO is the first difference of the natural log of the turnover by volume variable for each ETF. DRI is measured as the first log difference of the total return index variable for each ETF. Finally, DREER is calculated by the first log difference of the real effective exchange rate⁶. f_i represents the fixed effects variable which captures the unobserved individual heterogeneity⁷. d_t denotes the forward mean-differencing, following Love and Zicchino (2006), also referred to as the *Helmert procedure* (Arellano and Bover, 1995), and is employed in order to preserve the orthogonality between transformed variables and lagged regressors⁸.

The purpose of comparing the PVAR and the XTVAR estimations is to confirm, through different techniques, the research question of: Does speculation on exchange rates influence investor behavior? The hypothesis of this paper can be seen in Figure 1. If there is speculation

⁵ We estimated the Panel VAR and the impulse-response of the ETFs' market value (MV) and find no significant results. For this reason, changes in the market value (MV) were excluded from the analysis.

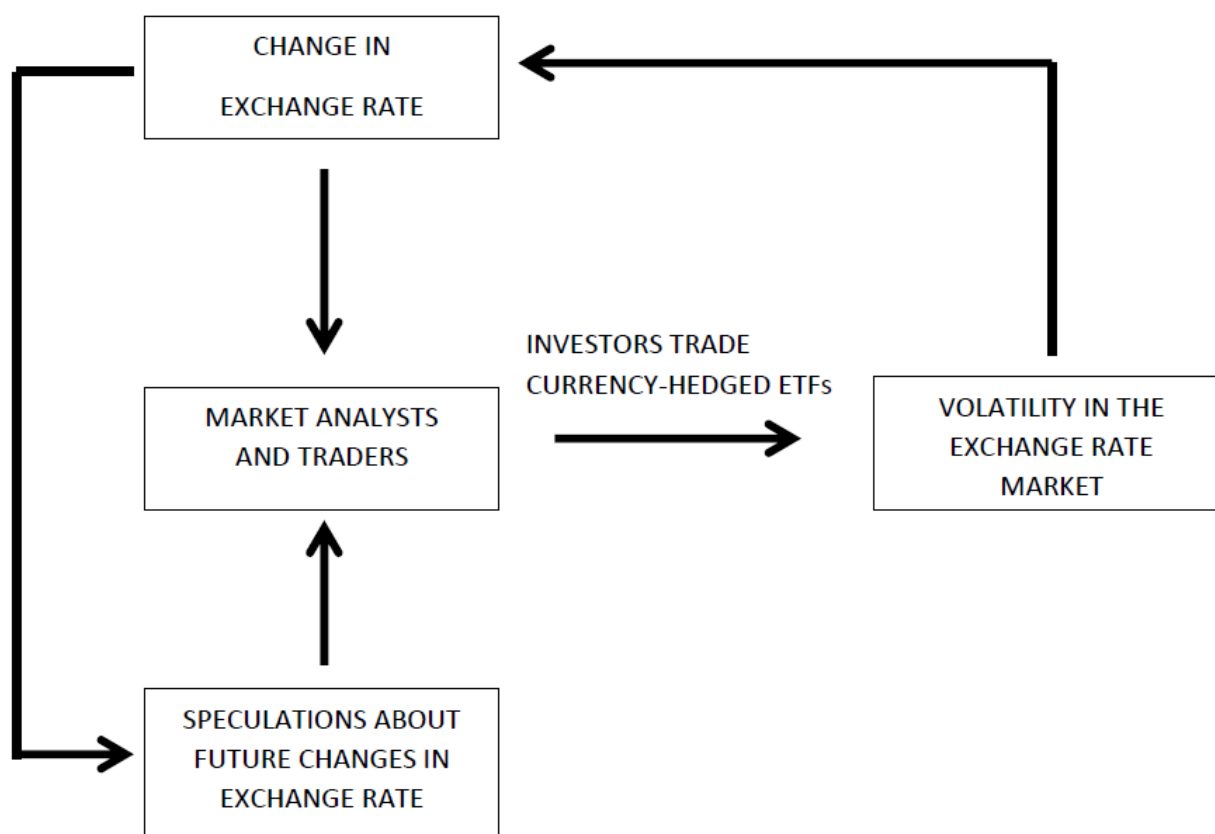
⁶ The real effective exchange rate uses the local currency of each of the three ETFs against a broad basket of currencies calculated by the Bank for International Settlements (BIS) database.

⁷ This is parallel to Grossmann et al. (2014) in order to allow each ETF to have an ETF-specific level of each of the factors in the model to capture other time-invariant factors, such as different exchange rate regimes, ETF benchmark indices, and financial regulation

⁸ This procedure allows using lagged regressors as instruments and estimates the coefficients by system GMM.

about future changes in the exchange rate, market analysts and traders will invest in currency-hedged ETFs. This will increase the trading activity in such ETFs before the change in exchange rate. The market analysts and traders will digest the information about the change in exchange rates and thus speculate on the future exchange rate changes continuing the cycle. This question can be answered by examining the following aspects.

Figure 1. The Use of Financial Instruments such as ETFs to Hedge Against Exchange Rate Volatility



First, if trading volume dynamically precedes the change in the country’s exchange rate, it will suggest that investors are able to anticipate real exchange rate movements and are investing in an ETF that hedges against this speculated exchange rate shock. Secondly, if there is a positive response to volume due to impulses to real exchange rates, then investors’ decisions will be based upon the exchange rate. This is a reasonable illation because if there is a positive

shock to exchange rates, investors may react by buying an investment that hedges against future exchange rate risk.

Lee and Rui (2002) find that trading volume does not Granger-cause stock market returns in the New York, Tokyo or London market. However, there does exist a positive relationship between trading volume and volatility in all three markets. Therefore, when trading volume in these ETFs increase, it is reasonable to assume volatility to coincidentally increase.

3. Results

Table 1 provides the summary statistics of the variables in the study. ETF average return is about 1% with returns ranging from -15% to +13%. Similarly, the average turnover by volume is about 14%. Finally, the returns of the exchange rate shows a slight appreciation of the United States dollar versus the currencies examined.

Table 1: Summary Statistics

This table reports the summary statistics of the variables. The number of observations (Obs), mean, standard deviation (Std. Dev) minimum (Min) and Maximum (Max) are provided for the turnover by volume (DVO), total index return (DRI) and real effective exchange rates (DREER). DVO, DRI, and DREER are all measured by the first log difference of their level variable. These variables are for the three US-listed currency-hedged ETFs: DXJ (WisdomTree Japan Hedged Equity ETF), which hedges the Japanese Yen against the US dollar; HEDJ (WisdomTree Europe Hedged Equity ETF), which provides US dollar hedging for the Euro stock benchmark index; and DBBR (Deutsche X-trackers MSCI Brazil Hedged Equity ETF), which hedges the Brazilian stock market benchmark index against the local currency exchange rate fluctuations towards the US dollar. The monthly data ranges from July 2011 to November 2015.

Variable	Obs	Mean	Std. Dev.	Min	Max
DVO	158	0.137	0.855	-2.444	5.508
DRI	158	0.009	0.050	-0.150	0.129
DREER	156	-0.006	0.025	-0.097	0.052

Table 2 displays panel unit root test results. The results for the Augmented Dickey-Fuller and Im-Pesaran-Shin panel unit root tests⁹ show the variables have unit roots in levels and are stationarity in first-differences. Table 3 displays results from the Johansen (1991) cointegration tests for the three variables: trading volume, index price, and real effective exchange rates in levels for all three ETF's examined. In all tests, we are unable to reject the null hypothesis of no cointegration among variables.

Table 2: Panel Unit Root Tests

This table presents the Augmented Dickey-Fuller Panel and Im-Pesaran-Shin panel unit root test for the variables VO, RI, and REER in levels and first differences for the monthly data from July 2011 - November 2015. Vo is the turnover by volume, RI is the price of the index, and REER is the real effective exchange rate. These variables are for the three US-listed currency-hedged ETFs: DXJ (WisdomTree Japan Hedged Equity ETF), which hedges the Japanese Yen against the US dollar; HEDJ (WisdomTree Europe Hedged Equity ETF), which provides US dollar hedging for the Euro stock benchmark index; and DBBR (Deutsche X-trackers MSCI Brazil Hedged Equity ETF), which hedges the Brazilian stock market benchmark index against the local currency exchange rate fluctuations towards the US dollar. The Augmented Dickey Fuller test uses inverse normal (Z) distributions while the Im-Pesaran-Shin tests uses Z-t-tilde-bar tests.

Variable	Levels				First Differences			
	ADF	p-value	IPS	p-value	ADF	p-value	IPS	p-value
VO	-0.482	0.315	-0.295	0.384	-11.103	0.000	-7.514	0.000
RI	1.913	0.972	2.039	0.979	-11.203	0.000	-7.425	0.000
REER	1.536	0.938	1.538	0.938	-7.592	0.000	-5.722	0.000

Table 3: Johansen Cointegration Tests (VO, RI, REER)

This table presents the Johansen cointegration test for the three variables VO, RI, REER where Vo is the turnover by volume, RI is the price of the index, and REER is the real effective exchange rate for the three ETFs examined. The three US-listed currency-hedged ETFs are: DXJ (WisdomTree Japan Hedged Equity ETF), which hedges the Japanese Yen against the US dollar; HEDJ (WisdomTree Europe Hedged Equity ETF), which provides US dollar hedging for the Euro stock benchmark index; and DBBR (Deutsche X-trackers MSCI Brazil Hedged Equity ETF), which hedges the Brazilian stock market benchmark index against the local currency exchange rate fluctuations towards the US dollar. R denotes the number of cointegrating vectors. The lag length in all tests are selected using Akaike Information Criteria (AIC). Rejection of the

⁹ Augmented Dickey Fuller-GLS test procedure developed by Elliott, Rothenberg and Stock (1996) and Im-Pesaran-Shin test for unit roots in heterogeneous panels by Im, Pesaran and Shin (2003).

null hypothesis is signified at 10% (*) 5% (**) and 1% (***) level. The critical values for the Trace test are 29.68, 15.41, and 3.76 for the maximum ranks of 0, 1, and 2 respectively. The critical values for the Lambda Max test are 20.97, 14.07, and 3.76 for the maximum ranks of 0, 1, and 2 respectively.

ETF	Hypothesis	$r = 0$	$r \leq 1$	$r \leq 2$
DBBR	Trace test	18.243	8.1104	1.0088
	λ max test	10.1326	7.1016	1.0088
HEDJ	Trace test	18.11	4.6265	0.9813
	λ max test	14.1846	3.6452	0.9813
DXJ	Trace test	23.1118	6.3464	1.3184
	λ max test	16.7654	5.028	1.3184

Figures 2 and 3 provide the impulse response graphs for the relationship between real effective exchange rates, index returns, and trading volume using the XTVAR and PVAR approaches, respectively. When examining the impulse of trading volume on exchange rates (upper right corner), we find a positive shock to trading volume leads to a statistically significant depreciation of the local currency exchange rate at 1 month. This provides evidence that investors anticipate long-term real exchange rate movements by trading volume increasing before the move in exchange rates in order to hedge against the speculated movement.

Figure 2: Impulse-Response for the Panel Vector Autoregression using the XTVAR approach: XTVAR(dreer, dri, dvo)

This figure reports the impulse-response for the Panel Vector Autoregression using the XTVAR approach (Cagala and Glogowsky (2014)) for the variables dreer, dri, dvo. Dreer is the return of the real effective exchange rate of the currency being hedged. Dri is the return of the index. Dvo is the return of the turnover by volume. Dreer, dri, and dvo are all measured by taking the first log difference of the level variable. The variables are collected for 3 US-listed currency-hedged ETFs: DXJ (WisdomTree Japan Hedged Equity ETF), which hedges the Japanese Yen against the US dollar; HEDJ (WisdomTree Europe Hedged Equity ETF), which provides US dollar hedging for the Euro stock benchmark index; and DBBR (Deutsche X-trackers MSCI Brazil Hedged Equity ETF), which hedges the Brazilian stock market benchmark index against the local currency exchange rate fluctuations towards the US dollar.

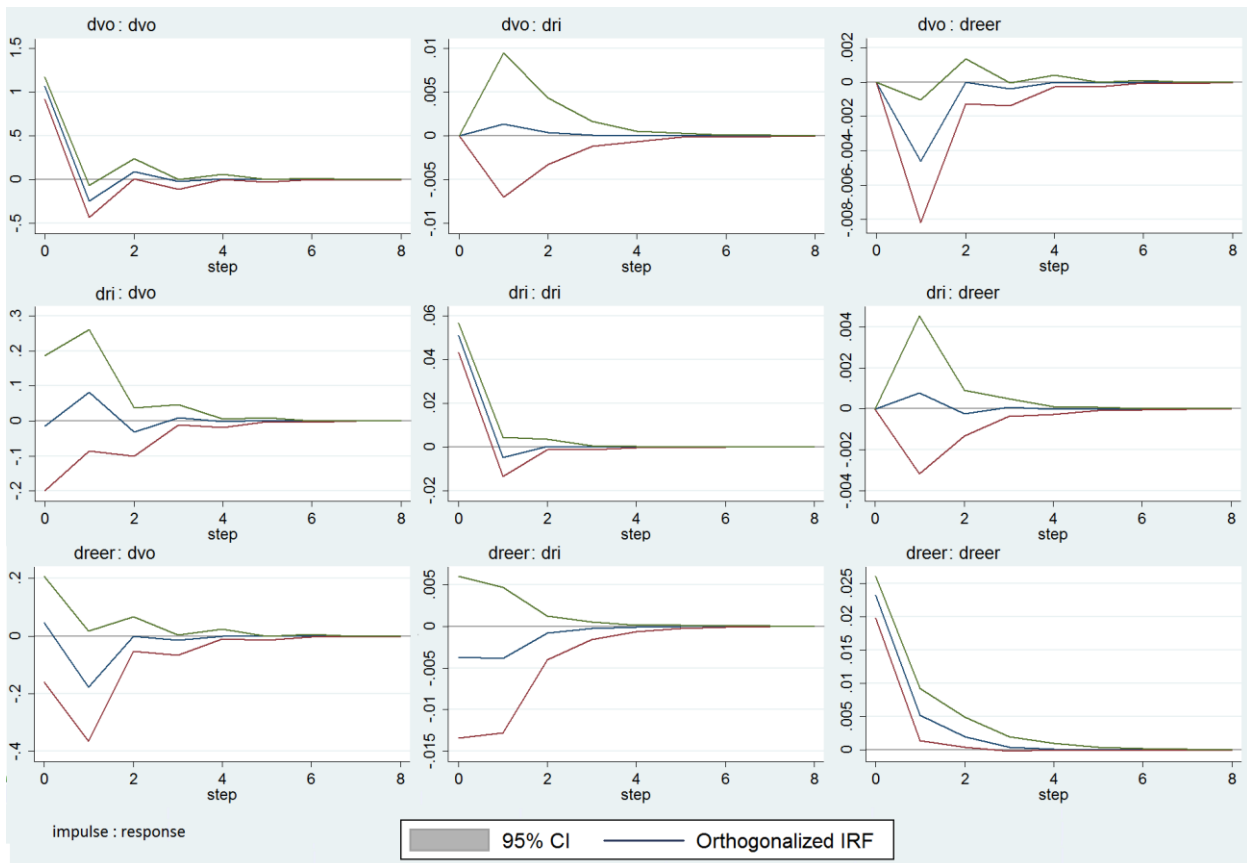
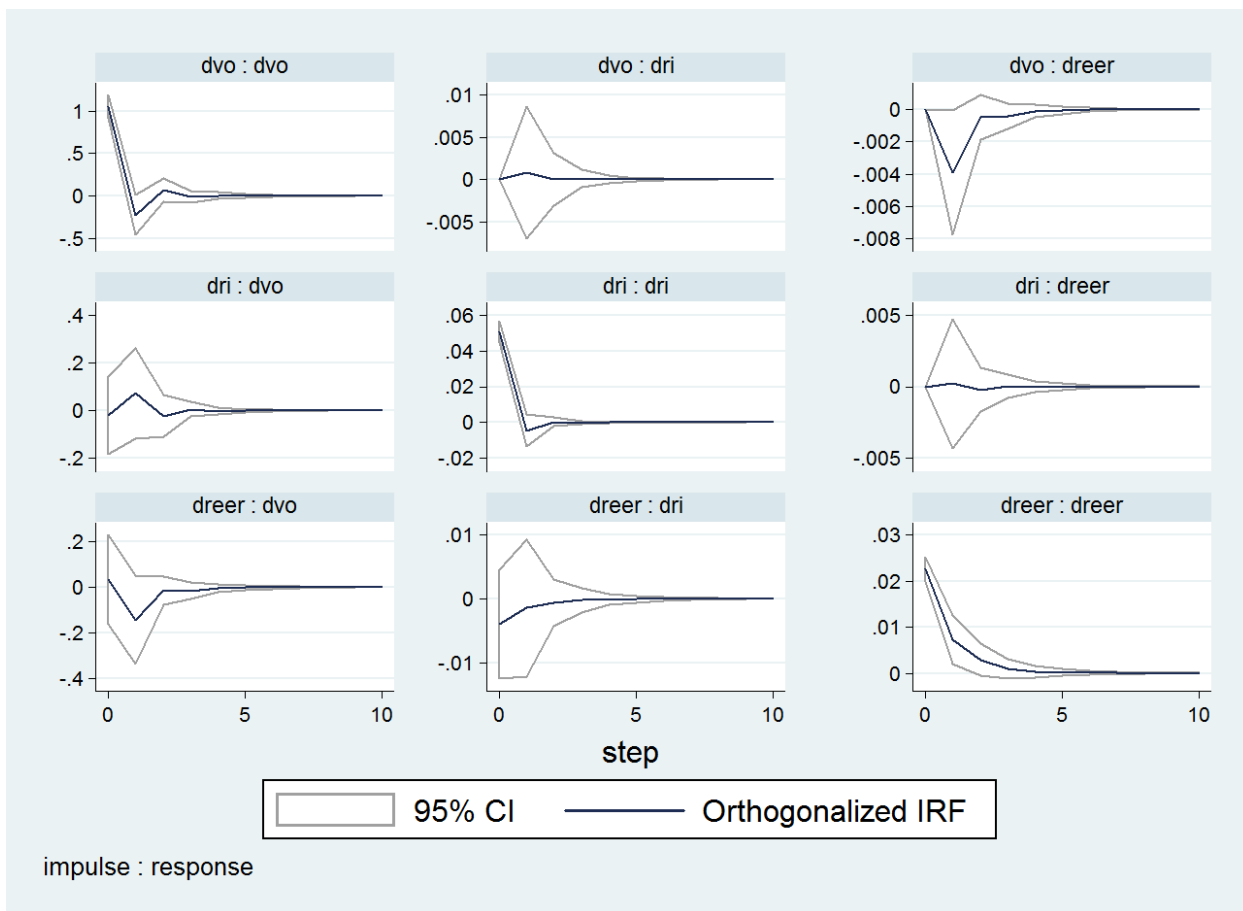


Figure 3: Impulse-Response for the Panel Vector Autoregression using the PVAR approach: PVAR(dreer, dri, dvo)

This figure reports the impulse-response for the Panel Vector Autoregression using the PVAR approach (Abrigo and Love (2015) for the variables dreer, dri, dvo. Dreer is the return of the real effective exchange rate of the currency being hedged. Dri is the return of the index. Dvo is the return of the turnover by volume. Dreer, dri, and dvo are all measured by taking the first log difference of the level variable. The variables are collected for 3 US-listed currency-hedged ETFs: DXJ (WisdomTree Japan Hedged Equity ETF), which hedges the Japanese Yen against the US dollar; HEDJ (WisdomTree Europe Hedged Equity ETF), which provides US dollar hedging for the Euro stock benchmark index; and DBBR (Deutsche X-trackers MSCI Brazil Hedged Equity ETF), which hedges the Brazilian stock market benchmark index against the local currency exchange rate fluctuations towards the US dollar.



The impulse-response function of exchange rates on trading volume shows that when there is a positive shock to real effective exchange rates, trading volume of these ETFs increases (bottom left). This shows that investors react to depreciation of the local currency of the index by buying currency hedged ETFs. The impulse of index returns on trading volume (middle left) is slightly below zero. When comparing this result to the response of trading volume from exchange rates (bottom left), we see that volume increases more to changes in exchange rates than to index returns, therefore we conclude that exchange rates are more important to investors' trading behavior than the returns of the ETF. Appendix A provides impulse response functions given different ordering of the variables to provide robustness to the results.

Based upon the results, we can conclude that investors increase trading volume before big moves in exchange rates and correspondingly, increase trading volume after exchange rates. This

is likely due to investors wanting to hedge against future shocks in exchange rates. However, as Lee and Rui (2002) show that increased trading volume Granger-causes increase in volatility, these investors that are investing in currency hedged ETFs to avoid exchange rate volatility, are in fact, creating volatility in the fund.

Table 4 presents the forecast error variance decomposition for both XTVAR and PVAR methods. Different ordering of variables is shown to add validity to the results. Panel A shows real effective exchange rates contribute more to trading volume than do ETF returns. This provides further evidence that investors are choosing these currency hedged ETFs because of the exchange rates rather than the returns of the ETF.

Table 4. Forecast Error Variance Decomposition

This table provides the forecast error variance decomposition for the three US-listed currency-hedged ETFs: DXJ (WisdomTree Japan Hedged Equity ETF), which hedges the Japanese Yen against the US dollar; HEDJ (WisdomTree Europe Hedged Equity ETF), which provides US dollar hedging for the Euro stock benchmark index; and DBBR (Deutsche X-trackers MSCI Brazil Hedged Equity ETF), which hedges the Brazilian stock market benchmark index against the local currency exchange rate fluctuations towards the US dollar caused by dvo, dri, and dreer using both XTVAR and PVAR models. Dvo is the return of the turnover by volume, dri is the return of the index, and dreer is the return of the real effective exchange rate. Dvo, dri, and dreer are all measured by taking the first log difference of the level variable. The time period is from July 2011 to November 2015. Significance is shown at the 10% (*) 5% (**) and 1% (***) levels.

Panel A. Percentage of Variation in DVO due to shocks to DRI or DREER (8-month horizon)				
XTVAR Model	XTVAR(dreer, dri, dvo)		XTVAR(dreer, dvo, dri)	
Shock due to	DRI	DREER	DRI	DREER
	0.65***	2.71***	0.58***	2.71***
PVAR Model	PVAR(dreer, dri, dvo)		PVAR(dreer, dvo, dri)	
Shock Due to	DRI	DREER	DRI	DREER
	0.51**	1.83**	0.43**	1.83**
Panel B. Percentage of Variation in DREER due to shocks to DVO or DRI(8-month horizon)				
XTVAR Model	XTVAR(dreer, dri, dvo)		XTVAR(dreer, dvo, dri)	
Shock due to	DVO	DRI	DVO	DRI
	3.58***	0.11***	3.60***	0.10***
PVAR Model	PVAR(dreer, dri, dvo)		PVAR(dreer, dvo, dri)	
Shock due to	DVO	DRI	DVO	DRI

	2.65**	0.01	2.65**	0.01*
Panel C. Percentage of Variation in DRI due to shocks to DVO or DREER(8-month horizon)				
XTVAR Model	XTVAR(dreer, dri, dvo)		XTVAR(dreer, dvo, dri)	
Shock due to	DVO	DREER	DVO	DREER
	0.07***	1.09***	0.10***	1.09***
PVAR Model	PVAR(dreer, dri, dvo)		PVAR(dreer, dvo, dri)	
Shock due to	DVO	DREER	DVO	DREER
	0.03	0.69**	0.06	0.69**

Panel B displays the contributions from trading volume and ETF returns to real exchange rates. Trading volume shows the highest coefficients demonstrating that investors may be anticipating exchange rate changes. Panel C shows that trading volume has very little contribution to ETF returns. However, real effective exchange rate shows a significant contribution to ETF returns. This result is expected as trading volume should have little impact on the returns of the underlying index similar to Lee and Rui (2002) and exchange rates should have an impact due to the index holding foreign companies.

Table 5 displays the results from the PVAR Granger-causality test. The results show that trading volume Granger-causes real effective exchange rate at a 6% significance level. This result is only possible if investors speculate about future exchange rates, causing the volume to increase. Combined with the result from the impulse-response functions and variance decomposition, Granger-causality results add robustness to previous findings that investors speculate about exchange rates causing them to increase trading volume in currency hedged ETFs.

Table 5: PVAR Granger Causality Wald Test

This table provides the granger causality test for the three US-listed currency-hedged ETFs: DXJ (WisdomTree Japan Hedged Equity ETF), which hedges the Japanese Yen against the US dollar; HEDJ (WisdomTree Europe Hedged Equity ETF), which provides US dollar

hedging for the Euro stock benchmark index; and DBBR (Deutsche X-trackers MSCI Brazil Hedged Equity ETF), which hedges the Brazilian stock market benchmark index against the local currency exchange rate fluctuations towards the US dollar. These ETFs are caused by dvo, dri, and dreer for the PVAR models. Dvo is the return of the turnover by volume, dri is the return of the index, and dreer is the return of the real effective exchange rate. Dvo, dri, and dreer are all measured by taking the first log difference of the level variable. The null hypothesis is that the excluded variable (column 2) does not Grange-cause equation variable (column 1) where df refers to the degrees of freedom. The time period is from July 2011 to November 2015. Significance is shown at the 10% (*) 5% (**) and 1% (***) levels.

Equation	Excluded	Chi-Squared	df	p-value
DREER				
	DRI	0.004	1	0.952
	DVO	3.693*	1	0.055
	ALL	3.709	2	0.157
DRI				
	DREER	0.115	1	0.734
	DVO	0.045	1	0.832
	ALL	0.148	2	0.929
DVO				
	DREER	1.417	1	0.234
	DRI	0.527	1	0.468
	ALL	3.561	2	0.169

4. Conclusions

The main findings in this paper are that investors are able to anticipate long-term real exchange rate movements as positive shocks to volume result in depreciation of the local currency in the following period. Similarly, the results show that when there is a positive shock to exchange rates, investors flock to currency hedged ETFs to protect themselves against future shocks.

These results provide valuable implications for the financialization of the ETF industry. As investors increase the trading volume in currency hedged ETFs due to increasing speculation

on exchange rates, they are likely increasing the volatility of their funds, even though the ETF is designed to prevent volatility due to exchange rates. Therefore, as the financialization of the ETF industry continues to grow, it is possible that trading volume and volatility will increase impacting both domestic and international financial markets.

Appendix A

Figure 4: Different Ordering using the *XTVAR* approach: *XTVAR* (dreer, dvo, dri)

This figure reports the impulse-response for the Panel Vector Autoregression using the *XTVAR* approach (Cagala and Glogowsky (2014)) for the variables dreer, dri, dvo. Dreer is the return of the real effective exchange rate of the currency being hedged. Dri is the return of the index. Dvo is the return of the turnover by volume. Dreer, dri, and dvo are all measured by taking the first log difference of the level variable. The variables are collected for 3 US-listed currency-hedged ETFs: DXJ (WisdomTree Japan Hedged Equity ETF), which hedges the Japanese Yen against the US dollar; HEDJ (WisdomTree Europe Hedged Equity ETF), which provides US dollar hedging for the Euro stock benchmark index; and DBBR (Deutsche X-trackers MSCI Brazil Hedged Equity ETF), which hedges the Brazilian stock market benchmark index against the local currency exchange rate fluctuations towards the US dollar.

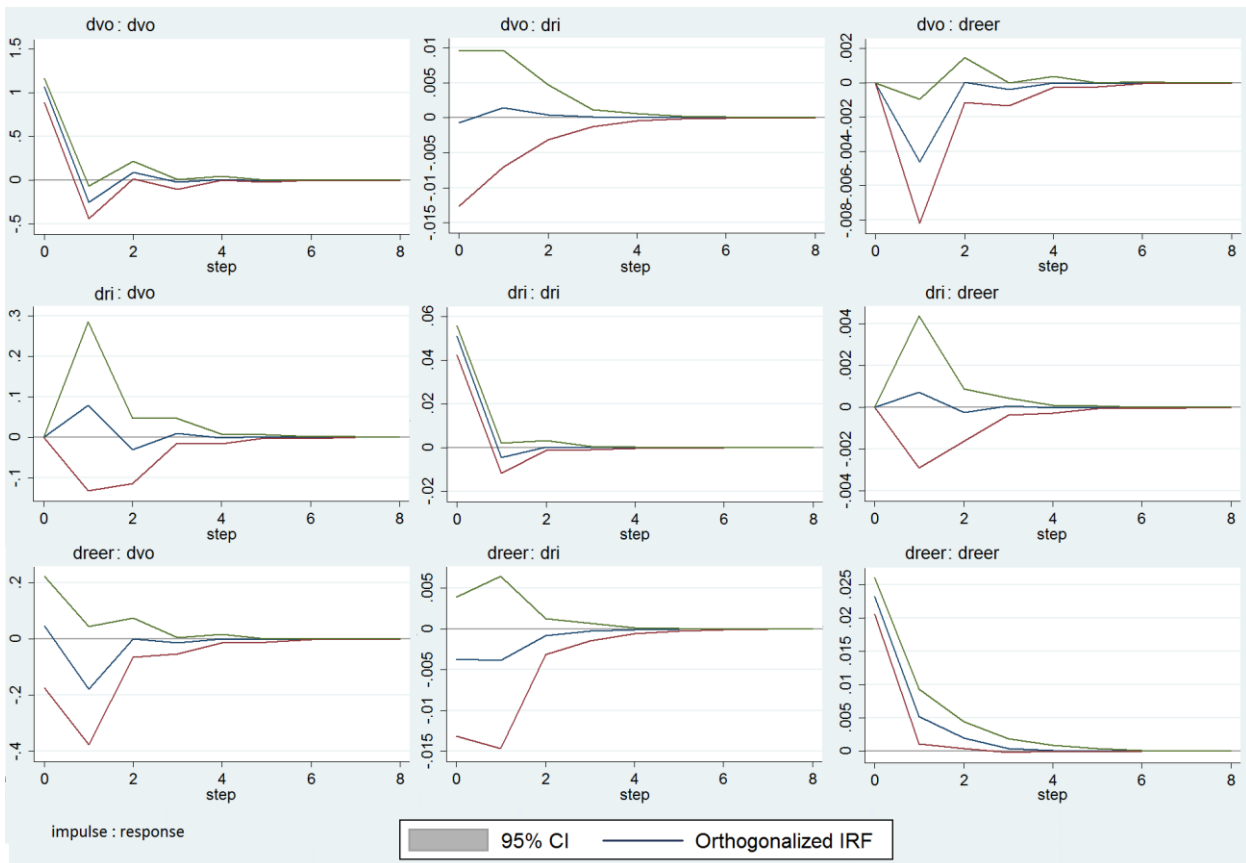
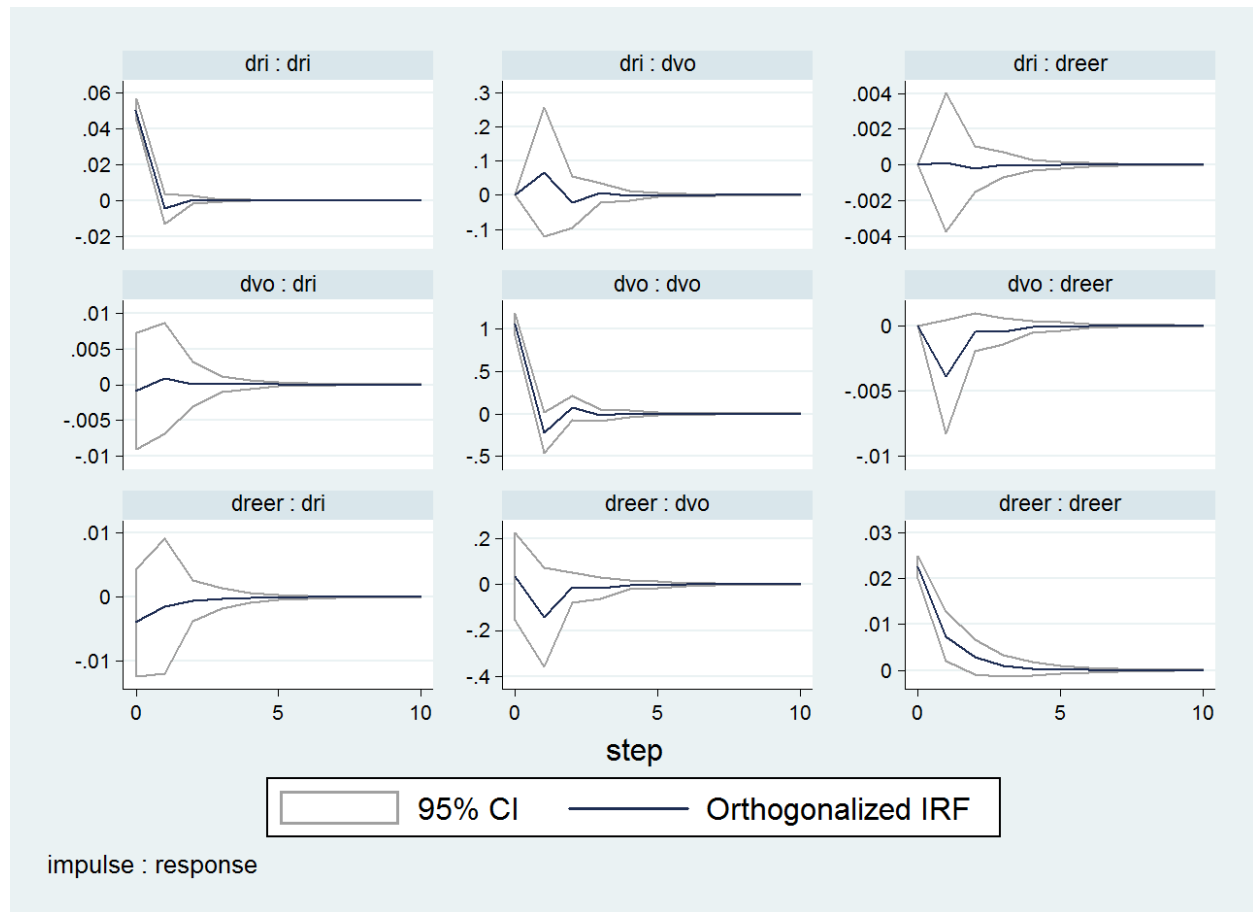


Figure 5: Different Ordering using the PVAR approach: PVAR (dreer, dvo, dri)

This figure reports the impulse-response for the Panel Vector Autoregression using the PVAR approach (Abrigo and Love (2015)) for the variables dreer, dri, dvo. Dreer is the return of the real effective exchange rate of the currency being hedged. Dri is the return of the index. Dvo is the return of the turnover by volume. Dreer, dri, and dvo are all measured by taking the first log difference of the level variable. The variables are collected for 3 US-listed currency-hedged ETFs: DXJ (WisdomTree Japan Hedged Equity ETF), which hedges the Japanese Yen against the US dollar; HEDJ (WisdomTree Europe Hedged Equity ETF), which provides US dollar hedging for the Euro stock benchmark index; and DBBR (Deutsche X-trackers MSCI Brazil Hedged Equity ETF), which hedges the Brazilian stock market benchmark index against the local currency exchange rate fluctuations towards the US dollar.



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