The asymmetric relationship between trade policy uncertainty and African forex markets

Abstract

Motivated by the potential impact of trade between different countries on the bilateral exchange rate, we study the impact of trade policy uncertainties on the forex markets of fifteen African economies by employing the causality-in-quantiles and the quantile-on-quantile framework for the period January 2015 to April 2025. We document the diverse predictive ability of trade policy uncertainty for several African economies across various quantiles, thereby underscoring a nonlinear and asymmetric relationship between trade policy uncertainty and forex markets. Our finding highlights the importance of designing cross-market and cross-asset hedging strategies for different economies and, as such, supports the integration of the African economies with global markets rather than the decoupling hypothesis. These findings have valuable implications for market participants, policymakers, investors, and regulators.

Keywords: Trade policy uncertainty; African economies; Low-income economies; Causality-in-quantiles; Quantile-on-Quantile regression

JEL: G15; G23; C58

1. Introduction

Forex markets are exposed to a broad spectrum of risks and uncertainties, including local, regional, and international factors. Among these factors, trade-related policies are one of the core factors influencing the forex markets through various channels, such as a direct effect on the currency demand, currency account, trade balances, inflation, and monetary policy reactions. These factors affect investor confidence, risk perceptions, and exchange rate expectations, which can affect a country's exchange rate in the short and long run. The effect of such policies is even more pronounced for currencies of low-income countries due to their fragile economic conditions. Therefore, the interaction between trade policy uncertainty and forex markets is a topic of great interest for regulators, investors, and policymakers. However, the existing literature predominantly discusses the role of broader economic uncertainty on the exchange rate predictability. (Balcilar et al., 2016; Chen et al., 2020; Ruan et al., 2024). While economic policy uncertainty does entail important information about the entire economic policy of a country (fiscal, monetary, trade, regulatory), the isolated impact of trade-related policy uncertainty may have a direct impact on the exchange rate due to directly affecting the demand for a country's products that will spillover to the exchange rate. This study contributes to this sparse domain of literature by analyzing the asymmetric predictability effect of trade policy uncertainty on major African economies' exchange rates.

In recent years, the increased globalization has led to an increasing integration of African economies with the global financial markets. This, coupled with the increased efforts of African economies to increase trade and investment inflows, may have rendered these economies more vulnerable to global policy shocks. As mentioned above, the existing literature on the impact of trade policy uncertainty on exchange rates is rather sparse, with a few studies analyzing the impact of trade policy uncertainty on exchange rates. Khalil and Strobel (2024) acknowledge the importance of trade policy uncertainty and document the impact of trade policy uncertainty on the US dollar and the Chinese renminbi exchange rate. Huynh et al. (2023) document the impact of trade policy uncertainty on G-10 currencies. However, to the best of our knowledge, none of the existing literature has analyzed the impact of trade policy uncertainty on low-income economies such as African economies.

This study investigates the asymmetric predictability of trade policy uncertainty for a wide range of African economies. We employ the trade policy uncertainty index (TPU) developed by Caldara et al. (2020) as a proxy for trade policy-induced market uncertainty. The index is constructed based on text mining from newspapers. We employ exchange data for fifteen African countries comprising Algeria, Botswana, Egypt, Ghana, Kenya, Malawi, Mauritius, Morocco, Namibia, Nigeria, South Africa, Tanzania, Tunisia, Uganda, and Zambia. All exchange rates are USD-denominated. Our empirical strategy encompasses the causality-in-quantiles approach developed by Balcilar et al. (2016) coupled with the quantile regression and the quantile-on-quantile regression approach developed by Sim and Zhou (2015). The causality-in-quantiles allows us to investigate the predictive power of TPU on exchange rates across various quantiles. The quantile-on-quantile approach enables us to explore the impact of TPU quantiles on the quantiles of exchange rates, thereby giving a more comprehensive and holistic picture of the effect of TPU on exchange rates across various quantiles.

We contribute to the literature as follows: We quantify the impact of trade policy uncertainty on the exchange rates of African economies. Thus, we contribute to understanding the impact of trade policy uncertainty changes on most of the lower/middle-income economies, an area largely ignored in academic literature. When writing this paper, we are the first to document the interaction between trade policy uncertainty and the exchange rate of African economies. We also contribute to the sparse literature on analyzing the integration or decoupling of African markets from the global markets. Lastly, our choice of methodology allows us to investigate this relation under various market conditions characterized by the different quantiles. In particular, our choice of quantile on-quantile regression approach allows us to robustly analyze the underlying interaction across various market conditions with more robust estimates appropriate for outliers and non-linearly distributed data. (Gupta et al., 2018; Hazgui et al., 2022). Our findings show the sizable predictive ability of the TPU for African economies, thereby underscoring the global integration of African economies and, as such, rejecting the decoupling hypothesis of African markets from global markets. These findings have important implications for market participants, investors, and regulators.

The structure of the paper is as follows. We present data and an empirical framework in Section 2, followed by a discussion of empirical results in Section 3, and conclude the paper in Section 4.

2. Data and methods

2.1. Data

Our data set comprises USD-denominated exchange rates of fifteen African economies: Algeria, Botswana, Egypt, Ghana, Kenya, Malawi, Mauritius, Morocco, Namibia, Nigeria, South Africa, Tanzania, Tunisia, Uganda, and Zambia, and the TPU index. We employ daily data from January 1, 2015, to April 28, 2025. Our choice of data is motivated by the availability of the longest-matched data series. We have retrieved data from the DataStream database. We report the descriptive statistics of the exchange rate and TPU series in Table 1 and a graphical depiction in Figure 1. We ensure that all series are stationary using the standard unit root tests of Augmented Dickey-Fuller (ADF) and Phillips–Perron test (PP). In addition, we also confirm that all series are non-normal using the Jarque Bera test, thereby underscoring the use of the asymmetric causality tests.

[Insert Table 1 here]

[Insert Figure 1 here]

2.2. Methodology

We adopt a two-step methodology. First, we employ the causality-in-quantile framework to quantify the predictability of TPU for the exchange rates across different quantiles, followed by a more comprehensive quantile-on-quantile framework.

2.2.1. Causality-in-quantiles framework

We employ the non-parametric causality in a quantile framework in the spirit of Nishiyama et al. (2011), Jeong et al. (2012), and Balcilar et al. (2016). Let us denote the exchange rate for each country with y_t and the TPU by x_t. We test the hypothesis that TPU (x_t) does not influence the exchange rate (y_t), in the θ^{th} quantile, given the lag vector $\{y_{t-1}, \dots, y_{t-p}, x_{t-1}, \dots, x_{t-p}\}$, if

$$Q_\theta\big(y_t \big| y_{t-1}, \dots, y_{t-p}, x_{t-1}, \dots, x_{t-p}\big) = Q_\theta\big(y_t \big| y_{t-1}, \dots, y_{t-p}\big). \quad (2.1)$$

Alternatively, TPU (x_t) causes the exchange rate, for the θ^{th} quantile, the lag vector $\{y_{t-1}, \dots, y_{t-p}, x_{t-1}, \dots, x_{t-p}\}$, if:

$$Q_\theta\big(y_t \big| y_{t-1}, \dots, y_{t-p}, x_{t-1}, \dots, x_{t-p}\big) \neq Q_\theta\big(y_t \big| y_{t-1}, \dots, y_{t-p}\big). \quad (2.2)$$

Here, $Q_\theta(y_t|\bullet)$ denotes $the\ \theta^{th}$ quantile of y_t. It is important to mention that the conditional quantiles, $Q_\theta(y_t|\bullet)$, of the exchange rate (y_t) are predicted by t such that $0 < \theta < 1$.

In addition, if $Z_t = Y_t,\ X_t$ has vectors $y_{t-1} = y_{t-1}, \dots, y_{t-p}$ and $x_{t-1} = x_{t-1}, \dots, x_{t-p}$, such that the conditional distribution functions are represented by $F_{y_{t|Z_{t-1}}}(y_t|Z_{t-1})$ and $F_{y_{t|Y_{t-1}}}(y_t|Y_{t-1})$, respectively, where Z_{t-1} and Y_{t-1} are conditional vectors. We assume that for all Z_{t-1} , $F_{y_{t|Z_{t-1}}}(y_t|Z_{t-1})$ exhibits strict continuity in y_t.

Furthermore, for $Q_\theta(Z_{t-1}) \equiv Q_\theta(y_t|Z_{t-1})$ and $Q_\theta(Y_{t-1}) \equiv Q_\theta(y_t|Y_{t-1})$, we obtain $F_{y_{t|Z_{t-1}}}\{Q_\theta(Y_{t-1})|Z_{t-1}\} = \theta$, with probability given by p= 1.

From (1) and (2), the causality-in-quantile hypothesis may be written as

$$H_0: P\left\{F_{y_{t|Z_{t-1}}}\{Q_\theta(Y_{t-1})|Z_{t-1}\} = \theta\right\} = 1. \quad (2.3)$$

$$H_1: P\left\{F_{y_{t|Z_{t-1}}}\{Q_\theta(Y_{t-1})|Z_{t-1}\} = \theta\right\} < 1. \quad (2.4)$$

It is pertinent to mention that the causality at fat tails differs from its median counterpart.

2.2.2. Quantile-on-quantile regression (QQR) framework

After analyzing the causality in quality detailed above, we follow the QQR framework proposed by Sim and Zhou (2015). This framework integrates a non-parametric procedure with the quantile regression (QR) framework. We envisage a comprehensive investigation of the overall interaction between TPU and exchange rates by employing the non-parametric QQR framework, enabling us to quantify the interactions between TPU and exchange rates across various quantiles.

We represent our QQR framework:

$$E_t = \beta^{\theta}(TPU_t) + u_t^{\theta}, \qquad (2.5)$$

E_t and TPU_t denote the exchange rate and TPU, respectively, at time t; $\beta^{\theta}(\bullet)$ denotes an unknown parameter to be estimated as the slope coefficient between E_t and TPU_t. Furthermore, θ denotes the respective quantile of the conditional distribution of the exchange rate. Lastly, u_t^{θ} denotes quantile residue, with an assumed value of zero for the respective conditional quantile. Following Sim and Zhou's (2015), we use a bandwidth of $h = 0.05$.

3. Empirical results

3.1. Causality-in-quantiles

The causality in the quantiles is reported in Table 2 and Figure 2, depicting the causal effect of TPU on each country's exchange rate across various quantiles. We start our discussion with Figure 2, which displays the variation in predictability measures by the t-statistics across various quantiles for each country's exchange rate. The results are statistically significant when the t-statistics are above a solid line, denoting a 5% significance level.

[Insert Table 2 about here]

[Insert Figure 2 about here]

We notice some heterogeneity across countries regarding the causal effect of TPU on the exchange rate. Certain countries exhibit statistically significant causality across all quantiles (Algeria, Egypt, Kenya, Malawi, Tanzania, Zambia), whereas for other countries, the causality is significant for a selection of quantiles. The heterogeneity underscores the choice of the quantile causality approach as the causality is exhibiting asymmetric behavior. Furthermore, we notice that causality is significant across the median, and the non-significant results are observed for extreme quantiles, underscoring our method choice. Our causality analysis also shows that TPU significantly impacts the exchange rate, giving important insight into the potential predictability of the exchange rate for these countries. Furthermore, we notice that the African economy's exchange rates are susceptible to US trade policy uncertainty, thereby rejecting the decoupling hypothesis of the African economy's exchange rates.

3.2. Quantile-on-Quantile regression (QQR)

After analyzing the causality in quantiles, in this section, we discuss the QQR estimate presented in Figure 3. We use three-dimensional graphs to report the QQR estimates and analyze the relative change across quantiles. We report the slope coefficients $\beta_1(\theta, \tau)$ depicted on the z-axis relative to the exchange rate quantiles on the y-axis (θ), whereas the x-axis (τ) $displays\ the$ TPU quantiles. The cooler colors (blue to green) depict negative values, and the brighter colors (green to red) depict positive values.

[Insert Figure 3 about here]

We notice that the TPU and exchange rate relationship is asymmetric, with different values across all quantiles. Furthermore, the relationship varies between negative and positive across quantiles. Some countries, such as Algeria, Mauritius, Morocco, Tunisia, and Zambia, exhibit more variation at extreme quantiles relative to central quantiles, underscoring greater asymmetry for these countries. On the contrary, countries such as Egypt, Nigeria, and Uganda exhibit more homogeneous relations between TPU and exchange rates.

4. Discussion and Conclusions

The impact of various uncertainties on financial markets has been a topic of great interest for academics and practitioners alike. This paper contributes to this unique domain of literature by documenting the impact of trade policy uncertainty on the foreign exchange rates of African economies. In particular, we investigate the asymmetric impact of the trade policy uncertainty on these exchange rates using causality-in-quantiles and quantities-on-quantile regression approaches.

Our findings document statistically significant TPU predictability for several African forex exchange rates across various quantiles. These findings extend the existing literature on the predictability of sentiment for financial markets and asset classes to the emerging markets, particularly the African forex exchange markets (Buchanan et al., 2011). Furthermore, our QQR analysis underscores the heterogeneous effect of TPU on various African forex markets, thus underscoring the importance of accounting for country-specific attributes and TPU for financial markets. (Caldara et al., 2020). Our findings also extend the work of Iyke et al. (2022), who have documented the predictability of geopolitical risk for the exchange rate of emerging markets through the channel of TPU, which is arguably a more direct channel of transmission due to the direct effect of international trade on exchange rates. These findings are helpful in designing cross-market and cross-country hedging and investment strategies. Another important phenomenon attributable to the varying relationship across different quantiles is the existence of a nonlinear relationship between TPU and exchange rates. This supports our choice of the underlying methodology in line with Jeong et al. (2012) and Balcilar et al. (2016). Another interpretation of our results can be through the lens of risk-on and risk-off sentiment. A higher level of trade policy uncertainty can lead to a more risk-off sentiment and vice versa, as witnessed by the global markets in response to trade tariffs imposed by the US president during April 2025. These uncertainties led to the appreciation/depreciation of various currencies. During such heightened periods of uncertainty, countries with weak economic fundamentals, such as the African economies, are expected to experience more substantial spillover effects. Thus, it underscored the need for continuous monitoring and designing country-specific policies. Another implication of our findings is the rejection of the decoupling hypothesis of African economies from the rest of the world. As such, our findings suggest that African economies are increasingly integrated with global markets and are not immune to global shocks. Lastly, our findings have important implications for future exchange rate predictive models with documented evidence of important trade policy uncertainty for African exchange rates.

Future work can envisage a deeper understanding of each country's country-specific attributes by considering country-specific and global financial conditions and trade conditions. Another important extension would be to look at the joint effect of various African economies in a multivariable context, thus building on the bivariate context in this study. Such an extension can also include other emerging markets and advanced economies for comparative analysis.

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Table 1. Descriptive statistics.

	Mean	Median	Maximum	Minimum	Std. Dev	Skewness	Kurtosis	Normtest.W	ADF	PP
Algeria	0.0002	0.0000	0.0353	-0.0135	0.0024	1.65	24.78	54458.07***	-36.85***	-53.90***
Botswana	0.0001	0.0000	0.0438	-0.0359	0.0060	0.30	7.27	2087.79***	-39.57***	-55.88***
Egypt	0.0007	0.0000	0.5408	-0.0640	0.0155	27.22	874.29	85547331.22***	-33.57***	-50.42***
Ghana	0.0006	0.0000	0.1528	-0.1579	0.0107	-0.75	51.39	263143.79***	-31.85***	-54.69***
Kenya	0.0001	0.0000	0.0114	-0.0359	0.0022	-4.22	60.58	380115.48***	-28.60***	-36.60***
Malawi	0.0005	0.0000	0.4138	-0.0714	0.0107	24.92	891.83	88957976.68***	-39.21***	-55.75***
Mauritius	0.0001	0.0000	0.1116	-0.0877	0.0078	1.12	68.78	486266.36***	-46.00***	-77.14***
Morocco	0.0000	-0.0001	0.0183	-0.0210	0.0035	0.02	6.16	1120.97***	-35.55***	-50.73***
Namibia	0.0002	-0.0002	0.0474	-0.0475	0.0096	0.24	4.01	141.23***	-36.86***	-50.86***
Nigeria	0.0008	0.0000	0.3499	-0.1355	0.0179	6.28	114.60	1415589.07***	-37.81***	-60.55***
South	0.0002	-0.0002	0.0490	-0.0499	0.0097	0.24	4.04	147.97***	-37.09***	-51.58***
Tanzania	0.0002	0.0000	0.0942	-0.0919	0.0044	-1.44	201.86	4439947.76***	-32.49***	-46.88***
Tunisia	0.0002	0.0001	0.0440	-0.0955	0.0066	-0.91	23.96	49692.65***	-49.18***	-77.25***
Uganda	0.0001	0.0000	0.0389	-0.0657	0.0043	-1.98	48.90	238256.42***	-36.95***	-53.75***
Zambia	0.0005	0.0007	0.1483	-0.1061	0.0103	-1.10	35.44	118630.79***	-33.31***	-41.36***
TPU	110.4802	69.1244	1933.3333	0.0000	153.7287	5.26	43.32	194946.43***	-8.19***	-10.17***

*Note: This table shows the sample statistics of the log-returns of the exchange rates of African economies and the trade policy uncertainty(TPU). The Jarque-Bera test (Normtest.W), Augmented Dickey-Fuller test (ADF), and Phillips–Perron test (PP) is reported along with the significance levels. *, **,*** denoting 10%,5%, and 1% significance level, respectively.*

Table 2. Test statistics from the causality-in-quantiles test.

Quantile	Algeria	Botswana	Egypt	Ghana	Kenya	Malawi	Mauritius	Morocco	Namibia	Nigeria	South	Tanzania	Tunisia	Uganda	Zambia
0.05	2.568**	1.847*	29.849***	2.758***	3.548***	10.501***	3.211***	1.302	1.147	0.34	1.064	6.336***	1.787*	2.561**	2.81***
0.1	3.788***	2.251**	68.629***	3.485***	5.178***	9.19***	4.312***	1.963**	1.935*	1.473	1.928*	95.26***	3.169***	3.595***	3.705***
0.15	4.306***	2.9***	58.113***	3.986***	6.927***	9.272***	9.589***	2.753***	2.222**	1.336	2.503**	72.909***	3.757***	4.239***	4.917***
0.2	4.93***	3.534***	47.389***	4.55***	8.018***	9.641***	17.005***	3.309***	2.496**	1.741*	2.51**	59.615***	4.316***	4.838***	5.769***
0.25	5.503***	3.977***	37.827***	5.943***	10.167***	11.377***	63.067***	3.722***	2.706***	1.592	2.765***	59.814***	4.906***	4.951***	6.145***
0.3	5.825***	4.682***	33.475***	6.95***	10.496***	11.211***	53.931***	3.965***	3.017***	1.233	2.96***	52.893***	5.386***	5.023***	6.707***
0.35	6.229***	4.863***	32.296***	6.468***	10.864***	11.529***	35.101***	3.642***	3.381***	9.859***	2.916***	47.247***	5.801***	5.138***	6.688***
0.4	6.628***	4.779***	29.598***	10.629***	14.265***	11.524***	39.987***	3.355***	3.866***	51.363***	3.076***	40.905***	5.165***	5.715***	6.672***
0.45	6.572***	4.383***	26.029***	9.276***	11.364***	11.853***	30.946***	3.604***	4.087***	65.979***	3.465***	32.633***	5.184***	6.862***	7.191***
0.5	6.441***	4.832***	21.757***	8.179***	10.359***	11.274***	24.291***	3.671***	4.231***	55.523***	3.724***	27.17***	5.3***	6.736***	7.17***
0.55	6.317***	4.414***	18.186***	6.204***	9.056***	10.452***	17.644***	3.401***	4.175***	24.389***	3.493***	21.98***	5.426***	6.384***	6.562***
0.6	6.041***	3.863***	15.322***	6.06***	8.006***	10.666***	13.244***	3.072***	4.028***	10.78***	3.475***	18.076***	5.244***	6.139***	6.751***
0.65	5.739***	3.712***	13.046***	5.453***	6.833***	10.745***	10.067***	3.427***	3.673***	1.125	3.062***	15.175***	5.019***	5.797***	6.746***
0.7	5.904***	3.505***	11.234***	5.091***	6.431***	10.692***	7.759***	3.121***	3.445***	1.112	3.171***	11.891***	4.734***	5.28***	6.434***
0.75	5.725***	3.205***	9.454***	4.811***	5.933***	10.317***	6.434***	2.808***	3.09***	2.429**	2.826***	9.463***	4.389***	5.35***	5.519***
0.8	5.229***	3.156***	7.815***	4.448***	5.599***	10.449***	5.311***	2.915***	2.591***	2.514**	2.141**	7.782***	3.981***	4.4***	5.098***
0.85	4.44***	2.706***	6.068***	3.778***	4.333***	10.881***	4.202***	2.639***	2.064**	2.107**	1.942*	5.579***	3.343***	3.508***	4.708***
0.9	3.455***	1.969**	4.671***	2.919***	3.637***	11.923***	3.498***	2.046**	1.972**	1.492	1.842*	3.991***	2.755***	3.21***	3.688***
0.95	2.24**	1.62	2.961***	1.569	2.068**	15.064***	2.139**	1.545	1.143	0.47	1.216	2.674***	1.699*	1.881*	2.335**

*Notes: This table reports the causality-in-quantile in means results. We report the test statistics for the causal effect of trade policy uncertainty (TPU) on exchange rates of African economies for various quantiles ranging between 0.05 and 0.95. As before, ***,**, and* denote 1%, 5%, and 10% significance levels, respectively.*

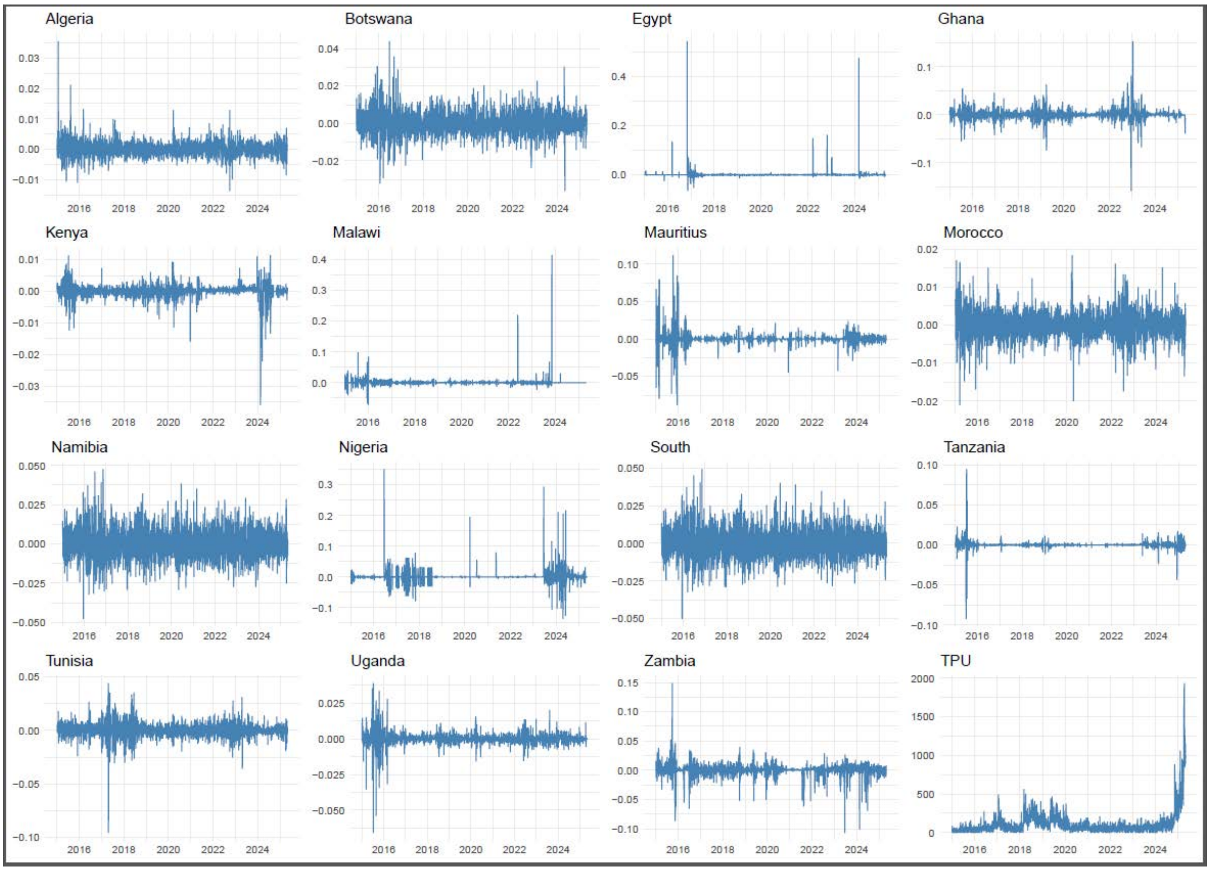
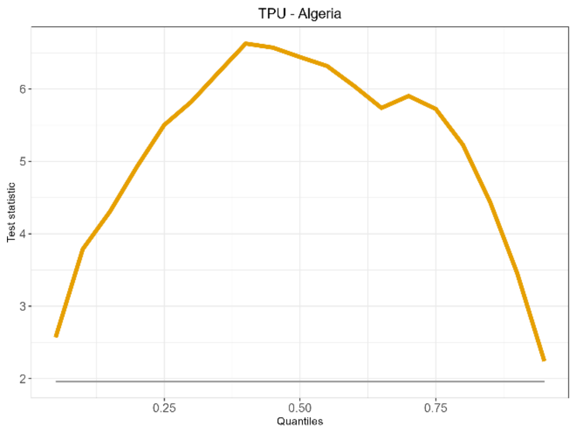


Figure 1. *This figure shows the graphs of log returns for exchange rates of African economies and trade policy uncertainty (TPU).*


TPU - Algeria
Test statistic
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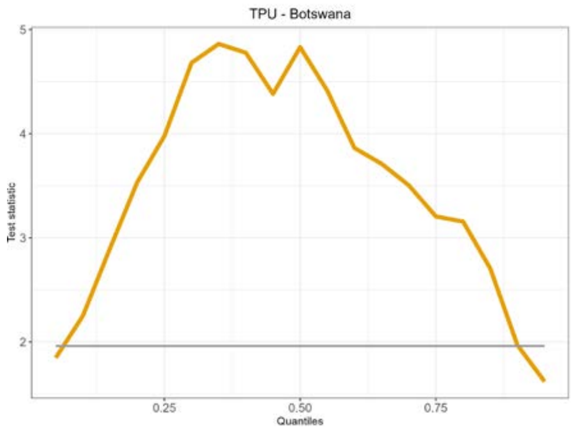
TPU - Botswana
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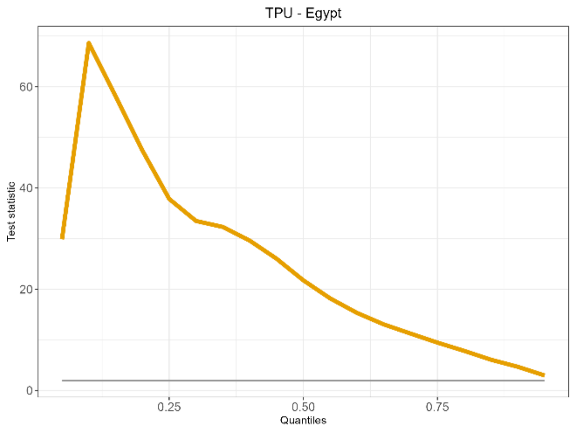
TPU - Egypt
Test statistic
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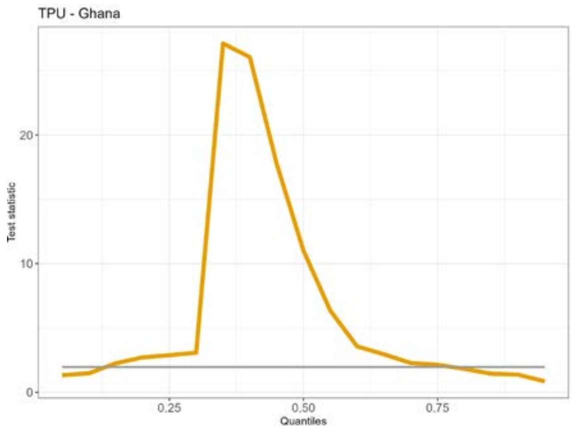
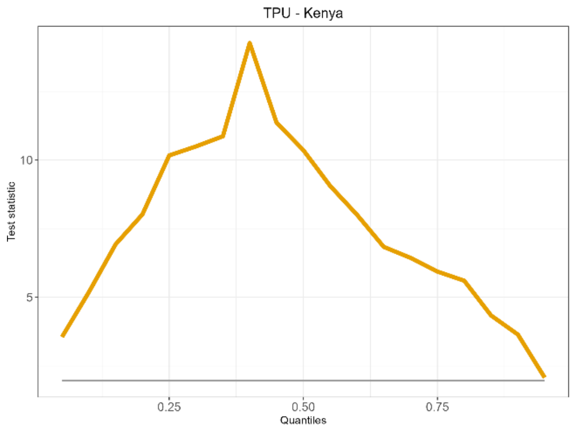
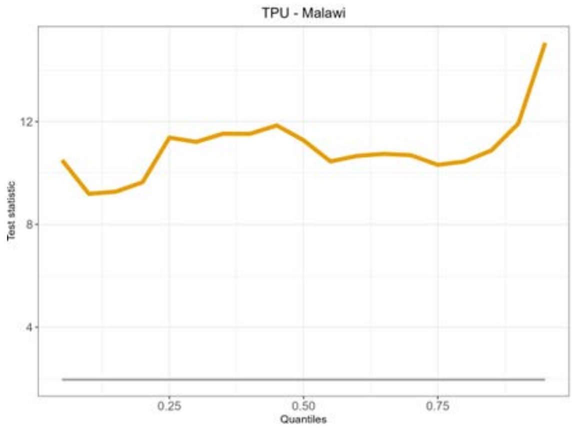
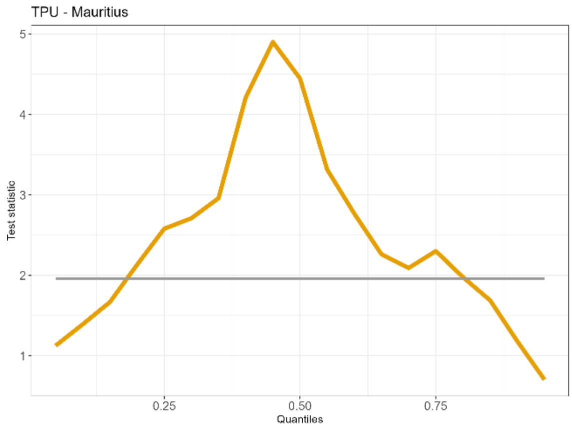
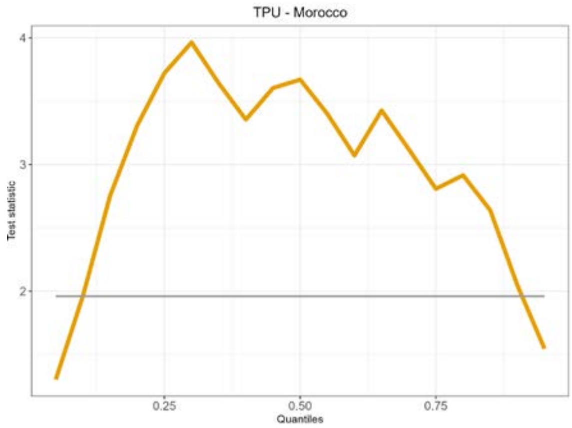
0.75
Quantiles

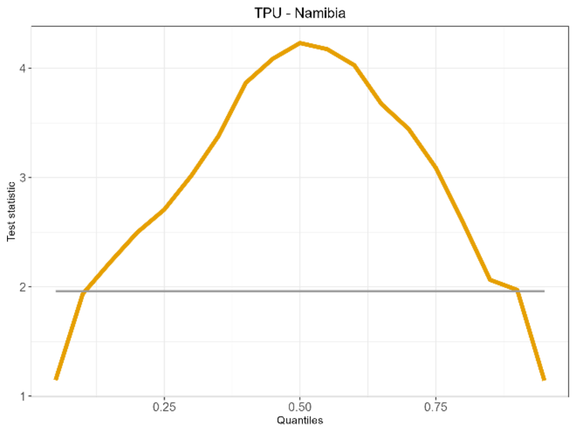

TPU - Ghana
Test statistic
0
10
20
0.25
0.50
0.75
Quantiles

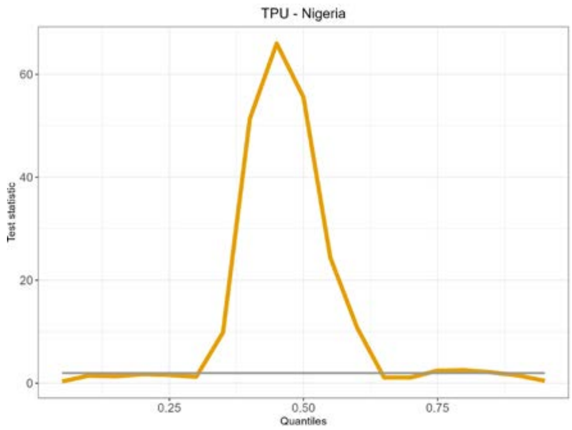

TPU - Kenya
Test statistic
5
10
0.25
0.50
0.75
Quantiles

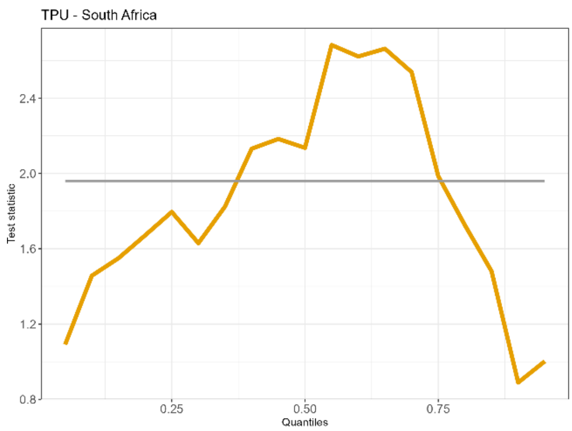

TPU - Malawi
Test statistic
4
8
12
0.25
0.50
0.75
Quantiles

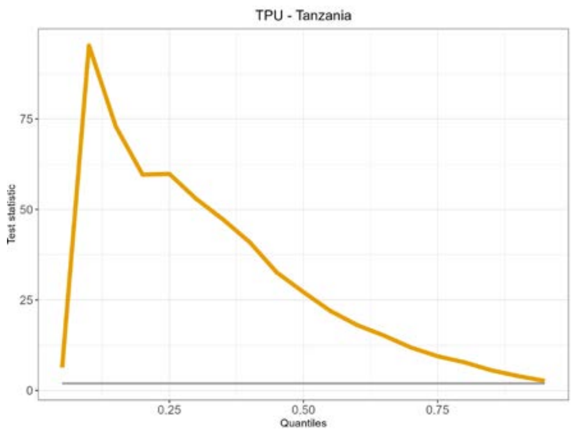

TPU - Mauritius
Test statistic
Quantiles
0.25
0.50
0.75
1
2
3
4
5


TPU - Morocco
Test statistic
Quantiles
0.25
0.50
0.75
2
3
4


TPU - Namibia
Test statistic
Quantiles
0.25
0.50
0.75
1
2
3
4


TPU - Nigeria
Test statistic
Quantiles
0.25
0.50
0.75
0
20
40
60


TPU - South Africa
Test statistic
Quantiles
0.25
0.50
0.75
0.8
1.2
1.6
2.0
2.4


TPU - Tanzania
Test statistic
Quantiles
0.25
0.50
0.75
0
25
50
75

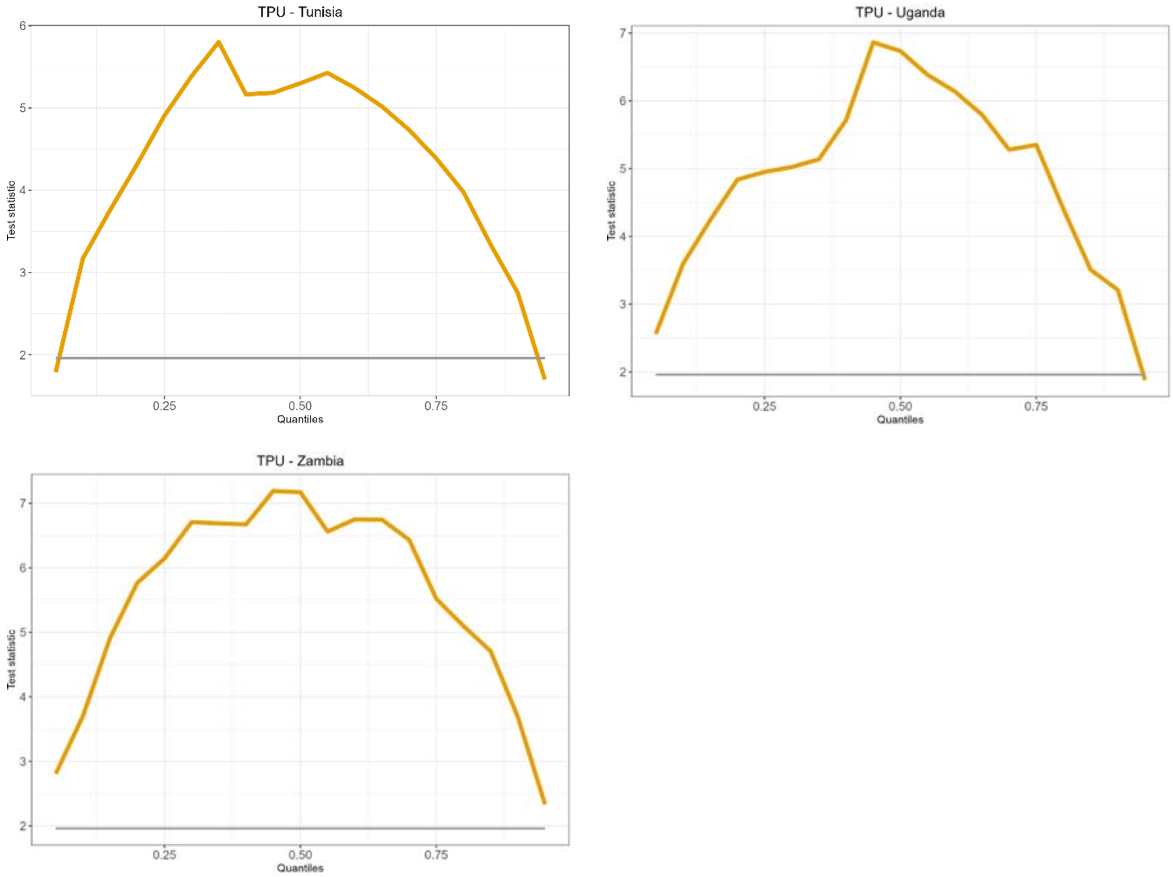
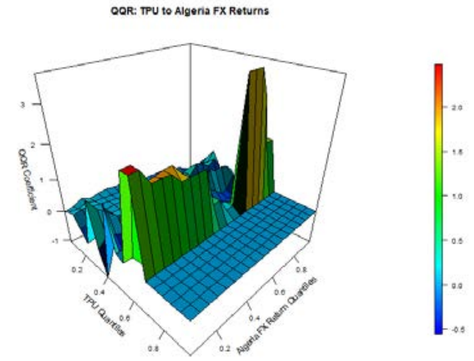
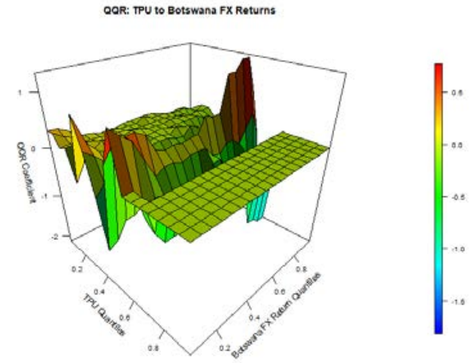
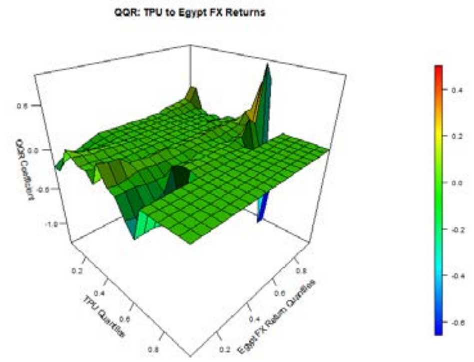


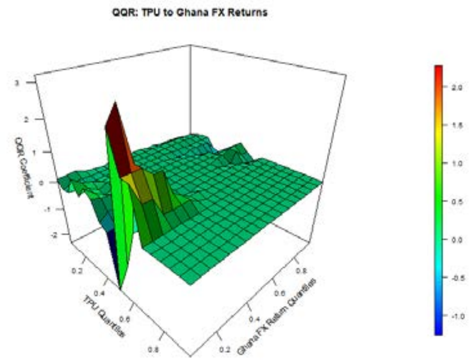
Figure 2. Causality-in-quantile.

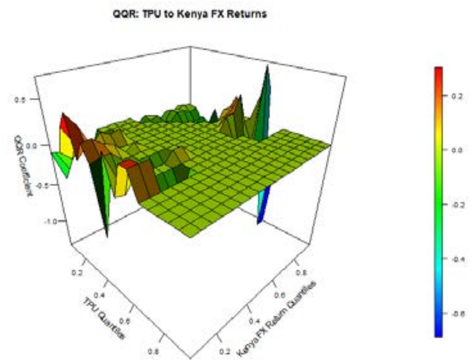
Notes: This figure shows the causality-in-quantile means t-stats of TPU causing the exchange rate for each country. The solid horizontal line denotes the t-stat at a 95% significance level.

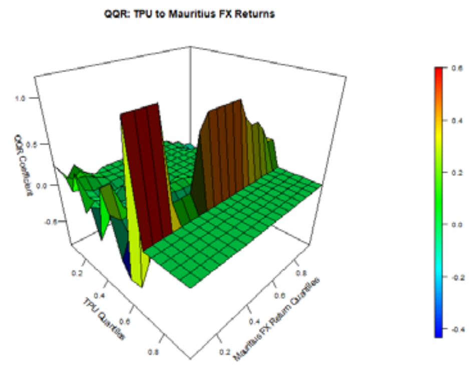

QQR: TPU to Algeria FX Returns
QQR Coefficient
TPU Quantiles
Algeria FX Return Quantiles

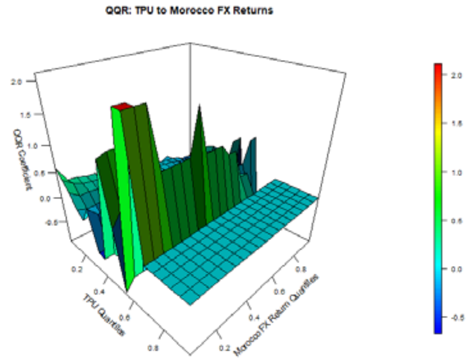

QQR: TPU to Botswana FX Returns
QQR Coefficient
TPU Quantiles
Botswana FX Return Quantiles

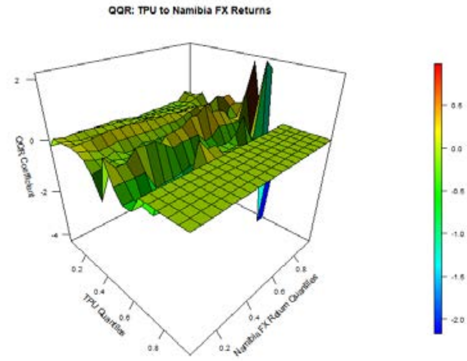

QQR: TPU to Egypt FX Returns
QQR Coefficient
TPU Quantiles
Egypt FX Return Quantiles

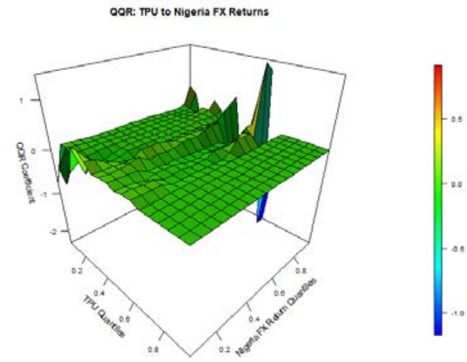

QQR: TPU to Ghana FX Returns
QQR Coefficient
TPU Quantiles
Ghana FX Return Quantiles

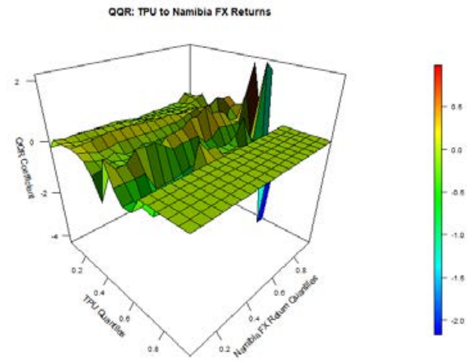

QQR: TPU to Kenya FX Returns
QQR Coefficient
TPU Quantiles
Kenya FX Return Quantiles

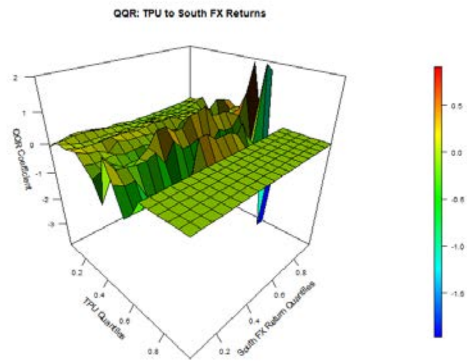

QQR: TPU to Mauritius FX Returns
QQR Coefficient
TPU Quantiles
Mauritius FX Return Quantiles

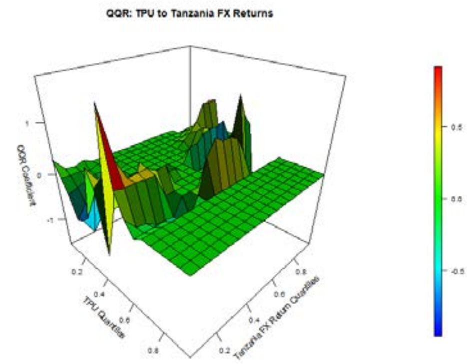

QQR: TPU to Morocco FX Returns
QQR Coefficient
TPU Quantiles
Morocco FX Return Quantiles


QQR: TPU to Namibia FX Returns
QQR Coefficient
TPU Quantiles
Namibia FX Return Quantiles


QQR: TPU to Nigeria FX Returns
QQR Coefficient
TPU Quantiles
Nigeria FX Return Quantiles


QQR: TPU to Namibia FX Returns
QQR Coefficient
TPU Quantiles
Namibia FX Return Quantiles


QQR: TPU to South FX Returns
QQR Coefficient
TPU Quantiles
South FX Return Quantiles


QQR: TPU to Tanzania FX Returns
QQR Coefficient
TPU Quantiles
Tanzania FX Return Quantiles

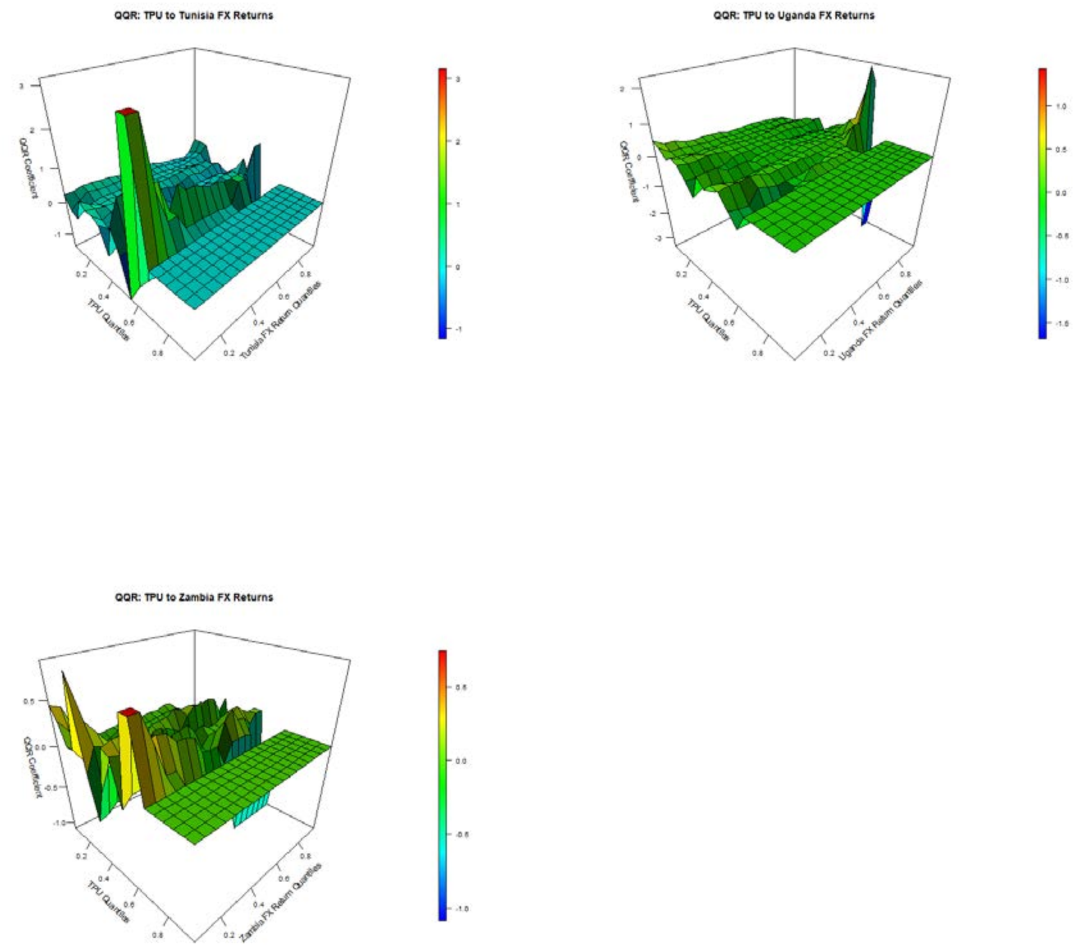


Figure 3. Quantile-on-Quantile regression plots.
Notes: This figure and color legend show the three-dimensional graphs of QQR estimates for trade policy uncertainty (TPU) and forex exchange returns.