FX Interventions Rules for Central Banks
A Risk-Based Framework

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Contributions

- Design a rule for central banks that intervene to prevent **disorderly market conditions**
- Provides guidance on **when** to intervene ("triggers")
- Appropriate for **floating exchange rate regimes** with FX risks to the economy (e.g. FX unhedged exposures)
- Consistenty control **FX risk** rather than arbitrary FX volatility/level threshold
- A **risk management framework** for central banks' financial stability mandate: aligned with **industry's best practices** in FX management

What the rule is NOT about

- Not designed to reach or to preserve a given FX level (e.g. alignment with the **equilibrium exchange rate level**)
- Doesn't prevent **appreciation/depreciation trends** to occur...
- ... but can be compatible with other approaches, e.g. discretionary FXI
- We **don't discuss the efficiency** of FX interventions from a welfare/macro point of view
- Not a guide to calibrate **FX interventions amount**
- Not a guide for the optimal **currency allocation** of FX reserves

Key Messages

Foreign Exchange intervention rules should

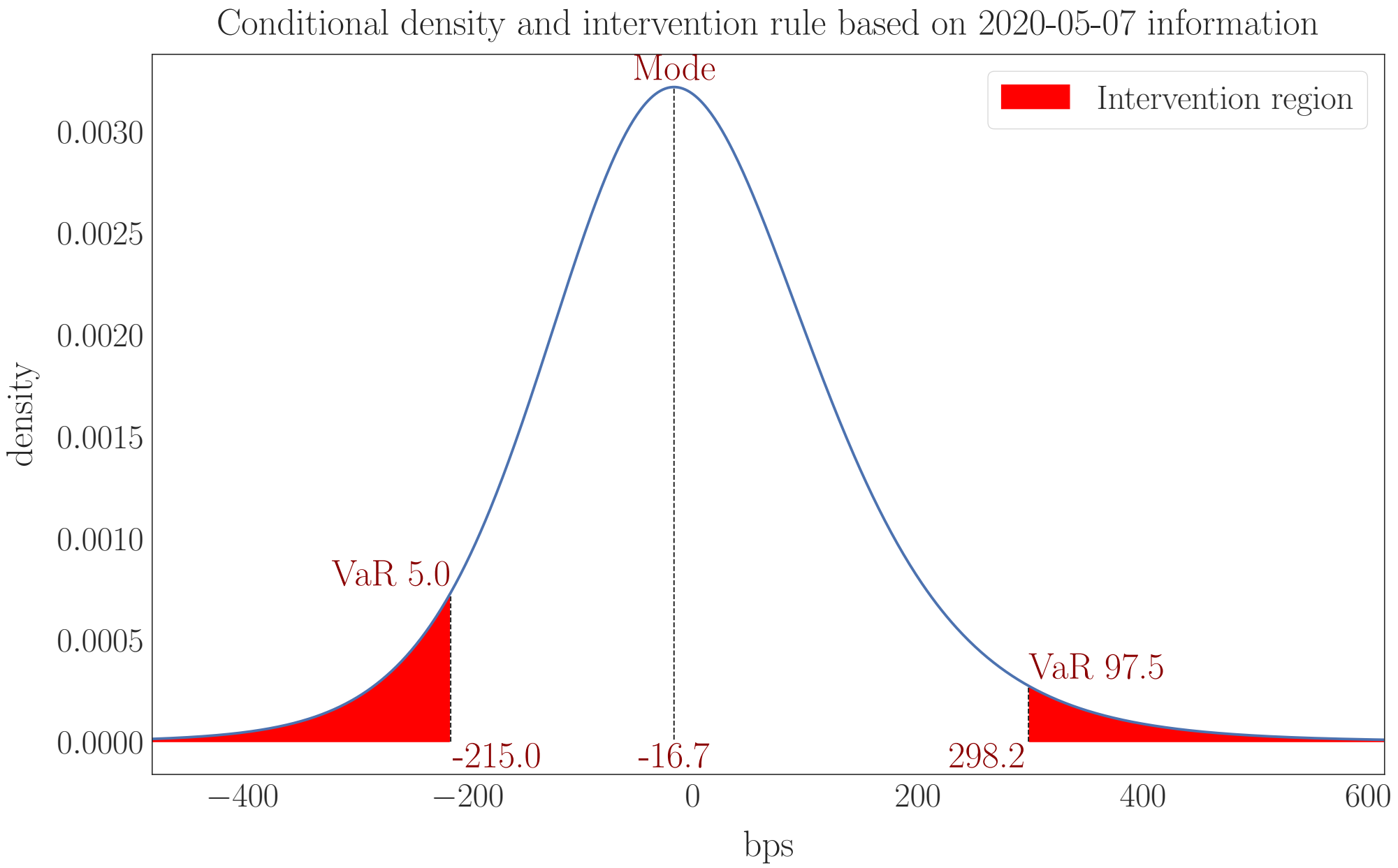
- Depend on market conditions
- Objective, be anchored to a risk tolerance level rather than an aribtrary FX level threshold
- Capture FX non-linearities and asymmetries between appreciation and depreciation
- Be easily operationalizable

We propose an FX intervention rule based on **Conditional Value-at-Risk**

Concept: Value-at-Risk Rule

- Rather than using a fixed volatility rule (e.g. intervene if daily exchange rate varies by more than 2%)
- Use a **risk-based rule**: intervene when the daily exchange rate log-returns are in the tails of the conditional distribution
- Measure the tail-risk via the concept of **Value-at-Risk** (the conditional quantile of the log returns distribution)
- The conditional distribution is estimated daily with a standard financial GARCH model and varies with market conditions
- The central bank decides on the **risk tolerance**: e.g. intervene in the tail at 1%, 5%, 10%, etc.

VaR FXI Rule


Conditional density and intervention rule based on 2020-05-07 information
Mode
Intervention region
VaR 5.0
VaR 97.5
-215.0
-16.7
298.2
density
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
0.0000
−400
−200
0
200
400
600
bps

A Risk-Management Approach to FX Interventions

- Under this framework, central bank interventions prevent FX tail risks to occur
- This rule allows flexible exchange rate to act as a shock absorber: don't prevent FX variation
- The central bank risk tolerance should be fixed in accordance with the macrofinancial risk in the economy (unhedged exposures from resident agents, degree of dollarization, etc.) as well as market resilience
- The financial stability mandate of the central bank is properly formalized and quantified. Aligned with industries' practice in risk management.

Features

1. Prevent moral hazard and market manipulation, and align the financi

2. This rule guarantees that the interventions will occur with a **fixed frequency** over the medium term

3.

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Specification

Non-linear, Exponential GARCH (EGARCH) model to estimate the conditional VaR of exchange rate log-retrurns r_t, $Q(r_t|\Omega_{t-1}, \theta)$

Drift AR-X(1): $r_{t+1} = \text{Intercept} + \rho r_t + \beta X_{t+1} + \epsilon_{t-1}$

Exponential volatility: $\log \sigma_{t+1}^2 = \omega + \beta g(r_t)$ where $g(r_t) = \alpha r_t + \gamma(|r_t| - \mathbb{E}|r_t|)$

Error term distribution $\epsilon_t = \sigma_t \varepsilon_t, \ , \varepsilon_t \sim \text{TSK}(k, v)$

- The GARCH estimation is standard and done with MLE; selection of parameters is done via AIC/BIC criteria.
- The Python package we designed allows to select the control variables, choose the lag, fit different distributions, etc.

Exogeneous Factors

1. FX bid-ask spread (averaged over the day) => **FX microstructure**
2. Daily interest rate differential with the US Libor => **CIP**
3. The one-month forward exchange rate => **cost of hedging** on the spot market
4. The lagged amount of central bank FX intervention => **policy interventions**
5. The VIX => **global risk sentiment**
6. The EURUSD exchange rate => control for **global FX factor**

Regression Table

	Constant	Microstructure	CIP	FXI	Baseline	Robustness
Intercept	1.09	-2.16	2.15	1.67***	1.63	1.64***
Lag FX log returns	0.09***	0.08***	0.08***	0.08***	0.08***	0.08***
Bid-ask spread abs value		0.11**	0.15***	0.14***	0.15***	0.15***
Forward points first difference		0.32***	0.32***	0.32***	0.27***	0.27***
Interbank rate vs Libor			-1.11***	-0.98***	-1.02***	-1.03***
FX intervention in USD lag				0.04	0.04	
VIX first diff					9.78***	9.79***
EURUSD log returns					0.13***	0.13***
FX intervention dummy lag						4.13
Omega	0.15***	0.14***	0.13***	0.13***	0.14***	0.14***
Alpha	0.17***	0.19***	0.18***	0.18***	0.19***	0.19***
Gamma	0.06***	0.06***	0.06***	0.05***	0.05***	0.05***
Beta	0.98***	0.98***	0.98***	0.99***	0.98***	0.98***
Nu	8.81***	9.11***	9.18***	9.15***	7.77***	7.77***
Lambda	0.13***	0.11***	0.12***	0.12***	0.1***	0.1***
R2	0.4 %	4.9 %	5.1 %	5.1 %	14.3 %	14.3 %
R2 adjusted	0.4 %	4.8 %	5.0 %	5.0 %	14.2 %	14.1 %
Number of observations	4511	4511	4511	4510	4510	4510
Significance *10%, **5%, ***1%						

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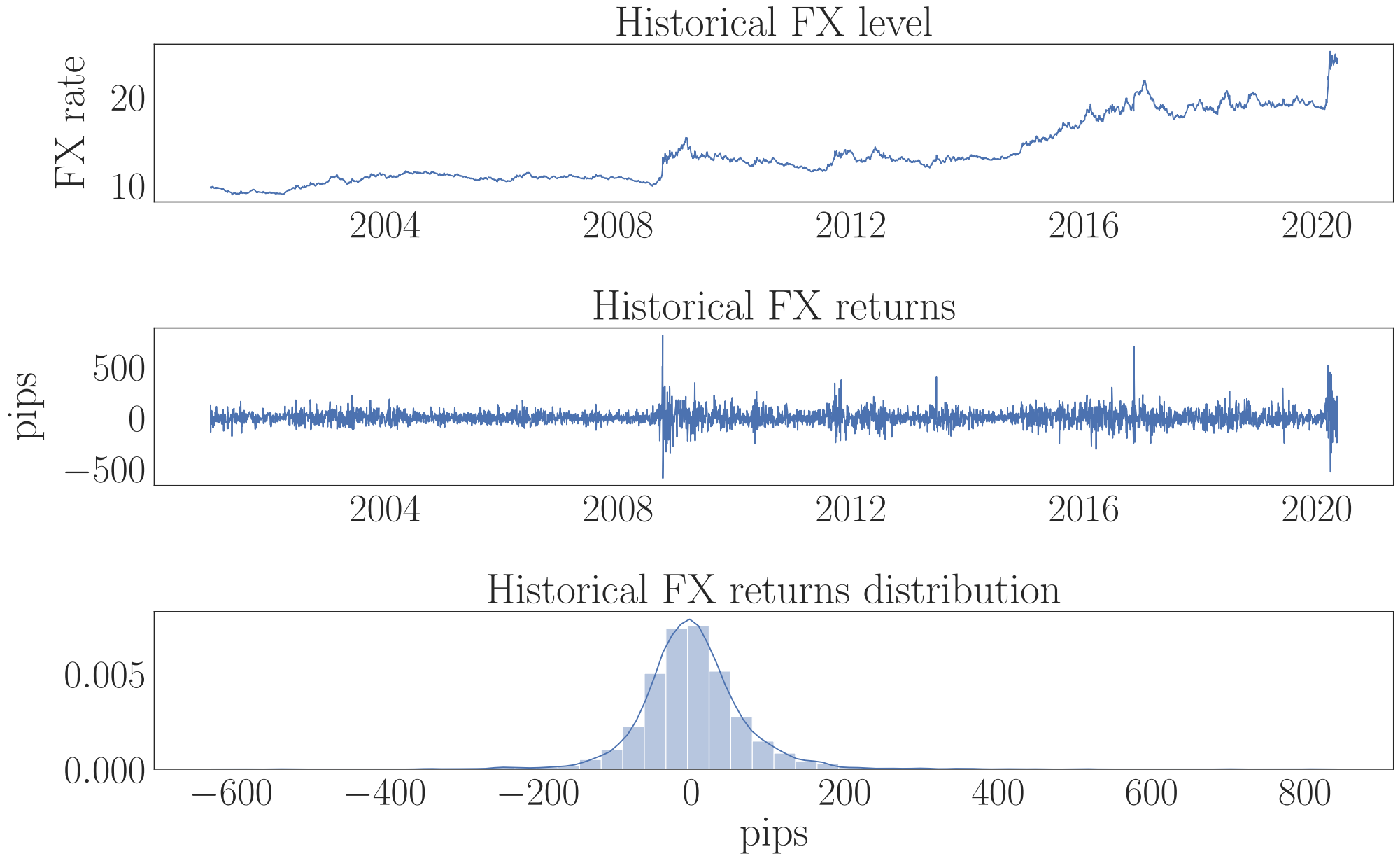
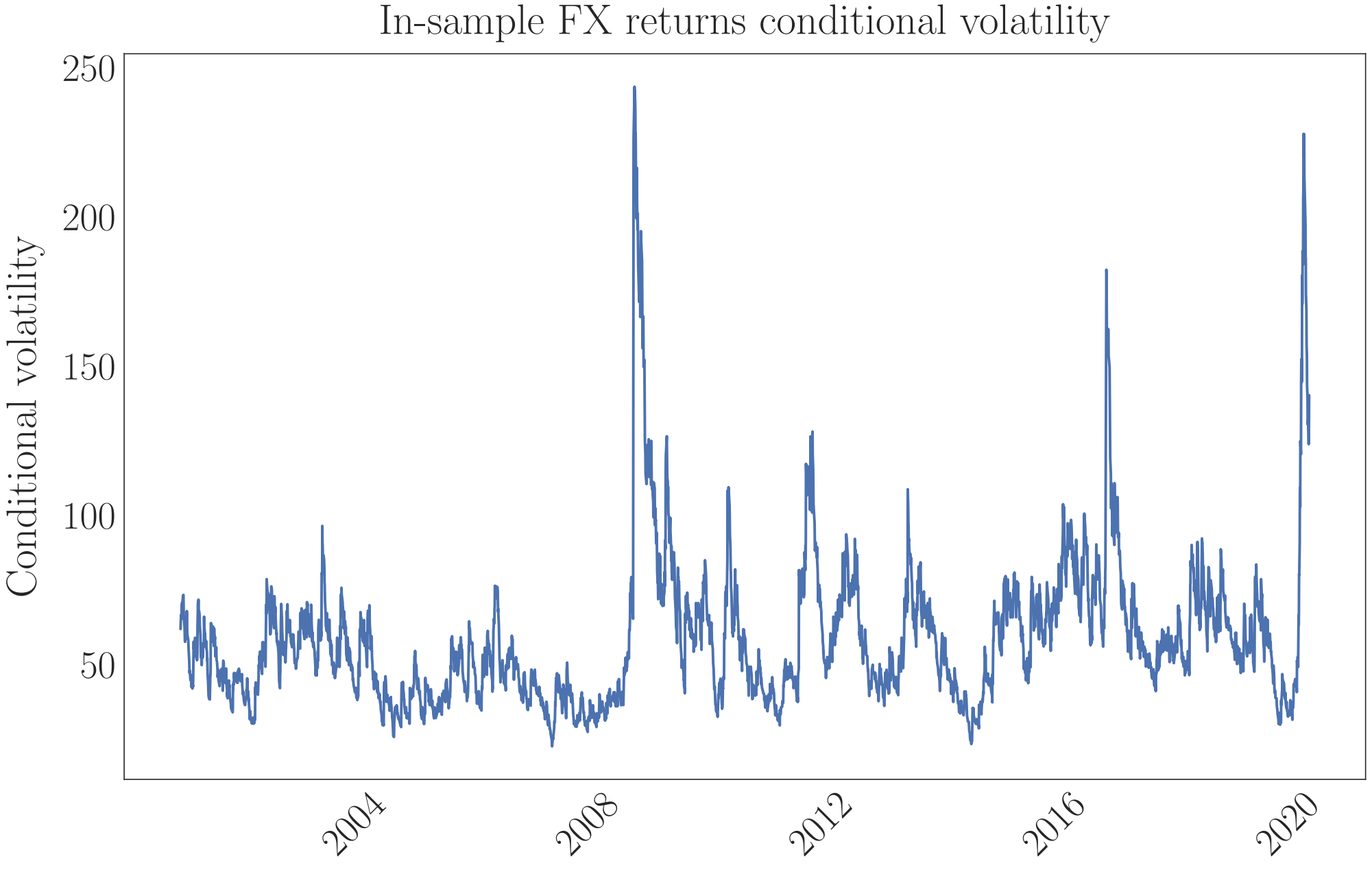
Dynamics of the Mexican Peso against USD



Conditional In-Sample Volatility of the Mexican Peso



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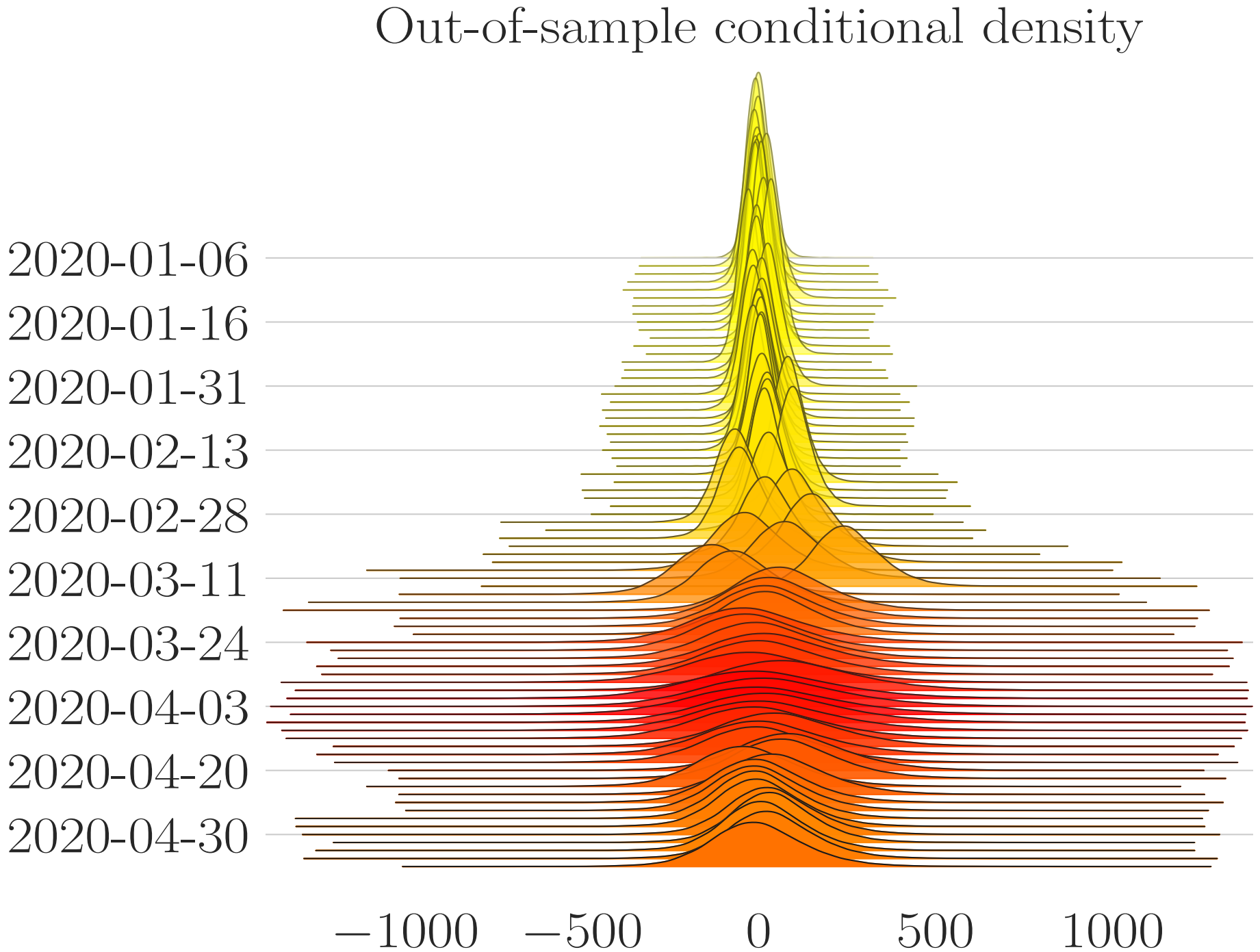
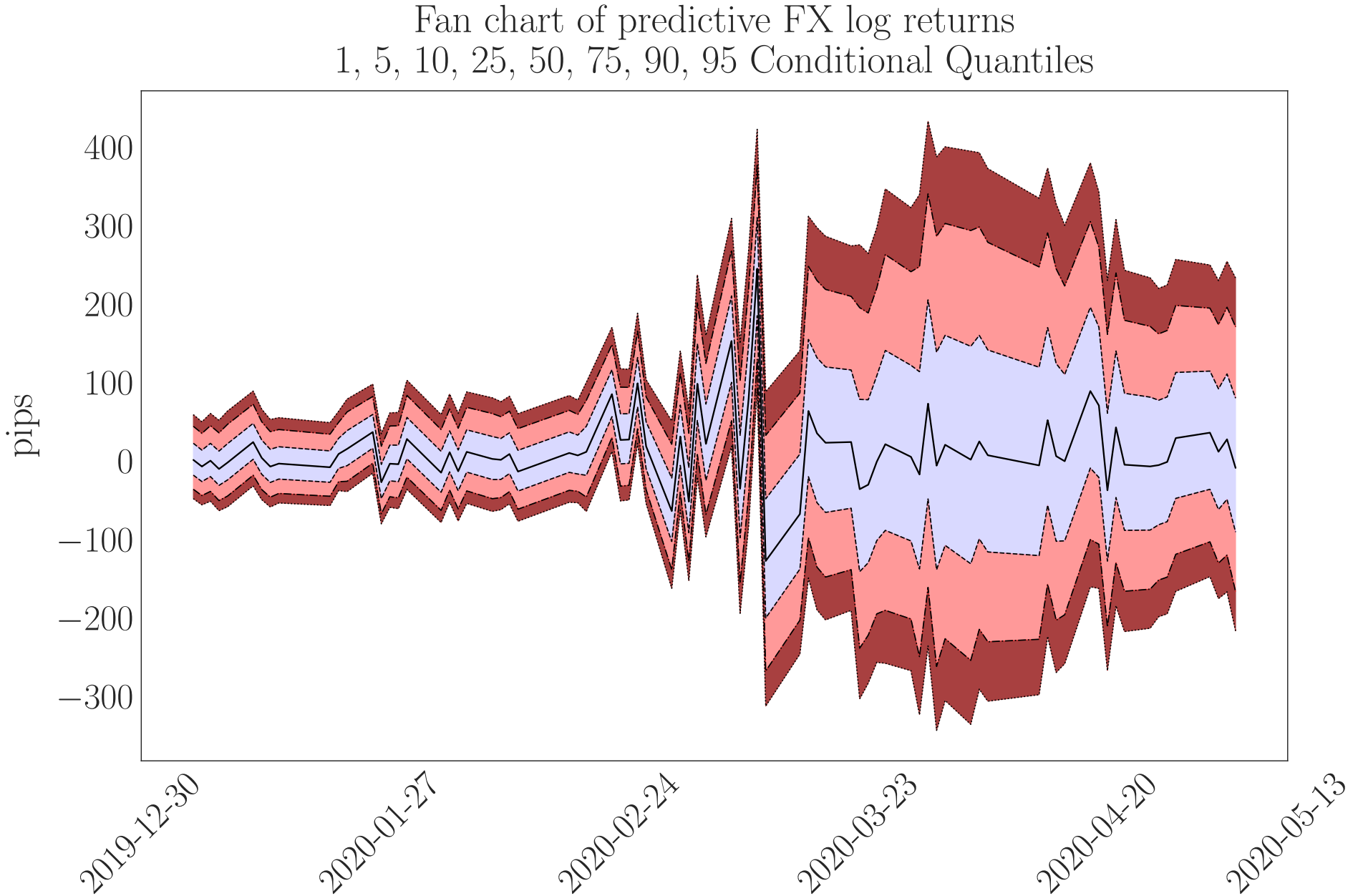
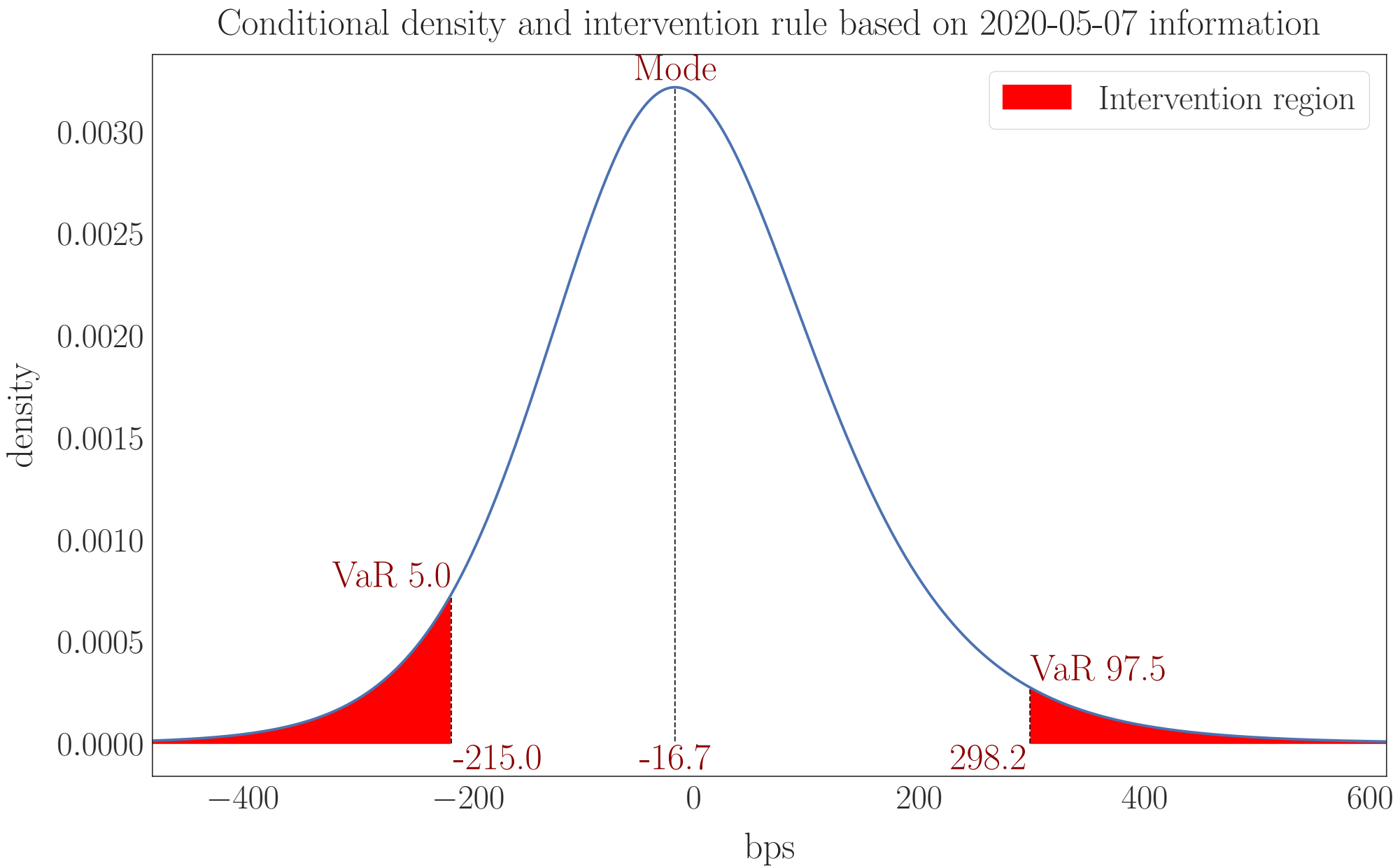

Out-of-sample conditional density
2020-01-06
2020-01-16
2020-01-31
2020-02-13
2020-02-28
2020-03-11
2020-03-24
2020-04-03
2020-04-20
2020-04-30
−1000
−500
0
500
1000

Fan Chart


Fan chart of predictive FX log returns
1, 5, 10, 25, 50, 75, 90, 95 Conditional Quantiles
pips
400
300
200
100
0
−100
−200
−300
2019-12-30
2020-01-27
2020-02-24
2020-03-23
2020-04-20
2020-05-13

VaR FXI Rule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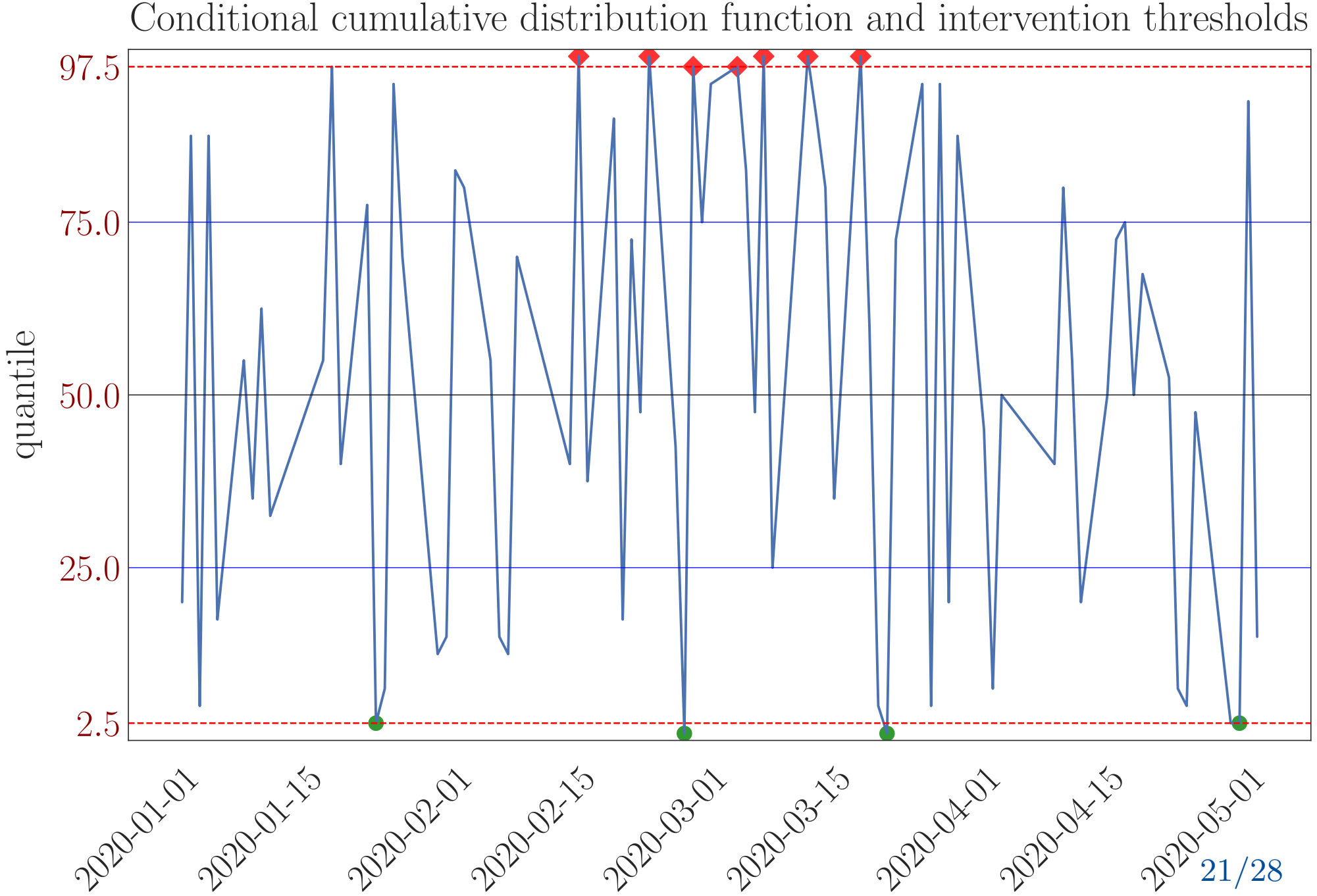
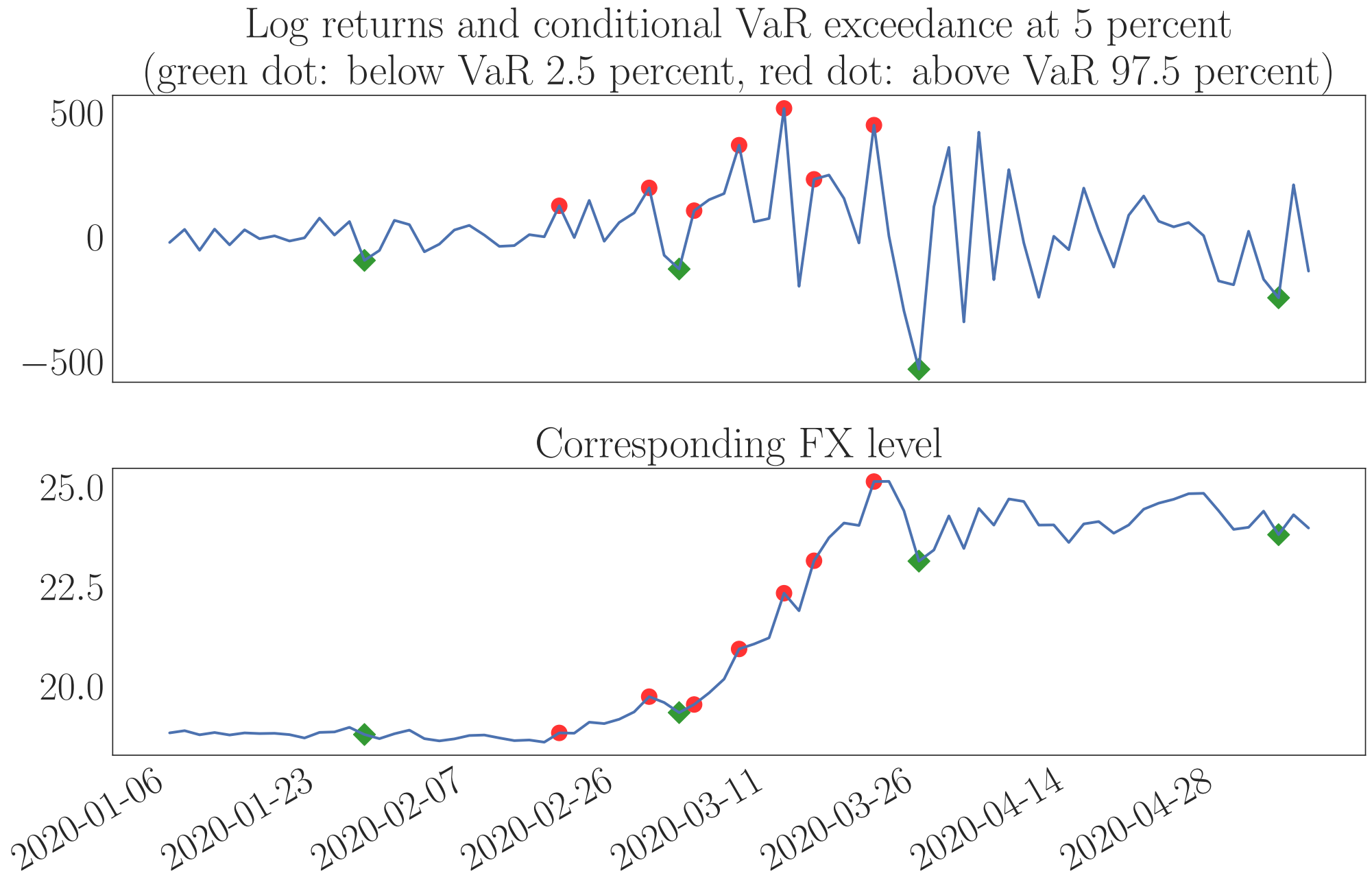
0.0020
0.0015
0.0010
0.0005
0.0000
−400
−200
0
200
400
600
bps

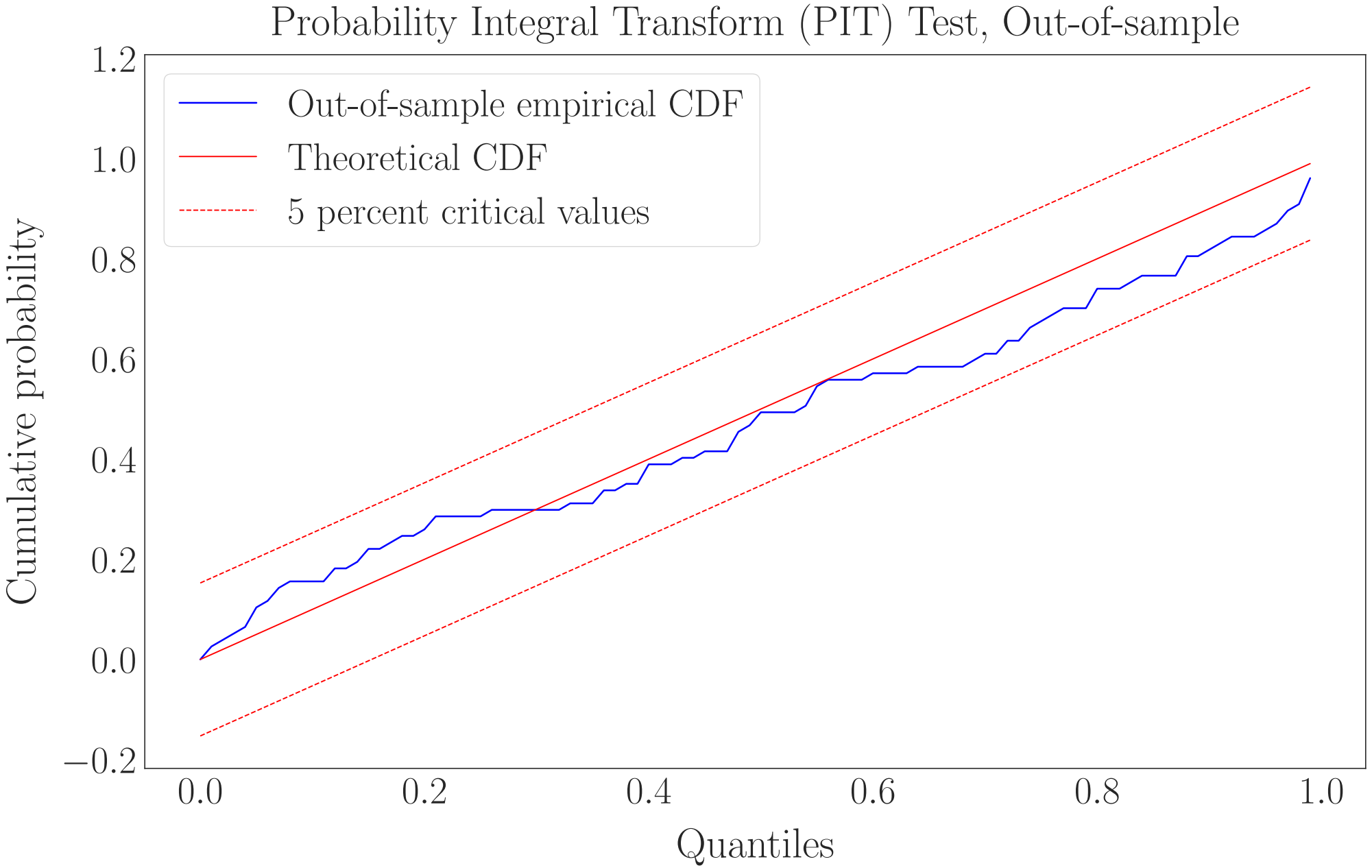
Conditional Cumulative Distribution Function



Conditional Exceedance



Density Evaluation



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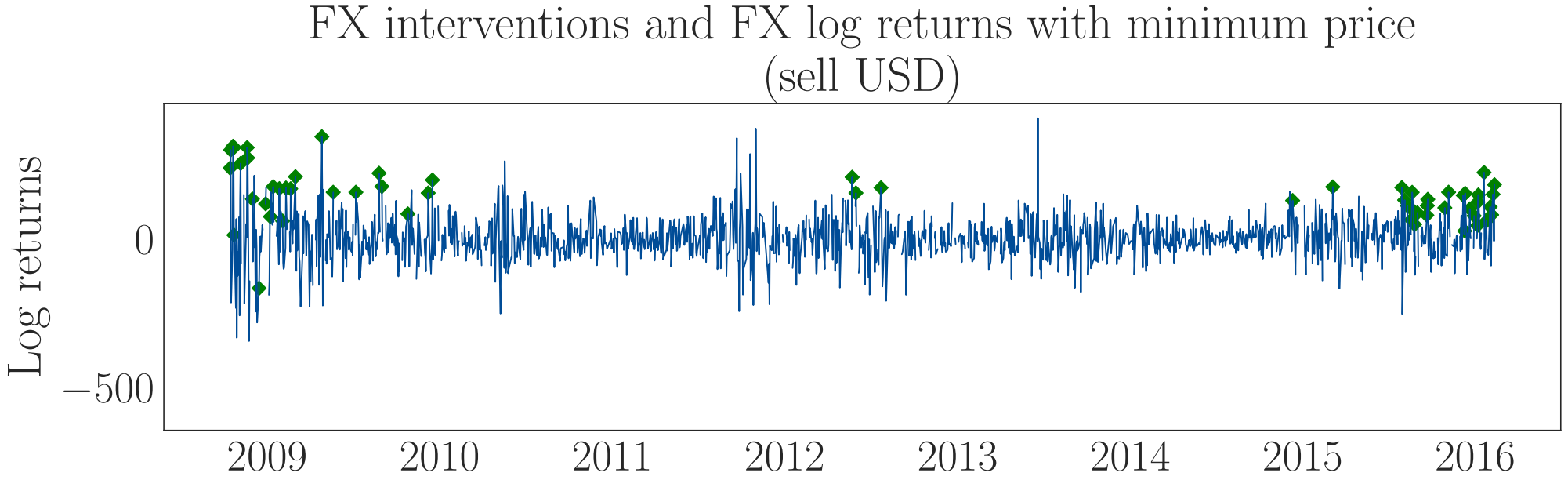
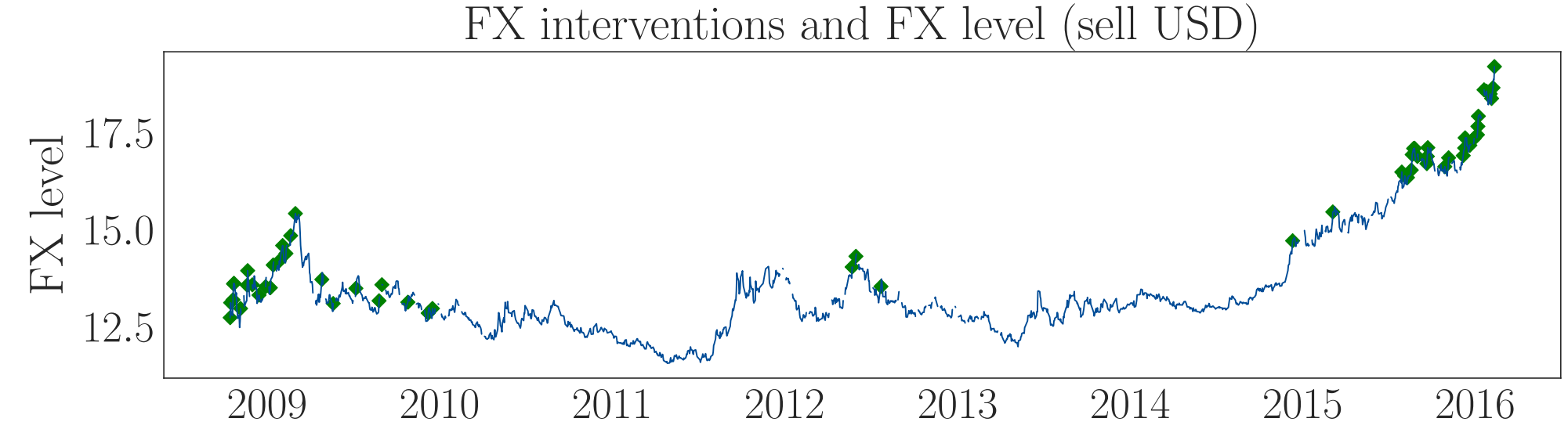
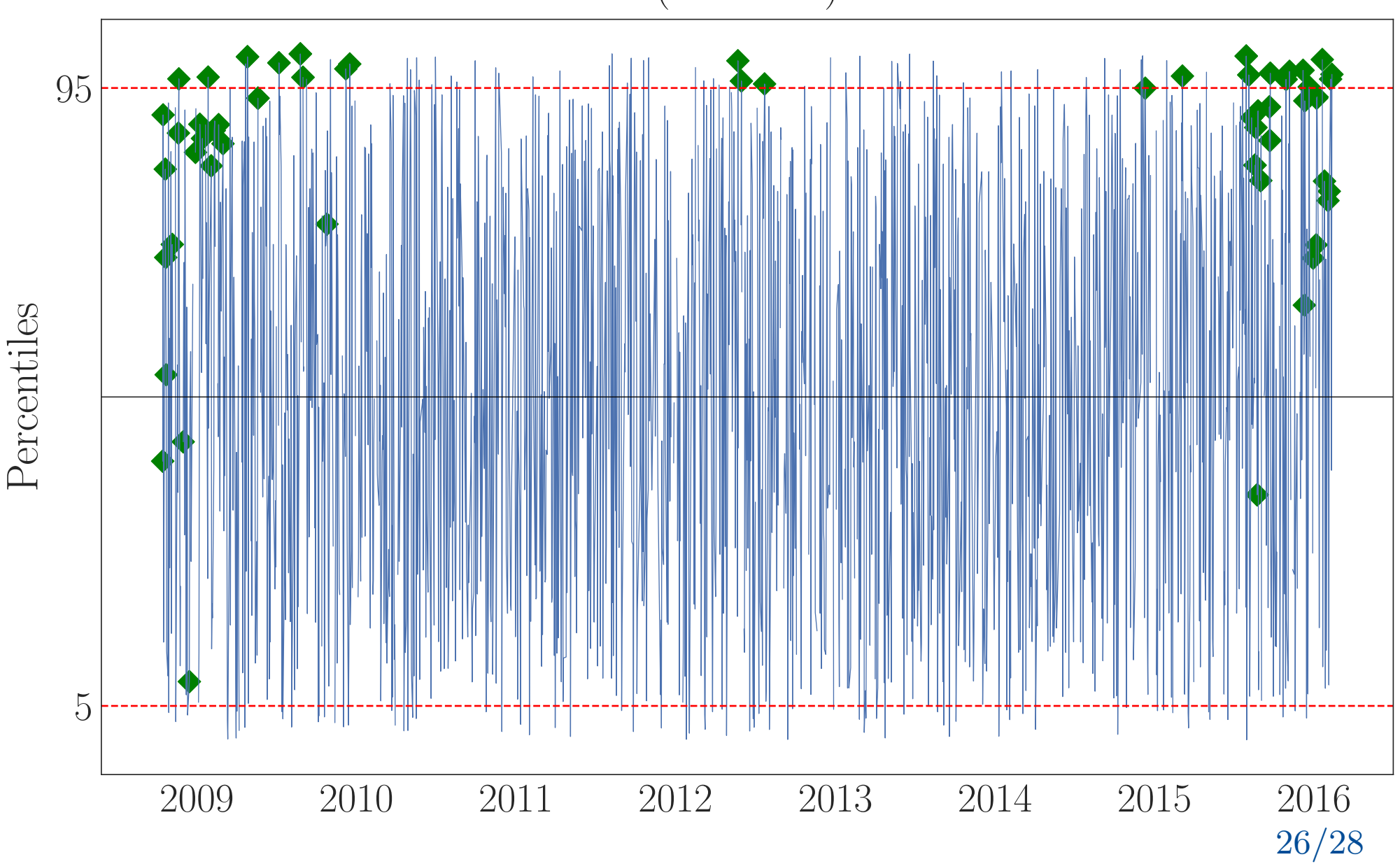
Rule-Based Benchmarking

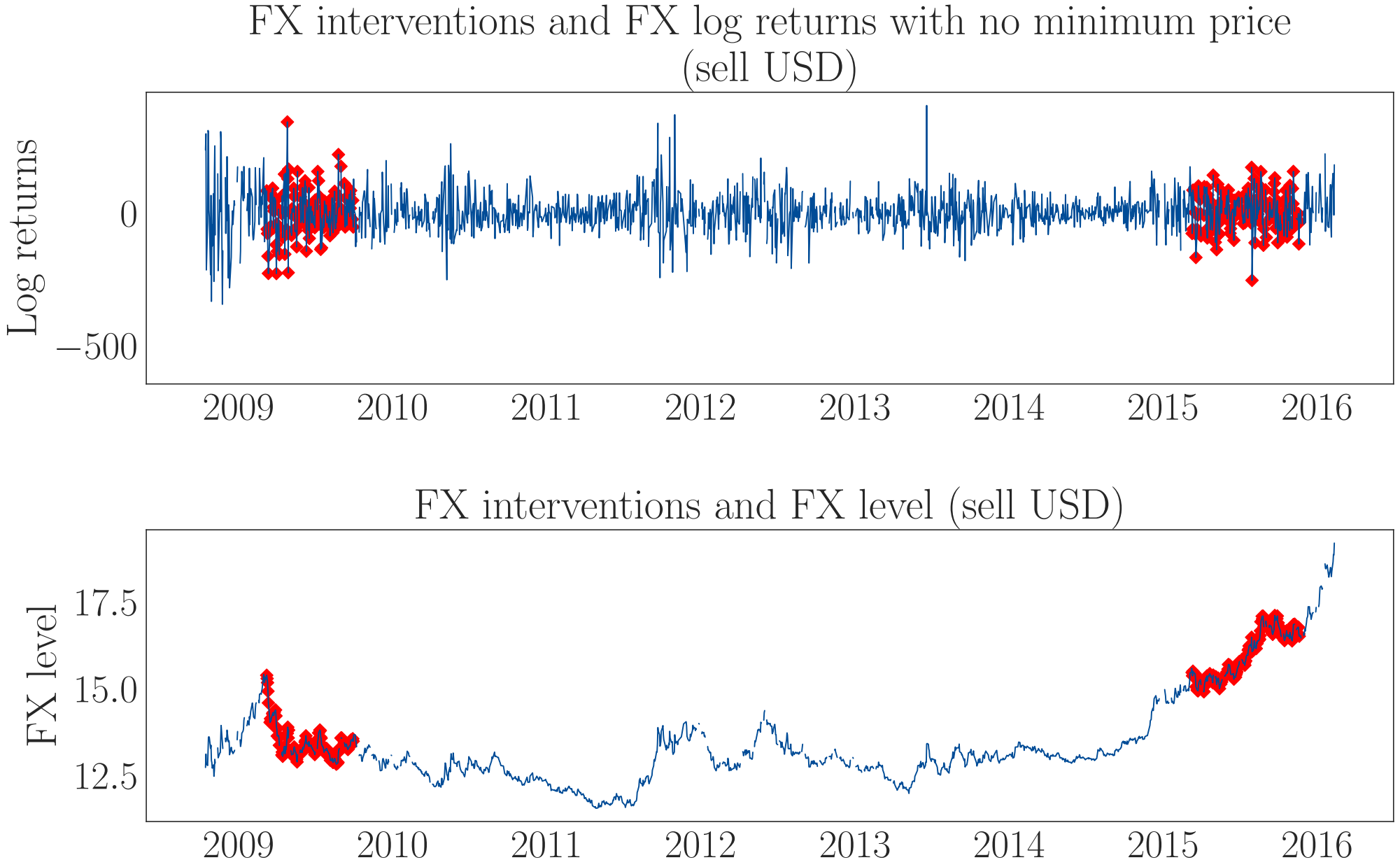




Rule-Based Benchmarking: Risk-Level



Discretion-Based Benchmarking



Discretion-Based Benchmarking: Risk-Level