Global financial risk and uncovered interest parity premia in Central and Eastern Europe

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Abstract

This paper investigates the impact of global financial risk on uncovered interest parity (UIP) premia in four Central and Eastern European (CEE) economies. Building on recent developments in the measurement of global financial risk, the study employs local projections that incorporate both external factors and local macroeconomic conditions. We find that global risk-on/risk-off shocks have positive, economically significant, but temporary effects on UIP premia in CEE economies. These effects typically exhibit peak-and-trough patterns, with some variation across countries, and are more pronounced for currency excess returns versus the US dollar than the euro. Importantly, we demonstrate that the transmission of global risk to UIP premia in CEE countries is primarily driven by adjustments in exchange rates rather than shifts in interest rate differentials. While the strongest responses of the UIP premia to global risk occur when shocks originate in currency markets, they extend to other asset markets. Furthermore, we find that both changes in the quantity of global risk (economic uncertainty) and the price of risk (risk aversion) affect the UIP premia in CEE economies, with the latter triggering more volatile adjustments in local currency excess returns. We interpret our findings using insights from an imperfect financial markets framework in the context of vulnerable economies.

Keywords: global financial risk, risk aversion, uncovered interest parity, currency excess returns, exchange rates, Central and Eastern Europe.
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1 Introduction

Deviations from the uncovered interest rate parity (UIP) highlight key open-economy issues related to currency and country risk, international capital flows, monetary regimes, and the workings of foreign exchange markets. The existence of UIP premia, or excess currency returns, that result from the misalignment between the interest rate differentials and exchange-rate adjustments implied by the UIP, has generated multiple explanations, both in a time-series perspective and in cross sections of currencies (Engel, 2014; Hassan and Zhang, 2021). However, the unconditional failure of the UIP reveals only part of the story behind this anomaly. Indeed, recent empirical studies suggest that the behaviour of UIP premia may substantially differ due to the nature of the underlying shocks that trigger their adjustments (Albagli et al., 2024; Schmitt-Grohé and Uribe, 2022). A prominent source of such shocks stems from shifts in global financial risk. Due to their impact on the pricing of assets, cross-border flows, and exchange-rate configurations, global financial shocks are critical both to international investors and policymakers in individual economies. Their consequences are also underscored in the theoretical frameworks based on imperfect financial markets (Maggiori, 2022; Akinci and Queralto, 2024) and in empirical studies that indicate the increasing importance of financial risk in explaining the disconnect of exchange rates from macroeconomic fundamentals (Lilley et al., 2022). Hence, a deeper understanding of the way that global financial risk affects UIP premia bears importance not only to identifying the dynamics but also to apprehending broader effects of international financial integration. This is especially true for economies that are vulnerable to external risk factors, their destabilizing impact on currency markets, and possible adverse effects on financial stability and economic activity.

Against this backdrop, the study provides an empirical inquiry into the role of global financial risk in driving UIP premia in four Central and Eastern European (CEE) economies: Czechia, Hungary, Poland, and Romania. Our focus on the CEE economies is a reflection of several features that make them well-positioned for this type of analysis. Over the past three decades, those economies have experienced rapid economic growth combined with an increasing degree of openness, financial liberalization, and high foreign capital inflows. Still, typically considered emerging market economies, CEE markets have been exposed to international shocks and experienced periods of large currency depreciations. The Covid-19 pandemic and the aftermath of the Russian invasion of Ukraine in 2022 are just two recent examples of such events. Compared to major currencies, the CEE currencies are also characterized by less-developed, shallower foreign exchange markets, which makes them a plausible laboratory for studying the predictions of imperfect financial market theories. Moreover, while de jure all four economies have followed inflation targeting, their actual monetary policies and exchange-rate arrangements are more complex and include periods of managed floating, currency pegs, and policy interventions. All this provides an opportunity to assess the interplay between global financial conditions and domestic vulnerabilities in explaining UIP deviations.

The paper evaluates the effects of global financial risk on UIP premia in CEE economies by building on recent advancements in its measurement. We primarily rely on the risk-on/risk-off shocks constructed from multiple financial assets by Chari et al. (2023) and uncertainty and risk aversion proxies developed by Bekaert et al. (2021). To this end, we estimate a series of

lag-augmented local projections that incorporate global and local control variables, including monetary policies by the Fed and the ECB, global growth and oil prices, as well as domestic macroeconomic fundamentals, inflation-rate differentials, and output growth. The baseline specifications use monthly data for the period between 2003 and 2024. Our results encompass the dynamic responses of the UIP premia, and their components – interest rate differential and exchange rate adjustments – to the risk-on/risk-off shocks, and contrast the results of local currency premia against the euro and the US dollar. Next, we explore the effects that originate from various dimensions of global risk, divided into four categories of credit spreads, equity, liquidity, and currency risks. We also empirically track the differences between the effects of the quantity of global risk (economic uncertainty) and the price of risk (risk aversion) for UIP premia. Finally, we discuss our findings in the context of theoretical predictions and structural features of CEE economies.

The empirical results lead to several conclusions. We find that global risk-on/risk-off shocks generate positive, economically significant, but temporary effects on UIP premia in CEE economies. The dynamic responses tend to follow a peak-and-through pattern: after a swift initial increase, local currency excess returns readjust downward before stabilizing. Yet, we identify some variation in the effects across countries, with Hungary and Romania displaying more pronounced effects than Czechia and Poland. We also show generally more clear-cut effects when the local currency excess returns are expressed in relation to the US dollar rather than the euro. Importantly, we demonstrate that the transmission of the financial risk to UIP premia in CEE countries is primarily driven by adjustments in the exchange rates rather than shifts in interest rate differentials. By comparing various dimensions of global risk, we show that the strongest responses of UIP premia occur when shocks come from currency markets, but the effects extend to other categories of risk, notably credit and liquidity risks. Furthermore, we find that both the financial proxies of economic uncertainty and risk aversion significantly impact UIP premia in CEE economies. However, shifts in global risk aversion trigger more volatile adjustments in the local currency premia. Our baseline results are robust to multiple sensitivity checks, including competing specifications of local projections and alternative variables used in the estimations.

The paper contributes to the ongoing debates on the explanations of UIP premia in vulnerable economies and the susceptibility of such economies to global risk. First, the study delivers a comprehensive analysis of the conditional UIP deviations driven by global financial risk. Apart from providing novel empirical evidence from arguably understudied CEE economies, it explores adjustments of currency excess returns in a dynamic setting, as opposed to standard UIP regressions. This approach also allows for the examination of how different facets of global financial risk impact the UIP premia, shedding light on their transmission and economic implications. Second, the responses of UIP premia in CEE economies to global financial risk contribute an empirical context for the assessment of predictions coming from theoretical models. We show that theories in which financial shocks play a major role in driving the time-varying risk premium wedge in the UIP condition provide a plausible framework to interpret our general findings. However, we also link our empirical results to theory in order to account for the cross-country variation in the reaction of CEE economies to global risk. Consequently, our

findings facilitate a discussion on issues typical for emerging market economies, such as less developed foreign exchange markets, high exchange-rate risk, and negative net foreign asset positions. This contribution is relevant for the assessment of countries' exposure to global risk and policies aiming to mitigate the adverse effects of external factors on local currency risk premia.

The remainder of the paper is organized as follows. In Section 2, we link the study to the recent literature in the field. Second 3 lays down our empirical framework, along with the data description. In Section 4, we present our empirical results, broken down into four steps. Section 5 discusses our findings within the imperfect financial markets framework. Section 6 contains the sensitivity checks on our baseline results. Section 7 concludes and outlines issues for further research.

2 Literature review

This study connects to three active fields in open economy macroeconomics and international macrofinance. First, the paper is directly related to the vast theoretical and empirical literature on the anomalies surrounding the UIP condition. Building on the seminal contribution by Fama (1984), this literature documents the magnitude of UIP premia and their possible explanations. Sarno and Taylor (2003) and Engel (2014) review several broad approaches that account for the failure of UIP, including the existence of time-varying risk premium, deviations from rational expectations, or policy factors. Hassan and Zhang (2021) summarize the theoretical foundations of the relationship between the forward premium puzzle and carry trade in foreign exchange markets, along with time-series and portfolio-based methods employed in the field. In a panel-data setting, Kalemli-Özcan and Varela (2021) document the empirical regularities of the UIP premia in advanced and emerging economies. They point to larger and more volatile UIP premia in emerging markets, which are correlated with capital flows, global risk, and policy uncertainty. Moreover, recent studies indicate that shifts in UIP premia may depend on the sources of drive their adjustment. Schmitt-Grohé and Uribe (2022) distinguish between the contrasting effects of permanent and transitory monetary shocks on the UIP premia, while Bernoth et al. (2023) demonstrate the relationship between US monetary policy shocks and global risk shocks on excess currency returns in advanced economies. Albagli et al. (2024) find that UIP deviations around monetary policy and uncertainty-related events and identify differences in their impact on currency excess returns.

Specifically, we address the literature on the UIP premium in Central and Eastern Europe. The UIP condition is typically rejected in empirical studies covering CEE countries, although due to different reasons. Filipozzi and Staehr (2012) find that the UIP failure may be explained by structural breaks in CEE exchange rates associated with global financial risk, while Triandafil and Richter (2012) credits it to macroeconomic fundamentals, in particular inflationary processes that increase the local risk premia. Using longer series, Dąbrowski and Janus (2023) augment the UIP tests on CEE currencies with various risk measures, highlighting the role of the euro-dollar risk premium for the UIP deviations in the region, and argue that those economies fit well a 'risky country' profile. Hoffmann (2012) studies carry trade returns in CEE economies and suggests that liquidity conditions and risk appetite drive the local currency excess returns. The role of

risk aversion and investors' sentiments is consistent with the UIP-based model of the Polish zloty exchange rate by Grabowski and Welfe (2016). On the other hand, rare contributions that demonstrate the validity of the UIP condition in CEE economies include Jiang et al. (2013), who underline the role of nonlinearities that appear in this relationship, and Cuestas et al. (2017), who provide evidence on the role of expectation in running the UIP tests on CEE currencies.

Second, the study is linked to the latest research on the role of financial risk in exchange rate dynamics and currency risk premia. Recent theoretical contributions advance financial shocks as the main force behind the exchange rate disconnect and several related puzzles in international macroeconomics, including the UIP deviations (see a review by Maggiori, 2022). Based on segmented financial markets, models by Gabaix and Maggiori (2015) and Itskhoki and Mukhin (2021) posit that a limited risk-bearing capacity of financial intermediaries plays a central role in the adjustments of global portfolios, capital flows, and exchange rates. The failure to absorb imbalances in the demand and supply of assets denominated in different currencies generates their imperfect substitutability. Consequently, financial shocks, such as an increase in risk aversion, generate deviations from the UIP – excess currency returns that may be understood as compensation for constrained intermediaries to accept a currency mismatch.[1] Expanding this line of reasoning, Adrian et al. (2022) and Fukui et al. (2023) both theorize that there may be more types of financial shock involved in generating deviations from the UIP, for example one related to noise trading (unrelated to fundamentals) and one to sudden stops (large capital outflows). Akinci and Queralto (2024) model the spillovers from the US monetary policy in emerging market economies and show that both international and domestic financial market imperfections contribute to strong effects of US monetary shocks on the exchange rates and UIP premia.

The empirical literature in this area documents relationships between financial market conditions, risk taking, and exchange rates. The existence of common global factors in currency returns has been long emphasized in studies on the carry trade profitability. Notably, Lustig et al. (2011) argue that the common factor in excess returns in the foreign exchange market may be partly ascribed to shifts in global risk, while Husted et al. (2018) link high carry trade returns to the influence of uncertainty on investors' risk preferences. Panayotov (2020) tests various sources of such factors and finds a prominent role of the global equity market factors in driving the exchange rates. Based on the data on advanced economies, Ismailov and Rossi (2018) show that the UIP premia are more likely in periods of high uncertainty, which they explain mainly with unpredictable arbitrage opportunity gains. Eguren-Martin and Sokol (2022) demonstrate that currencies can be considered as 'safe-haven' or 'risky', depending on the performance of the distribution of their returns during tight global financial conditions. Lilley et al. (2022) argue for the US dollar 'exchange rate reconnect', as the relationship between the broad dollar and proxies for financial risk has become stronger in the period following the Global Financial Crisis.

Third, the study relates to a growing literature on global financial risk and its transmission to individual economies. The major concept in this line of research is the global financial cycle, as described by Rey (2013) and Miranda-Agrippino and Rey (2020). The cycle captures the worldwide comovement in numerous asset prices and it is shaped by fluctuations in global risk

[1] We come back to more detailed theoretical predictions of such a framework in Section 5.

appetite, liquidity, and the behaviour of global banks, with a pronounced role of the US monetary policy. Importantly, the existence of a global financial cycle makes individual economies more sensitive to risk spillovers from abroad than previously thought, even under floating exchange rate regimes. On the empirical front, recent research identifies various channels through which global financial risk propagates into domestic conditions, such as sovereign risk (Gilchrist et al., 2022), capital-flow and exchange-rate pressures (Goldberg and Krogstrup, 2023), flight-to-safety tendencies in emerging bond markets (Janus, 2023), and equity returns in emerging market economies (Horvath and Yang, 2024).

Due to its empirical setup, our study connects to the latest advancements in the measurement of global financial risk, including proxies for global risk aversion and funding conditions. Such measures differ across several dimensions, including the underlying assets used for their calculation, and specific types of risk or uncertainty they capture (see a review by Chari, 2023). Habib and Venditti (2019) put forward a risk measure based on the comovement of global stock market returns and demonstrate that it is strongly related to cycles in international capital flows. They also show that financial shocks, that relate to disruptions in the risk-bearing capacity of financial intermediaries, are more important in driving global risk than the US monetary policy. Bekaert et al. (2021) apply a dynamic asset pricing model to risky asset classes and macroeconomic US data to distinguish between aggregate proxies to physical risk (uncertainty) and price of risk (risk aversion). While the uncertainty measure is linked to future economic downturns, the risk aversion one has strong predictive properties for asset excess returns. Lastly, Chari et al. (2023) use the principal component of multiple financial market variables to capture the risk-on and risk-off states of investors' activity. They next find that the risk-on/risk-off shocks display a strong effect on the entire distribution of emerging market capital flows and returns.

3 Methodology and data

This section discusses the empirical strategy of the study, detailing the estimation methods and data. Our main variables of interest are the excess returns on local-currency assets in CEE economies, defined as the gap between the interest rate differentials and the exchange rate adjustment term:

$$\rho_{t+12} \equiv (i_t - i_t^*) - (s_{t+12} - s_t) \tag{1}$$

where i_t denotes the domestic (CEE) interest rates and i_t^* are foreign interest rates, either in the Economic and Monetary Union (EMU) or in the US. s_t is expressed as the log price of foreign currency in terms of local currency, such that its increase denotes depreciation of home currency versus the euro or the dollar, and s_{t+12} is a 12-month ahead log exchange rate. Since the UIP implies that the expected excess returns on investments in the international market should be nil, the term ρ_{t+12} captures the ex-post UIP premium on assets denominated in local currencies. A positive UIP premium, which, as we will see, is typical for CEE currencies, implies that the returns on domestic assets are higher than those on foreign assets because the local currency does not depreciate enough to offset the difference between the returns, or even appreciates.

We investigate the dynamic responses of UIP premia in CEE economies to shifts in global

financial risk using local projections introduced by Jordà (2005). There is now growing evidence that local projections serve as a flexible and intuitive alternative to various structural vector autoregressions, and the resulting impulse response functions are well-suited for analyzing persistent macroeconomic and financial data. Our baseline local projections for the UIP premia are described by the following equation:

$$\rho_{t+12+h} = \alpha_h + \beta_h risk_t + \sum_{i=1}^{p} \delta_i \mathbf{z}_{t-i} + u_{t+12+h}, \tag{2}$$

where h is the local-projection horizon, while u_{t+12+h} denotes the residual term. The key predictor, $risk_t$, is the global financial index by Chari et al. (2023), to which we refer as the global risk-on/risk-off shock. As mentioned, this measure relies on principal components in daily financial series to capture shifts in the global investor risk appetite, and hence it is plausibly exogenous to local conditions in small open CEE economies. The index is constructed using financial variables both in the US and the EMU. This feature makes it particularly suitable for the task at hand, since we are interested in the behaviour of UIP premia in CEE economies with respect to the euro and the US dollar. The financial shocks are defined as one standard deviation of the monthly averages of the risk-on/risk-off measure, with positive values indicating risk-off tendencies in global financial markets.

We estimate the local projections in monthly frequency and obtain impulse response functions of the UIP premia over a horizon of up to 15 months, focusing on short-term deviations from the UIP.[2] To improve the specification of the local projection regressions, we follow the lag-augmentation practice (Montiel Olea and Plagborg-Møller, 2021). This means that matrix $\mathbf{z}$ on the right-hand side of Equation (2) includes the lagged values of the dependent variable and the control variables but also the lags of the $risk_t$ variable. In the baseline, we set the lag length to $p = 12$, which should keep us on the safe side when it comes to the persistence of monthly series. Confidence intervals on the impulse response functions are calculated using the Newey-West standard errors.[3]

Matrix $\mathbf{z}$ contains additional factors, both foreign and domestic, that can possibly explain out the reaction of UIP premia to the risk-on/risk-off shocks. We introduce six control variables, which can be divided into two groups.

The first group of controls consists of factors external to CEE economies. Here, we include the comprehensive global economic activity indicator by Baumeister et al. (2022), which approximates worldwide macroeconomic conditions, along with monthly changes in the log prices of oil. This variable is based on crude oil WTI prices obtained from the FRED database. Next, because we know that the global financial cycle is influenced by monetary policies in advanced economies, we control for monetary policy shocks of the Fed and the ECB. In both cases, we use the monetary policy shocks obtained using high-frequency identification by for the Fed by Bu et al. (2021) and similar shock series for the ECB provided by Jarociński and Karadi (2020), both of which have relatively long coverage.

[2] See Valchev (2020) for a recent account on the evidence on UIP violations at longer horizons and the so-called UIP reversal phenomenon.

[3] The local projections are estimated via OLS, and the standard errors are corrected for the projection horizon. For computation, we use the *lpirfs* R package by Adämmer (2019).

The second set of control variables comprises local macroeconomic conditions that may both trigger adjustments in exchange rates and interest rates and affect the sensitivity of CEE countries to external shocks. We take into account two country-specific variables: the inflation-rate differential between the home economy and the reference economy, along with the rate of growth of the domestic industrial production index. All the underlying series are seasonally adjusted and sourced from the Eurostat and FRED databases.

Having produced the main results for the currency excess returns, we take a closer look into potential sources of UIP deviations by dissecting them down into two main components of the UIP premium, as in Equation (1), namely the exchange-rate adjustments and interest-rate differentials. We re-estimate the basic local projections for $i_t - i_t^*$ and $s_{t+12} - s_t$ and dependent variables, using analogous local-projections specifications, along with the full set of controls. This allows us to identify the dominant channel behind the transmission of global risk to UIP premia, but also to assess policy trade-offs that CEE economies face under financial shocks.

Next, we break down the risk-on/risk-off measure by Chari et al. (2023) into four components and explore the role of various categories of global risk in driving the UIP premia. The credit risk measure is based on movements in spreads of corporate bonds, and it shows strains in credit markets. The equity-based index relies on returns in the US and the EMU equity markets, along with the well-known measures of option-implied volatilities, including the VIX and the VSTOXX indices. The funding liquidity measure is built on various bid-ask spreads in financial markets, such as the LIBOR-OIS spread, while the currency and gold dimension derives from the US dollar index against advanced economies and prices of gold. By comparing the outcomes obtained for four sub-indices of the risk-on/risk-off shocks, we can thus ask what types of global risk shocks are most consequential for the response of the UIP premia in CEE economies.

Finally, we investigate the response of the UIP premia to shifts in uncertainty and risk aversion proxies by Bekaert et al. (2021, henceforth: BEX). The basic problem we deal with here is that standard measures or risk, such as the VIX index and the empirical risk-on/risk-off shocks, may reflect changes both in economic uncertainty and risk aversion of investors in global markets. BEX sharpen this distinction using a dynamic asset pricing model of equities and corporate bonds. The first measure they obtain is a financial proxy to economic uncertainty. It is linked to macroeconomic fundamentals and maps to periods of countercyclical "bad" volatility in financial markets, low cash flows, and high "physical risk" in financial markets. On the other hand, the time-varying risk aversion (or: the inverse of risk appetite) captures the nonfundamental "price of risk". It is related to equity risk-neutral variances and sentiment or confidence indices, as it increases with the demand for insurance against future losses. Shifts in risk aversion may be interpreted as preference shock and risk constraints in the financial sector. To keep both variables comparable to the baseline risk-on/risk-off measure $risk_t$, we transform the BEX proxies into one standard deviation of their month-over-month changes.

The analysis covers four CEE economies – Czechia, Hungary, Poland, and Romania – using monthly frequency data for the period between March 2003 and January 2024. The time coverage of the study is restricted by data availability, specifically by the date on which the risk-on/risk-off series begin. For each economy, we calculate the UIP premia, or local currency excess returns, as in Equation (1), using spot exchange rates vis-à-vis two reference currencies: the euro and

the US dollar. The corresponding interest rate adjustments are computed using annual money market interest rates with 12-month maturity in individual economies. The exchange rate and interest rate series are obtained from the Refinitiv Datastream and prepared as monthly averages of daily data. When performing the sensitivity analysis, we introduce a number of important modifications into the baseline empirical setup, which are discussed in detail in Section 6.

Table 1: Descriptive statistics of main variables used in the study

	Variable	Mean	Median	St.dev	Q(25)	Q(75)	Skewness	Kurtosis
Czechia – EUR	UIP premium	2.199	2.370	4.803	-0.574	5.433	-0.187	0.128
	ER adjustment	-1.460	-1.686	4.660	-4.594	1.185	-0.098	0.585
	IR differential	0.739	0.408	1.482	-0.070	1.037	1.786	3.614
Czechia – USD	UIP premium	1.007	0.105	10.621	-5.390	8.515	-0.001	-0.147
	ER adjustment	-0.992	0.040	10.948	-8.229	5.841	-0.051	0.010
	IR differential	0.015	0.068	1.394	-0.993	0.896	0.141	0.374
Hungary – EUR	UIP premium	1.799	0.961	7.005	-2.186	4.963	0.454	0.010
	ER adjustment	1.962	1.758	5.534	-1.019	4.568	0.136	0.051
	IR differential	3.761	3.584	2.859	1.279	5.247	0.931	0.542
Hungary – USD	UIP premium	0.607	-0.046	12.976	-8.802	10.583	0.004	-0.757
	ER adjustment	2.430	1.282	12.056	-7.148	10.616	0.254	-0.530
	IR differential	3.037	2.665	3.456	0.448	5.416	0.194	-0.877
Poland – EUR	UIP premium	2.726	2.473	7.958	-0.683	6.859	-0.903	2.850
	ER adjustment	-0.150	0.071	7.475	-4.254	2.937	1.037	3.375
	IR differential	2.577	2.319	1.445	1.715	3.146	1.562	3.525
Poland – USD	UIP premium	1.534	2.204	13.146	-5.903	10.403	-0.437	0.441
	ER adjustment	0.319	-0.001	13.175	-7.769	7.524	0.545	0.818
	IR differential	1.853	1.812	1.877	0.177	3.591	0.074	-1.381
Romania – EUR	UIP premium	4.179	2.280	7.680	0.633	6.372	1.445	3.064
	ER adjustment	1.168	1.106	5.357	-0.463	2.301	0.105	2.013
	IR differential	5.347	4.228	4.248	2.612	5.781	1.722	2.217
Romania – USD	UIP premium	2.987	2.445	12.288	-4.643	9.966	0.304	-0.001
	ER adjustment	1.636	1.004	10.599	-5.076	7.798	0.431	-0.042
	IR differential	4.624	2.924	4.904	1.293	5.974	1.516	1.598
Risk-on/risk-off	Overall	0.001	-0.032	0.268	-0.129	0.108	1.547	7.180
	Credit spreads	-0.002	-0.047	0.395	-0.172	0.120	2.167	14.215
	Equity	-0.005	-0.034	0.178	-0.098	0.085	0.750	1.846
	Liquidity	-0.004	-0.008	0.287	-0.049	0.034	3.234	33.845
	Currency & gold	0.001	0.011	0.226	-0.145	0.135	0.254	1.405
BEX	Uncertainty	-0.000	-0.021	0.237	-0.103	0.095	1.599	19.886
	Risk aversion	0.000	-0.004	0.520	-0.113	0.096	0.871	11.740

Notes: The table displays descriptive statistics for the main variables used in the study: the UIP premium series (in percentage points), the exchange rate (ER) adjustments (in percent), and the interest rate (IR) differentials (in percentage points), along with the global financial risk indices, before the standardization of monthly series. Risk-on/risk-off refers to Chari et al. (2023), while BEX to Bekaert et al. (2021) financial risk measures.

Table 1 reports descriptive statistics of the three major country-level variables: the UIP premia, and its two components, exchange rate (ER) adjustments and interest rate (IR) differential, at the country level, along with the risk-on/risk-off measures and BEX indices. The statistics show that the mean and median values of the currency excess returns in CEE economies are generally positive, although they range substantially from around zero to more than 5 percentage points. The central tendencies of their components show that, on average, the interest rate differentials are positive. In most of cases, the same is true for the exchange rate adjustments, but the average currency depreciations are smaller than the interest rate

differentials, which gives rise to average values of UIP premia above zero. In the case of the Czech koruna and the Polish zloty/euro currency pair, the mean values of the exchange rate adjustments are negative, further adding to the interest rate differentials. The UIP premium and exchange rate series are also highly volatile, as indicated by large standard deviations and wide interquartile ranges, while the interest rate differentials are positively skewed, indicating the presence of large positive values in their distributions. The fluctuations of the UIP premia seem to be larger for the US dollar than the euro. Finally, all of the risk proxies that we rely on are centered at zero but exhibit high skewness and kurtosis, indicative of asymmetries and fat tails in their distributions.

4 Empirical results

This section presents the findings of our empirical analysis. We start by investigating the dynamic responses of UIP premia in CEE economies to global financial risk. Next, we explore the relative role of two major components of the currency excess returns, the exchange rate adjustments and interest rate differentials, in explaining our results. We supplement those findings by examining the differences across four dimensions of global financial risk for CEE currency excess returns. Lastly, we compare the role of global uncertainty and risk aversion factors in driving the UIP premia.

4.1 Global financial risk and UIP premia

Our baseline results rely on the lag-augmented local projections, estimated for four CEE economies versus the two reference currencies and including the full set of control variables. Figure 1 plots the impulse response function of the UIP premia to global financial risk, defined as a one standard deviation increase in the risk-on/risk-off measure, which indicates a deterioration in the global financial conditions.

The baseline impulse responses of the UIP premia reveal several key insights. First, the timing and magnitude of the responses are noteworthy. On impact, the global risk-on/risk-off shock leads to an increase in the excess returns on local CEE currencies, in line with our expectations. The maximum effect of the variation in the global risk on the UIP premia generally appears quite quickly, a month after the shock. The UIP premia increase significantly for all CEE economies and both reference currencies, with the sole exception of Czechia when the euro is the reference currency. These effects then endure for several months before a gradual decline, and the responses follow a peak-and-trough pattern: after the initial increase, the UIP premia tend to adjust downward, in some cases entering negative territory. This highlights the transient nature of the effect of financial disturbances on the UIP deviations in CEE economies, with a sharp increase followed by a dissipation of the effects of financial disturbances.

Second, there are notable country-specific differences in the responses of the UIP premia captured in the functions. Hungary and Romania show stronger and more long-lasting effects of the risk-on/risk-off shocks. In these two economies, the local currency excess returns rise sharply and remain significantly positive for up to six months following the shock. In contrast, Czechia and Poland exhibit weaker responses, indicating a more muted reaction to global financial risk,

with an increase in ρ_t visible only in the very first months. These differences suggest the varying degrees of vulnerability and resilience to global financial risks among the CEE currencies, to which we come back later.

Third, the effects are more substantial and volatile when the US dollar is the reference currency used to express the excess returns, compared to the euro. This is true for all the CEE countries, but again more clear-cut for Hungary and Romania. such a difference is consistent with the fact that during risk-off episodes and heightened risk aversion, international investors demand higher risk premia for holding CEE currencies, and when portfolios are re-balanced away from relatively riskier CEE assets towards safer alternatives, it is the US dollar that plays a more pronounced role in the transmission of global risk.

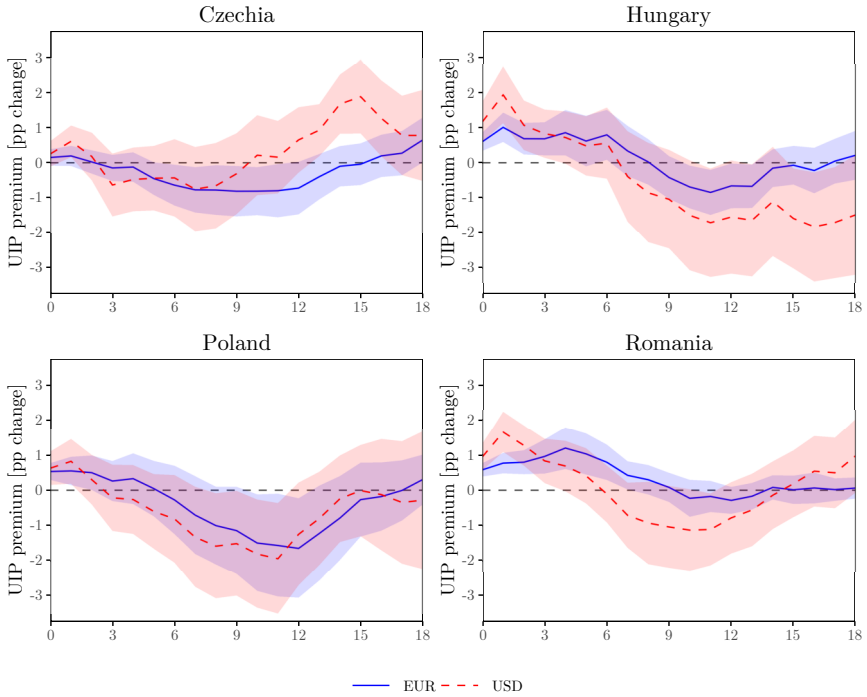

Figure 1: Impulse response function of UIP premia to the global risk-on/risk-off shocks

Notes: The figure shows impulse response functions of the UIP premia in CEE economies to one standard deviation increase in the risk-on/risk-off index, vis-à-vis two reference currencies, the euro and the US dollar. The responses are based on local projections with 12 lags of all variables, including the dependent variable, the risk-on/risk-off measure, and the control variables. The set of global controls consists of global growth, monetary policy shocks of the Fed or the ECB, and changes in oil prices. The set of local controls includes the inflation rate differential and the industrial production rate of growth. Bands around the base estimates show 90-percent confidence intervals obtained using the Newey-West standard errors.

Table 2 reports a quantitative depiction of these responses, highlighting the values of the impulse response function at selected horizons of the local projections estimates. In the early months following the variation in the risk-on/risk-off measure, there is a generally positive impact on the UIP premia, statistically significant at conventional levels, with Hungary exhibiting the strongest responses and Czechia the weakest. The peak response in Hungary reaches approximately 1.9 percentage points for the US dollar and 1.0 percentage points for the euro. In Romania, the response is also substantial, with the effect for the euro still highly significant six months after the risk-on/risk-off shock. In contrast, the maximum response in Czechia is about 0.6 percentage points for the US dollar and 0.2 percentage points for the euro

(statistically insignificant at conventional levels), reflecting a more subdued reaction. Against this background, Poland shows intermediate responses, with a peak of 0.8 percentage points for the US dollar and 0.5 percentage points for the euro.

Importantly, the effects of the risk-on/risk-off shocks on the UIP premia are economically significant. Given that the average values of UIP premia in CEE economies over the period under analysis oscillate between 0.6 and 4.2 percentage points, the magnitude of the effects captured in the impulse response functions translates to substantial increases in currency excess returns. Furthermore, the baseline results demonstrate that these effects hold even when we control for several relevant foreign and local factors, indicating that shifts in global financial risk generate positive UIP deviations for CEE currencies independently of other external factors, as well as the domestic macroeconomic fundamentals. This suggests that global risk-on/risk-off shocks are a distinct and significant source of UIP deviations, which introduce a temporary time-varying risk premium into the CEE currency excess returns.

Table 2: Impulse response function of UIP premia to the risk-on/risk-off shocks: response values at selected horizons

		Horizon (h)						
		$h=0$	$h=1$	$h=2$	$h=3$	$h=6$	$h=12$	$h=18$
Czechia	EUR	0.151	0.194	0.023	-0.148	-0.637	-0.722*	0.648*
		(0.142)	(0.174)	(0.202)	(0.226)	(0.353)	(0.454)	(0.388)
	USD	0.253	0.610**	0.178	-0.634	-0.43	0.651	0.779
		(0.22)	(0.273)	(0.412)	(0.544)	(0.669)	(0.566)	(0.788)
Hungary	EUR	0.600***	1.009***	0.685**	0.682**	0.795*	-0.658*	0.214
		(0.158)	(0.254)	(0.273)	(0.286)	(0.432)	(0.387)	(0.423)
	USD	1.166***	1.935***	1.068**	0.828**	0.559	-1.547	-1.484
		(0.346)	(0.491)	(0.428)	(0.417)	(0.615)	(0.981)	(1.036)
Poland	EUR	0.530***	0.547**	0.496*	0.26	-0.274	-1.648*	0.302
		(0.145)	(0.243)	(0.296)	(0.345)	(0.588)	(0.863)	(0.429)
	USD	0.626**	0.818**	0.299	-0.215	-0.812	-1.248	-0.282
		(0.289)	(0.386)	(0.427)	(0.57)	(0.754)	(0.89)	(1.19)
Romania	EUR	0.578***	0.768***	0.794***	0.958***	0.792***	-0.287	0.062
		(0.115)	(0.176)	(0.206)	(0.295)	(0.304)	(0.231)	(0.182)
	USD	0.946***	1.651***	1.270***	0.832**	-0.106	-0.782	0.977
		(0.232)	(0.344)	(0.348)	(0.382)	(0.49)	(0.615)	(0.634)

Notes: The Table displays the impulse response functions estimated in local projections. See Figure 1 for the detailed description. The horizon values are expressed in months. Standard errors, calculated using Newey-West methods, are given in brackets. ***, **, and * denote statistical significance at 0.01, 0.05, and 0.1 levels, respectively.

4.2 Exchange rate adjustments and interest rate differentials

To provide a more detailed picture of the reaction of CEE currency excess returns to global financial risk, we now investigate the response of the two building blocks of the UIP premia, exchange rate adjustments and interest rate differentials, to the global risk-on/risk-off.

Figure 2 displays the impulse response functions based on the local projections with the exchange rate adjustments as the dependent variable. In general, the functions show a significant but temporary downward movement in the exchange rate components of the UIP premia, followed by a positive realignment in the following months. The initial negative values of the exchange rate adjustments, $s_{t+12} - s_t < 0$, imply that the global financial shocks

trigger an immediate depreciation of CEE currencies that is not fully compensated by their 12-months-ahead appreciation. As the exchange rate adjustment component loads negatively on the UIP premium, this inequality pushes up the excess returns in CEE economies in the first months after the shocks. The initial effects of the shock turn out to be larger and more persistent in Hungary and Romania, where the response function values for the US dollar drop well below -1%. In all four economies, the exchange rate adjustments are more clear-cut for the US dollar than the euro, consistently with the findings on the UIP premia.

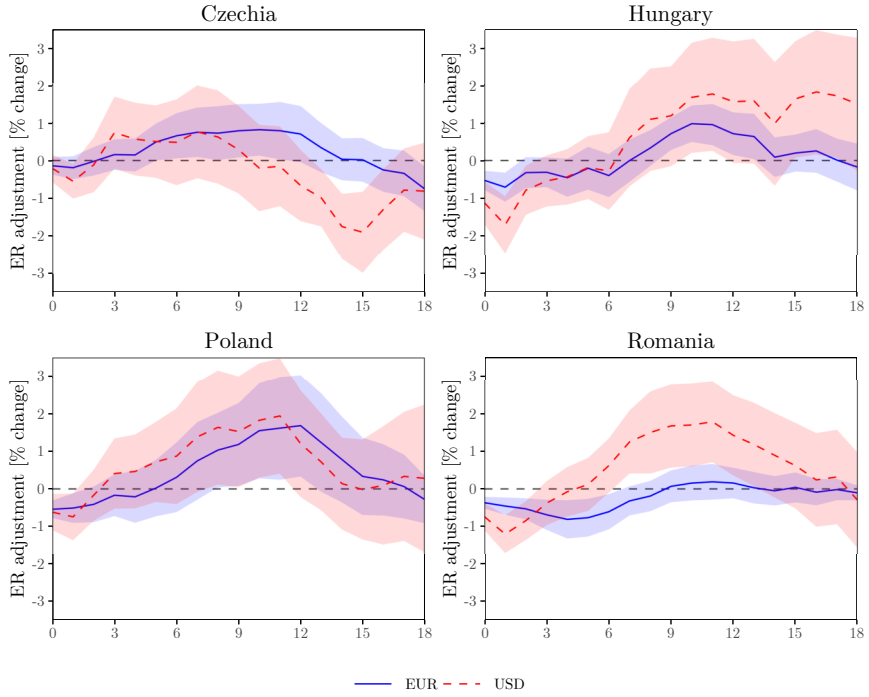

Figure 2: Impulse response function of exchange rate adjustments to the risk-on/risk-off shock

Notes: The figure shows impulse response functions of exchange rate adjustment components in UIP premia to one standard deviation change in the risk-on/risk-off index, vis-à-vis two reference currencies, the euro and the US dollar. The horizontal axes denote time in months. The local projections include 12 lags of the dependent variable and the risk-on/risk-off measure, along with global and local control variables. Bands around the base estimates show 90-percent confidence intervals obtained using the Newey-West standard errors.

Turning to the findings for the interest rate differentials, we first notice that the response of these UIP premium components, plotted in Figure 3, display quite diverse patterns. In Czechia, the reaction of interest rate differential to the risk-on/risk-off shocks is almost non-existent for both reference currencies, with just a minuscule upward change at the two-month horizon. Similarly, in the Polish case, the shifts in interest rate differentials are detectable only when the US dollar is the reference currency, with relatively wide confidence intervals around the point estimates. On the other hand, the reaction of interest rate differentials is much stronger and significantly positive in Hungary and Romania, implying a widening of the gap between the local and foreign interest rates, $i_t - i_t^* > 0$. In the Hungarian case, the response functions take the inverted U shape for both reference currencies. Following a risk-off shock, the interest rate differential incrementally rises, reaches the peak value of around 0.5 points in nine to twelve months after the shock, and the effects dissipate by the 15-month mark. The response of interest rate differential in Romania is sharper on the impact of the risk-on/risk-off, with changes up to

0.4 points in the horizon of five months, and persists for several months, both for the US dollar and the euro, before going back to the baseline.

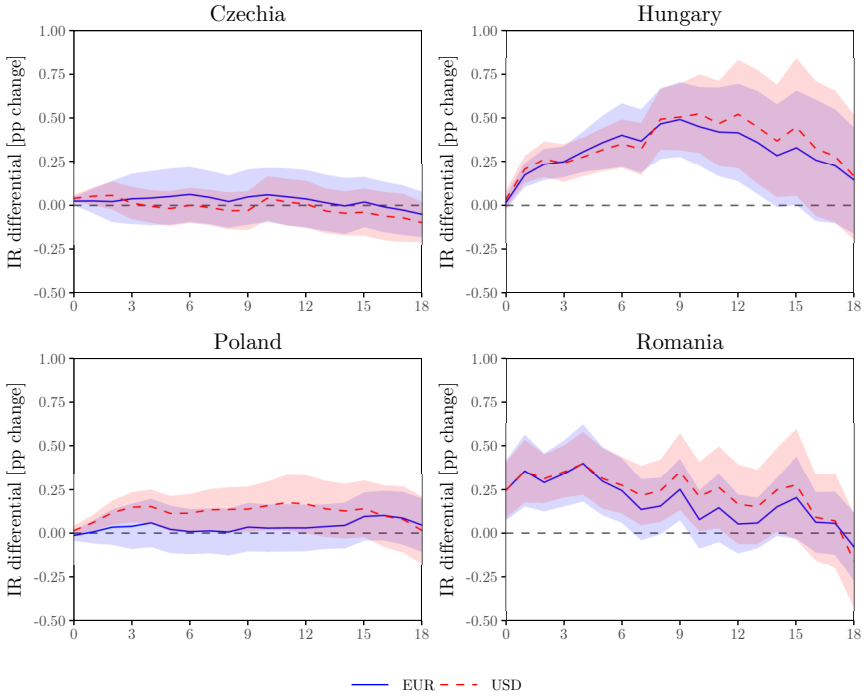

Figure 3: Impulse response function of interest-rate differentials to the risk-on risk-off shocks

Notes: The figure shows impulse response functions of interest rate differential components in UIP premia to one standard deviation change in the risk-on/risk-off index, vis-à-vis two reference currencies, the euro and the US dollar. The horizontal axes denote time in months. The local projections include 12 lags of the dependent variable and the risk-on/risk-off measure, along with global and local control variables. Bands around the base estimates show 90-percent confidence intervals obtained using the Newey-West standard errors.

Taken together, the most important takeaway from this part of the analysis is that the reaction of UIP premia in CEE countries to the risk-on/risk-off shocks is primarily driven by exchange rate adjustments rather than interest rate differentials. In Czechia and Poland, the responses of the currency excess returns propagate almost exclusively through exchange rate adjustment and the effects identified in interest rates are hardly detectable or an order of magnitude lower than their exchange rate counterparts. In Hungary and Romania, where the reaction of interest rate differential is non-negligible, this component adds to higher positive UIP deviations in the aftermath of global financial shocks. Because these effects appear to be consistent for both the local currency returns versus the euro and the US dollar, they likely reflect domestic reactions to external financial shocks, such as monetary policy responses aimed at taming capital outflows or mitigating large depreciation of the local currency. However, even in those two cases, the changes in interest rates are still dominated by the magnitude of exchange rate adjustments, especially in the first months following the risk-on/risk-off shock.

4.3 Sub-components of global financial risk

We now turn to the role of various dimensions of global financial risk in driving the UIP premium. As mentioned, the overall risk-on/risk-off index by Chari et al. (2023) can be broken down into four sub-components linked to relevant asset markets: credit spreads, equity, funding liquidity,

and currency & gold. Positive changes in each sub-index imply risk-off behaviour, and we continue to define them as one standard deviation shift in the index. Figure 4 displays 16 impulse response functions divided into four categories of risk and presented for all CEE economies. Here, we focus our attention on the results obtained for the local currency excess returns expressed versus the US dollar, again using lag-augmented local projections and controlling for a set of global and local factors.[4]

The plots in the left-hand panel of the figure show the effects of the variation in global risk related to credit and equity markets. In general, the functions display an initial increase in the UIP premia across CEE economies, similar to the baseline functions, followed by a noticeable negative adjustment and the dissipation of the risk-on/risk-off shock effects. The reactions are more pronounced in Hungary and Romania, where the UIP premia show sensitivity to both global credit and equity market conditions. However, the equity market risk induces a less pronounced downward adjustment in the response function for those two economies, suggesting that shocks to credit spreads trigger more volatility in the behavior of UIP premia. Czechia and Poland exhibit relatively smaller increases in the UIP premia for both categories of risk, especially concerning the equity-based measure. This points to greater insulation of their excess currency returns from these types of financial disturbances.

The right-hand panel of the figure exhibits the responses of UIP premia to the liquidity and currency & gold dimensions of global risk. When it comes to the former, the responses imply substantial cross-country differences. While Hungary experiences a large and prolonged elevation in UIP premia, the reactions are generally more subdued in the remaining economies but still significant in Hungary and Romania. In contrast, the currency & gold components, directly related to risk-on/risk-off tendencies in global foreign exchange markets, have the most pronounced impact across all CEE economies. The shifts of the UIP premium are largest, often going above 2 points, and statistically significant for at least six months following the financial shock. On top of that, this dimension of the risk-on/risk-off index also generates the most volatile impulse response functions, likely by triggering the strongest impact on the worldwide exchange rate configurations.

In total, the impulse response functions obtained using four categories of the risk-on/risk-off measure corroborate our baseline findings. They show similar patterns in the dynamic responses of UIP premia to global risk and highlight cross-country previously identified differences. At the same time, they add to our prior results. We find that the responses of UIP premia are most definite and sustained when global risk originates in foreign exchange markets in advanced economies. This result aligns with the dominant role of the exchange rate adjustments, as opposed to interest rate differentials, in driving the short-term fluctuations in the CEE currency excess returns. However, we also find their responsiveness to credit and liquidity risks, which suggests that the UIP premia in CEE economies may be subject to a wider array of financial factors, extending beyond risks originating in currency markets alone.

[4]Corresponding results obtained for the UIP premia calculated for the euro as the reference currency are given in Figure A.1 in the Appendix. The effects captured in the impulse response functions are qualitatively similar but smaller than the ones obtained for the US dollar and discussed in this section, in line with our baseline results.

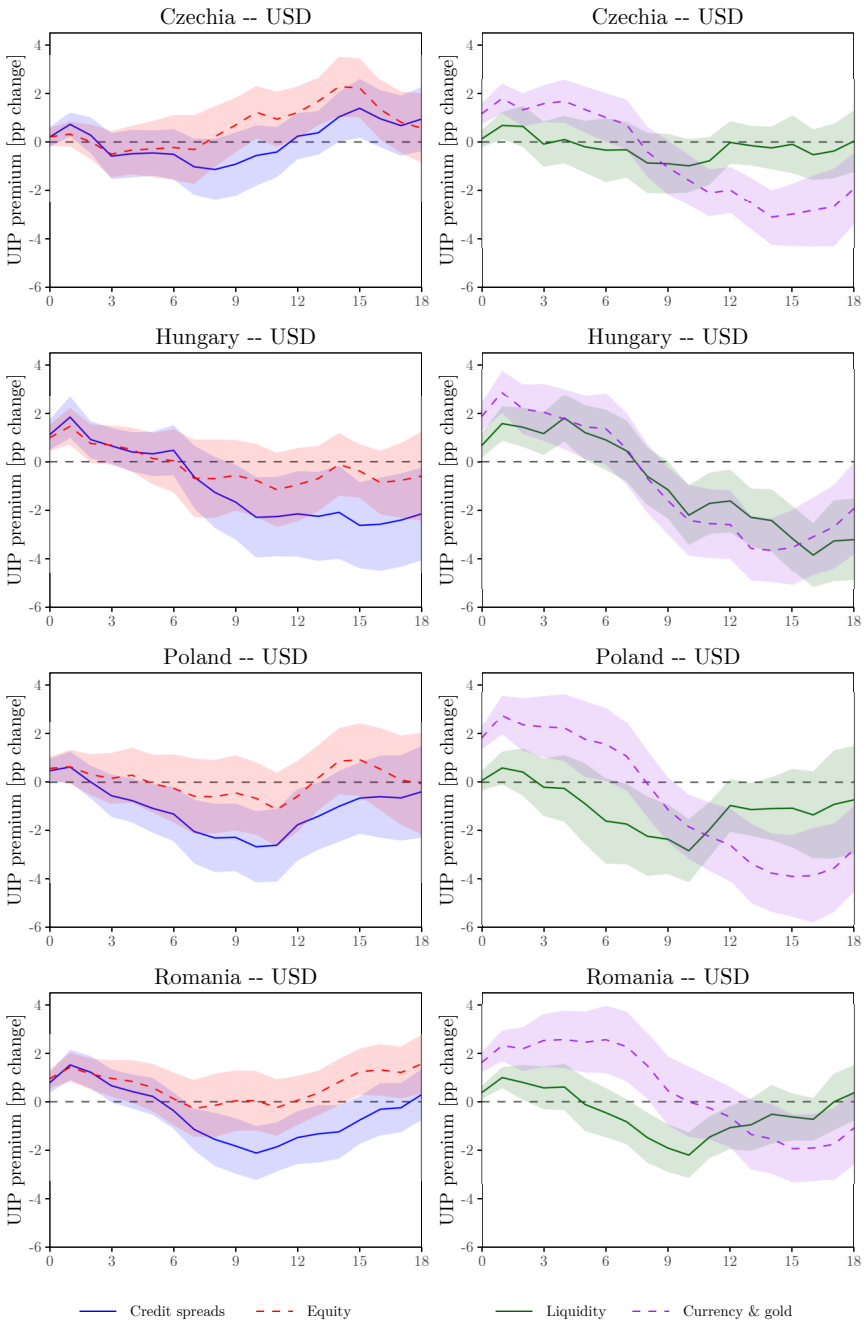

Figure 4: Impulse response functions of UIP premia to sub-components of the global risk-on/risk-off

Notes: The figure plots the impulse response functions of UIP premia in CEE economies calculated vis-à-vis the US dollar to four sub-components of the global risk-on/risk-off measure: credit spreads, equity, liquidity, and currency & gold (Chari et al., 2023). The horizontal axes denote time in months. The local projections include 12 lags of the dependent variable and the shock, along with global and local control variables. Bands around the base estimates show 90-percent confidence intervals obtained using the Newey-West standard errors.

4.4 Global uncertainty and risk aversion

One limitation of the risk-on/risk-off measure is that it does not distinguish between economic uncertainty (the quantity of risk) and risk aversion (the price of risk). Here, we address this issue by re-examining the effects of global financial risk using the (Bekaert et al., 2021) measures instead of the risk-on/risk-off shocks. To keep both sets of results comparable, the

BEX proxies are introduced into local projection specifications in a manner analogous to the baseline ones. Figure 5 plots the impulse response functions of the UIP premia in four CEE economies, calculated vis-à-vis the US dollar, in response to changes in the BEX uncertainty and risk aversion measures.[5]

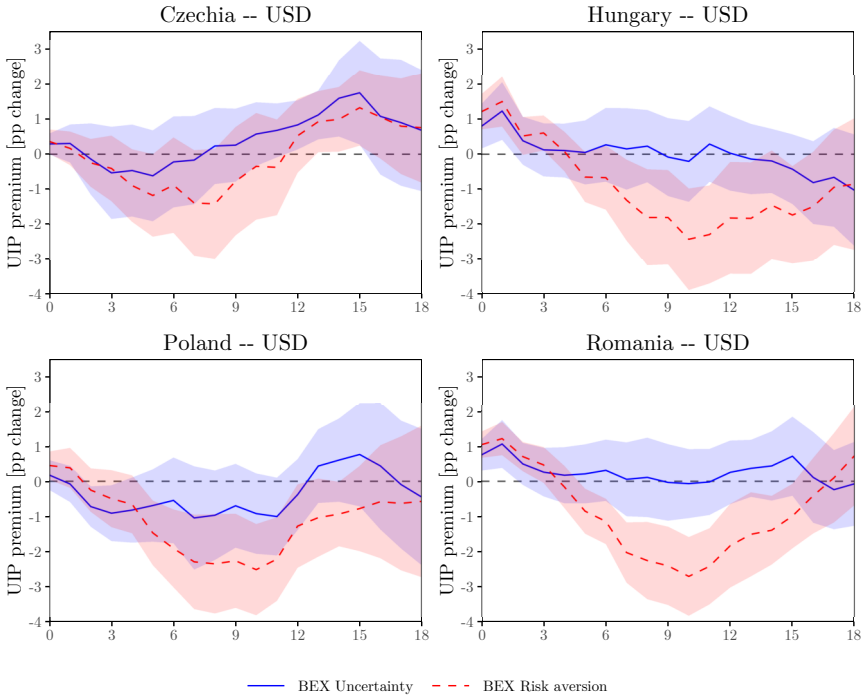

Figure 5: Impulse response functions of UIP premia to BEX uncertainty and risk aversion measures

Notes: The figure plots the impulse response functions of UIP premia in four CEE economies vis-à-vis the US dollar to a one standard deviation change in the BEX measures of global uncertainty and risk aversion (Bekaert et al., 2021). The horizontal axes denote time in months. Local projections include 12 lags of the dependent variable and the shock, along with global and local control variables. Bands around the base estimates show 90-percent confidence intervals obtained using the Newey-West standard errors.

We first notice that, on impact, an increase in both measures exerts a positive impact on UIP premia in CEE economies, consistent with our previous findings for the risk-on/risk-off shocks. The impulse response functions display an initial upward movement, consistent with the view that heightened uncertainty and risk tend to raise local currency excess returns. Yet the responses to both shocks, but even more so to the risk aversion, are stronger and last noticeably longer in Hungary and Romania. In the Czech and Polish cases, the effects are weaker, especially for the uncertainty measure, where the impulse response values, even for the initial months, are not statistically significant at conventional levels. Hence, these findings support our observations on cross-country differences in sensitivities to global risk.

However, a unique insight from the BEX measures is that the reaction of the UIP premia to the risk aversion shock displays more volatility compared to its reaction to the uncertainty shock across CEE economies. Again, larger fluctuations of functions based on the risk aversion proxy are more apparent for Hungary and Romania, moderate for Poland, and weakest but

[5] Figure A.2 in the Appendix displays the corresponding results obtained for the euro as the reference currency. As in the previous cases, the identified patterns are comparable to the US dollar, but the effects are quantitatively smaller.

still visible for Czechia. Changes in the UIP premium in the face of a risk aversion shock demonstrate a deeper and more pronounced decrease following the initial increase, going into significantly negative values. On the other hand, the responses to the uncertainty shock are generally smoother and do not involve a downward adjustment phase, which also stands in contrast to the effects of the risk-on/risk-off shocks. These differences in the variability of responses in the UIP premia seem to be related to the sources of the two BEX global risk proxies. The uncertainty measure captures physical risk, embedded in macro fundamentals, and is a good predictor of economic downturn, while the risk aversion measure captures the sentiment/confidence of market participants and is a proxy for the pricing kernels of financial intermediaries. Hence, the latter may be a closer empirical counterpart to nonfundamental, purely financial sources of changes in UIP premia, excess volatility in the exchange rate, and a more general exchange rate disconnect. Furthermore, Chari et al. (2023) demonstrate that while both shocks to the BEX uncertainty and risk aversion are manifested in shifts in the entire distribution of emerging market portfolio flows and returns, shocks to uncertainty weigh more heavily on the tails (especially the negative tail) of the distributions. Given that our specifications of local projections are based on condition means, our results are compatible with these findings.

5 Discussion

In this section, we discuss our empirical findings by linking them to the growing literature on the exchange rate determination under imperfect financial markets. We focus on both the common features of CEE economies and cross-country differences. Next, we relate the results to recent empirical studies in the field.

Theoretical frameworks based on market imperfections place financial intermediaries at the center of open-economy macro models (Gabaix and Maggiori, 2015; Itskhoki and Mukhin, 2021; Maggiori, 2022). They assert that international financial markets are segmented and the exchange rate dynamics are driven by shifts in portfolios of global financiers. In such setups, households can trade only domestic assets, and their foreign transactions must be intermediated. Intermediaries, however, face limits to arbitrage, which drive a wedge into their Euler equations and break the link between interest-rate differentials and adjustments in the exchange rate that would prevail in a frictionless setup. This, in turn, implies the failure of the UIP and a broader exchange rate disconnect from macroeconomic fundamentals. What is important from our point of view, is that an increase in global risk aversion disrupts the risk-bearing capacity of financiers and makes their borrowing (leverage) constraints more binding. Faced with such constraints, intermediaries increase the premium they demand to absorb the imbalances in the demand for local currency-denominated debt and take on the exchange rate risk. Consequently, local currency assets need to generate excess returns to compensate financiers for taking long positions in those currencies and intermediate international financial flows.

These mechanisms offer a plausible explanation for our main empirical findings. A positive and quick response of excess currency returns to an increase in global risk indicates that CEE economies are sensitive to international imbalances in the global demand and supply of financial assets. We also show that risk-on/risk-off shocks generate peak-and-trough responses of the UIP

premia. This speaks to the distorting or even inefficient fluctuations in the UIP triggered by financial shocks and deleveraging, as implied by the theory. In principle, positive UIP premia may stem from higher interest rate differentials or from today's currency depreciation of the local currency followed by its future (expected) appreciation. Our results show that the adjustments propagate mainly through the exchange rate channel, which highlights the role of exchange rate risk in the transmission of global financial shocks to CEE currency markets. This mechanism may also explain why our results are more clear-cut for the dollar than the euro. Even though the CEE economies are not a part of the Exchange Rate Stabilization Mechanism and adopt inflation-targeting regimes, their tendency to stabilize the exchange rate versus the euro rather than the US dollar is definitely greater, especially in periods of financial strain. Furthermore, our findings show that shifts in risk aversion (the price of risk) generate more volatile adjustments than shifts in economic uncertainty (the quantity of risk), which supports the notion that it is the risk appetite of global investors that is conducive to shifts in UIP premia.

Theoretical contributions based on imperfect financial markets also point to country-specific factors that may affect the role of global financial shocks in driving UIP deviations. Here, we focus on several crucial vulnerabilities. The first, and perhaps the most natural one, is the local currency exchange rate risk, approximated by the conditional or realized volatility of the exchange rate. For example, in Gabaix and Maggiori (2015), the expected riskiness of the exchange rate adds to the effective risk-taking capacity of global intermediaries. Second, the theory implies that the foreign exchange market liquidity, or more broadly, the depth of financial markets, may also impact the exchange rate determination. Shallow foreign exchange markets, with a limited number of intermediaries, exacerbate financial frictions and make the UIP premia more sensitive to shifts in global risk aversion. Economies with higher levels of financial development should be able to easier absorb such shocks. Third, the response of UIP deviations to global financial shocks may be influenced by the net international investment position of a country. What matters is both a country's status of a net debtor versus the rest of the world and the size of this position, which changes its exposure to global intermediation. It is worth noting here, however, that all these vulnerabilities may be endogenous to the UIP premia and global financial frictions, and their role in explaining cross-country differences in our results should be approached with a critical eye.

Based on the factors listed above, Table 3 reports simple statistics on several potential vulnerabilities of UIP premia in CEE economies to global financial risk. The table includes the US dollar exchange rate realized variance (RV), calculated using daily returns of the US dollar exchange rate for each month and averaged over the period of the analysis, June 2003 to January 2014.[6] The table also shows the realized variance unexplained by the global risk aversion proxy by Bekaert et al. (2021), along with the foreign-exchange market liquidity, measured by the bid-ask spread of the US dollar spot exchange rate. The last two columns contain the average values of the financial development index and the ratios of net foreign assets to GDP in each CEE economy.

[6]We also estimate the conditional variance series, based on the ARMA(1,1)-GARCH(1,1) models fitted to daily log US dollar exchange rate returns. The values of conditional variances, averaged over the sample, stand at 0.682 (Czechia), 0.832 (Hungary), 0.776 (Poland), and 0.654 (Romania). Hence, their relative values across CEE economies are comparable to the realized variance ones reported in Table 3.

Table 3: Selected vulnerabilities of UIP premia in CEE economies to global financial risk

Country	USD exchange rate realized variance (RV)	RV unexplained by global factor	USD exchange rate bid-ask spread	Financial development index	Net foreign assets to GDP ratio
Czechia	0.523	0.295	12.358	0.423	-30.2%
Hungary	0.791	0.375	12.668	0.481	-77.8%
Poland	0.703	0.357	9.062	0.433	-52.9%
Romania	0.490	0.651	10.987	0.247	-48.4%

Notes: The table displays average values of several variables related to the vulnerabilities of UIP premia in CEE economies to global financial risk. The US dollar exchange rate realized variance (RV) is calculated using squared daily log exchange rate returns, summed over each month, and averaged over the period of the analysis, 2003M6-2024M1. The RV unexplained by the global factor ($1 - R^2$) comes from the regression of monthly RV on the risk-aversion proxy of Bekaert et al. (2021). The US dollar exchange rate spread is calculated as the difference between the offer (ask) price and the bid price, divided by the mid price, and expressed in basis points. The financial development index is the aggregate ranking of financial institutions and markets provided by the IMF (Sahay et al., 2015), in annual values, averaged over 2003-2021. Net foreign assets to GDP ratios come from the External Wealth of Nations database (Lane and Milesi-Ferretti, 2018), based on annual values, averaged over 2003-2022.

These vulnerabilities provide additional context for the cross-country differences in our results. First, recall our finding that the excess currency returns in Czechia show a relatively weakest and least persistent reaction to the global risk. Accordingly, Czechia exhibits low US dollar exchange rate volatility (second only to Romania) and although the bid-ask spread in the Czech foreign exchange markets is relatively high (more than three points higher than in Poland), its level of financial development is high and its net foreign asset positions is least negative among the CEE economies, standing at the average value of -30.2%. All of these characteristics indicate a comparatively low susceptibility of the Czech UIP premia to global risk. By comparison, when it comes to the Hungarian case, in which we find a strong reaction of UIP premia to risk-on/risk-off shocks, we notice increased markers of vulnerabilities. Hungary reveals the most elevated US dollar exchange rate volatility, the widest bid-ask spreads in the foreign exchange market, and the most negative net foreign investment position. These indicators seem to reflect Hungary's limited capacity to withstand financial shocks, aligning our empirical findings with the theoretical predictions. Moreover, our results show that Poland represents an intermediate case, with its UIP premium being more responsive to global shocks than Czechia but less than Hungary and Romania. These results seem to be reflected in moderate levels of vulnerabilities in the Polish economy. Its exchange rate volatility is larger than in Czechia, but the net international investment position is less negative than in Hungary and the financial development index is comparable to Czechia and Hungary. Along these lines, Poland comes out as somewhat more vulnerable than Czechia but less so than Hungary, which corresponds well to our findings.

Against this background, Romania stands out as an interesting case. Relatively low average values of the US dollar exchange rate variance and the bid-ask spread, as well as moderately negative net foreign assets, would imply that Romania's currency excess returns should be comparatively resilient to the risk-on/risk-off shocks. Nevertheless, we find that the responses of currency excess returns in Romania to global risk are substantial – similar to Hungary and stronger than in Czechia and Poland. There are two hints coming from Table 3 that may

explain this apparent discrepancy. First, even though the Romanian exchange rate variance shows a low average value, especially when compared to Hungary and Poland, we find that in the remaining CEE economies, only about a third of the exchange rate realized variance is unexplained by the global risk (here: the BEX measure of risk aversion). In Romania, this fraction stands at two-thirds. Hence, it is conceivable that higher idiosyncratic risks or a unique market environment, such as foreign-exchange interventions by the central bank, create a less predictable environment for global investors in Romania, which necessitates additional compensation, in the form of higher excess currency returns, under global risk-off shocks. The second feature that implies a higher vulnerability of UIP premia in Romania is its relative low level of financial development. A limited financial market depth, in turn, may increases the country's susceptibility to global financial shocks, which aligns with the empirical results.

Lastly, our findings enable a meaningful comparison with recent empirical studies in the field. In general, based on a different methodology, country sample, and timespan, our results lend support to studies that find that excess currency returns increase in periods of high uncertainty (Ismailov and Rossi, 2018) and under external financial shocks (Bernoth et al., 2023). When it comes to studies on UIP premia in CEE economies, our findings complement the accounts of the risky profile of foreign exchange markets in these economies (Filipozzi and Staehr, 2012; Dąbrowski and Janus, 2023), but offer a more detailed explanation of the channels of propagation of global risk. Similarly to Albagli et al. (2024), we find evidence that the widening of UIP deviations may be attributed to risk-on/risk-off shocks. However, we further show that these effects extend beyond high-frequency responses around uncertainty-related events and generate more long-lasting and volatile adjustments in the UIP. Compared to the panel-data results of Kalemli-Özcan and Varela (2021), we confirm the substantial impact of global risk on UIP deviations using alternative measures of risk. On the other hand, even though we find some evidence of the reaction of interest rate differentials to the risk-on/risk-off shocks, our results suggest that exchange rate adjustments dominate the interest rate channel in governing the behaviour of UIP premia, contrary to what Kalemli-Özcan and Varela (2021) find for emerging market economies. Such a difference may stem from the fact that we employ a dynamic local projection setting and explore UIP premia reaction to financial disturbances, rather than unconditional UIP regressions, but it can also reflect properties of relatively flexible exchange rates in the four CEE economies that we investigate.

6 Sensitivity analysis

This section lists a set of four sensitivity checks on our baseline results. We start by modifying the specification of local projections in terms of the number of lags in the dependent variable, the risk-on/risk-off shocks, and all the control variables. Specifically, we set the number of lags to 6 instead of 12. Figure A.3 plots the impulse response functions based on such specifications, which align with the baseline. However, the figure shows that the effects are stronger than in the baseline, especially for Czechia and Poland, which are now more similar to the remaining economies. This shows that our baseline specification is more conservative, and it does not overestimate the effects of risk-on/risk-off shocks. More generally, it shows the importance of using a sufficiently high number of lags to ensure that the model adequately captures the

dynamics of the variables of interest. Moreover, we augment the local projection specifications with contemporaneous values of four global control variables: global economic activity, oil prices, and monetary policy shocks by the ECB and the Fed. Figure A.4 shows the resulting impulse responses. These results are highly comparable to the benchmark case, but they appear even more precise, as the confidence intervals on the impulse response functions are narrower.

Second, we investigate the stability of our baseline estimates in time. Figure A.5 plots the responses of UIP premia in the CEE economies to the risk-off shock in the sample that excludes the post-Covid-19 period (2003M6 - 2019M12). In all CEE economies, the excess currency returns increase for several months following the shocks to re-adjust later by going into the negative territory. Again, the effects are more pronounced for the US dollar than the euro, and generally weakest in the Czech case. The results for the sample restricted to the period after the Global Financial Crisis (GFC) (2010M1 - 2024M1) are depicted in Figure A.6. The effects for Hungary, Poland, and Romania are in line with the baseline. However, we capture interesting dynamics in the responses of UIP premia in Czechia. The functions show a visibly stronger reaction vis-à-vis the US dollar and an almost non-existent one for the euro. One potential explanation for this difference is that the Czech National Bank maintained a peg to the euro for a relatively long period after 2010, potentially reducing deviations from UIP against the euro in Czechia.

Third, we re-estimate the baseline local projections using an alternative proxy for the global financial risk and different interest rate series. Here we opt for a popular alternative and use the monthly changes in the excess bond premium (EBP) by Gilchrist and Zakrajšek (2012), which has been shown to be a valid proxy for global financial risk in multiple studies. Figure A.7 indicates that the general shape of UIP premia to the EBP and the peak-and-trough shapes of the impulse response functions are comparable to the baseline case. However, the fact that the magnitude of effects is attenuated suggests that the choice of a more comprehensive measure of the risk-on/risk-off shocks in the baseline case is justified. Furthermore, we modify the underlying interest rate series used to calculate the currency excess returns. Figure A.8 depicts the results for UIP premia calculated with the annualized 3-month money market interest rates, instead of the 12-month ones. This sensitivity check demonstrates that using interest rates with shorter maturities leaves the results virtually unchanged.

Lastly, we investigate the sensitivity of our results to potential nonlinearities in the impact of risk-on/risk-off shocks on UIP premia. We follow recent empirical literature on the asymmetries in the effects of monetary shocks (e.g., Stenner, 2022). To explore this possibility, we add the cubed term ($roro_t^3$) as an additional variable in the local projections, both in its contemporaneous and lagged values (12 lags). Figure A.9 displays the results of such augmented specifications. The general patterns that we have identified hold and there is an immediate positive positive response of UIP premia to global risk. However, the effects of risk-on/risk-off shocks seem to be attenuated relative to the baseline case, and the oscillatory nature of the UIP premia response is weaker. This may indicate that large risk adjustments, either negative or positive, can have a disproportionately strong impact on the UIP premiums. Hence, this result presents an intriguing opportunity for future investigation into the size and sign asymmetries in the impact of external financial risk on UIP premia.

7 Conclusions

Understanding the mechanisms behind UIP deviations has significant implications for various economic and financial issues, ranging from the macroeconomic effects of financial integration to risk management strategies for international investors. This paper provides empirical evidence on the role of global financial risk in driving excess currency returns in four CEE economies: Czechia, Hungary, Poland, and Romania, over the period from 2003 to 2024. Using monthly series and lag-augmented local projections, we investigate the response of UIP deviations to refined risk-on/risk-off shocks, both vis-à-vis the US dollar and the euro. Apart from providing a detailed analysis of the transmission of global shocks to currency excess returns, the study examines the relative roles of exchange rate adjustments and interest rate differentials in influencing the UIP premium. We also investigate the effects of the sub-components of the risk-on/risk-off measure, as well as separate proxies for uncertainty and risk aversion, to capture different dimensions of global financial risk.

We demonstrate several notable features of the responses of UIP premia in CEE economies to global financial shocks. First, we find that global risk-on/risk-off shocks trigger both statistically significant and economically meaningful increases in local currency excess returns. However, these effects are transitory: they peak within a few months following the financial shock and subsequently dissipate. These impacts are more pronounced when the US dollar, rather than the euro, is used as a reference currency, and we find cross-country differences in the reaction to global financial risk. Second, our results emphasize the more significant role of exchange rate adjustments relative to interest rate changes in driving the UIP premium. Third, we find the sub-components of the risk-on/risk-off measure differ in their impact on excess currency returns, suggesting that the source of the global financial risk significantly determines the magnitude and duration of the UIP deviations. Fourth, our analysis shows that shifts in risk aversion (the price of risk) lead to more volatile adjustments compared to changes in economic uncertainty (the quantity of risk), highlighting the dominant role of investor sentiment and confidence in driving excess currency returns.

Taken together, based on the investigation of CEE currencies, we provide consistent empirical support for the risk-based theoretical explanations of UIP deviations. Specifically, our findings align with recent theories based on imperfect financial markets that emphasize the role of financial shocks in driving UIP premia and generating various exchange rate puzzles, its excess volatility, and disconnect from fundamentals. The impact of global shocks on UIP risk premia in domestic currencies leads to a natural question on the effective policy tools to mitigate inefficient fluctuations in currency risk (Adrian et al., 2022). Financially-driven exchange rates, characterized by sensitivity to investor risk appetite and global financial conditions, may require more than traditional monetary policy tools and foreign exchange interventions, and call for additional measures, such as macroprudential policies, to improve the resilience of local currency markets and mitigate the impact of global financial shocks. Along with a robust financial market infrastructure, such policies may improve the overall balance of benefits and costs of international financial integration for open but vulnerable economies, ensuring a more stable financial environment and reducing exposure to external risk.

Despite controlling for various external and local factors potentially affecting UIP premia,

our study does not explicitly investigate the moderating role of country-specific variables on the resilience of CEE economies to external shocks. Future research could delve deeper into the interactions between global and domestic financial factors, such as local credit risk, as suggested by Akinci and Queralto (2024), to better understand the dynamics at play. Additionally, exploring the relative effectiveness of different policy options in mitigating the impact of global financial shocks on local currency markets remains an important area for further empirical inquiry.

References

Adämmer, P. (2019). lpirfs: An R package to estimate impulse response functions by local projections. *The R Journal (2019)*, 11(2):421–438.

Adrian, T., Erceg, C. J., Lindé, J., Kolasa, M., and Zabczyk, P. (2022). Managing monetary tradeoffs in vulnerable open economies. *CEPR Discussion Paper*, 16972.

Akinci, Ö. and Queralto, A. (2024). Exchange Rate Dynamics and Monetary Spillovers with Imperfect Financial Markets. *Review of Financial Studies*, 37(2):309–355.

Albagli, E., Ceballos, L., Claro, S., and Romero, D. (2024). UIP deviations: Insights from event studies. *Journal of International Economics*, 148.

Baumeister, C., Korobilis, D., and Lee, T. K. (2022). Energy Markets and Global Economic Conditions. *The Review of Economics and Statistics*, 104(4):828–844.

Bekaert, G., Engstrom, E. C., and Xu, N. R. (2021). The Time Variation in Risk Appetite and Uncertainty. *Management Science*, 68(6):3975–4004.

Bernoth, K., Herwartz, H., and Trienens, L. (2023). The Impacts of Global Risk and US Monetary Policy on US Dollar Exchange Rates and Excess Currency Returns. *DIW Berlin Discussion Paper*, 2037.

Bu, C., Rogers, J., and Wu, W. (2021). A unified measure of Fed monetary policy shocks. *Journal of Monetary Economics*, 118:331–349.

Chari, A. (2023). Global Risk, Non-Bank Financial Intermediation, and Emerging Market Vulnerabilities. *Annual Review of Economics*, 15(Volume 15, 2023):549–572.

Chari, A., Dilts Stedman, K., and Lundblad, C. (2023). Risk-On Risk-Off: A Multifaceted Approach to Measuring Global Investor Risk Aversion. *NBER Working Papers*, 31907.

Cuestas, J. C., Filipozzi, F., and Staehr, K. (2017). Uncovered interest parity in Central and Eastern Europe: Expectations and structural breaks. *Review of International Economics*, 25(4):695–710.

Dąbrowski, M. A. and Janus, J. (2023). Does the Interest Parity Puzzle Hold for Central and Eastern European Economies? *Open Economies Review*, pages 1–36.

Eguren-Martin, F. and Sokol, A. (2022). Attention to the Tail(s): Global Financial Conditions and Exchange Rate Risks. *IMF Economic Review*, 70(3):487–519.

Engel, C. (2014). Exchange Rates and Interest Parity. In Gopinath, G., Helpman, E., and Rogoff, K., editors, *Handbook of International Economics*, volume 4 of *Handbook of International Economics*, pages 453–522. Elsevier.

Fama, E. F. (1984). Forward and spot exchange rates. *Journal of Monetary Economics*, 14(3):319–338.

Filipozzi, F. and Staehr, K. (2012). Uncovered Interest Parity in Central and Eastern Europe: Convergence and the Global Financial Crisis. *Estonian Discussions on Economic Policy*, 20(1).

Fukui, M., Nakamura, E., and Steinsson, J. (2023). The Macroeconomic Consequences of Exchange Rate Depreciations. *NBER Working Papers*, 31279.

Gabaix, X. and Maggiori, M. (2015). International Liquidity and Exchange Rate Dynamics. *The Quarterly Journal of Economics*, 130(3):1369–1420.

Gilchrist, S., Wei, B., Yue, V. Z., and Zakrajšek, E. (2022). Sovereign risk and financial risk. *Journal of International Economics*, 136:103603.

Gilchrist, S. and Zakrajšek, E. (2012). Credit spreads and business cycle fluctuations. *American Economic Review*, 102(4):1692–1720.

Goldberg, L. S. and Krogstrup, S. (2023). International capital flow pressures and global factors. *Journal of International Economics*, 146:103749.

Grabowski, W. and Welfe, A. (2016). An Exchange Rate Model with Market Pressures and a Contagion Effect. *Emerging Markets Finance and Trade*, 52(12):2706–2720.

Habib, M. M. and Venditti, F. (2019). The Global Capital Flows Cycle: Structural Drivers and Transmission Channels. *ECB Working Paper*, 2280.

Hassan, T. A. and Zhang, T. (2021). The Economics of Currency Risk. *Annual Review of Economics*, 13(Volume 13, 2021):281–307.

Hoffmann, A. (2012). Determinants of carry trades in Central and Eastern Europe. *Applied Financial Economics*, 22(18):1479–1490.

Horvath, J. and Yang, G. (2024). Global Financial Risk, Equity Returns and Economic Activity in Emerging Countries. *Oxford Bulletin of Economics and Statistics*, 86(3):672–689.

Husted, L., Rogers, J., and Sun, B. (2018). Uncertainty, currency excess returns, and risk reversals. *Journal of International Money and Finance*, 88:228–241.

Ismailov, A. and Rossi, B. (2018). Uncertainty and deviations from uncovered interest rate parity. *Journal of International Money and Finance*, 88:242–259.

Itskhoki, O. and Mukhin, D. (2021). Exchange rate disconnect in general equilibrium. *Journal of Political Economy*, 129(8):2183–2232.

Janus, J. (2023). Flights to safe assets in bond markets: Evidence from emerging market economies. *Journal of International Money and Finance*, 139:102973.

Jarociński, M. and Karadi, P. (2020). Deconstructing monetary policy surprises-The role of information shocks. *American Economic Journal: Macroeconomics*, 12(2):1–43.

Jiang, C., Li, X. L., Chang, H. L., and Su, C. W. (2013). Uncovered interest parity and risk premium convergence in Central and Eastern European countries. *Economic Modelling*, 33:204–208.

Jordà, Ò. (2005). Estimation and inference of impulse responses by local projections. *American Economic Review*, 95(1):161–182.

Kalemli-Özcan, S. and Varela, L. (2021). Five facts about the UIP Premium. *NBER Working Papers*, 28923.

Lane, P. R. and Milesi-Ferretti, G. M. (2018). The External Wealth of Nations Revisited: International Financial Integration in the Aftermath of the Global Financial Crisis. *IMF Economic Review*, 66(1):189–222.

Lilley, A., Maggiori, M., Neiman, B., and Schreger, J. (2022). Exchange Rate Reconnect. *The Review of Economics and Statistics*, 104(4):845–855.

Lustig, H., Roussanov, N., and Verdelhan, A. (2011). Common risk factors in currency markets. *Review of Financial Studies*, 24(11):3731–3777.

Maggiori, M. (2022). International macroeconomics with imperfect financial markets. In Gopinath, G., Helpman, E., and Rogoff, K., editors, *Handbook of International Economics: International Macroeconomics*, volume 6, pages 199–236. Elsevier.

Miranda-Agrippino, S. and Rey, H. (2020). U.S. Monetary Policy and the Global Financial Cycle. *The Review of Economic Studies*, 87(6):2754–2776.

Montiel Olea, J. L. and Plagborg-Møller, M. (2021). Local Projection Inference Is Simpler and More Robust Than You Think. *Econometrica*, 89(4):1789–1823.

Panayotov, G. (2020). Global risks in the currency market. *Review of Finance*, 24(6):1237–1270.

Rey, H. (2013). Dilemma not Trilemma: The Global Financial Cycle and Monetary Policy Independence. *Proceedings - Economic Policy Symposium - Jackson Hole*.

Sahay, R., Cihak, M., N'Diaye, P., Barajas, A., Ayala Pena, D., Bi, R., Gao, Y., Kyobe, A., Nguyen, L., Saborowski, C., Svirydzenka, K., and Yousefi, R. (2015). Rethinking Financial Deepening: Stability and Growth in Emerging Markets. *IMF Staff Discussion Note*, 2015/008.

Sarno, L. and Taylor, M. P. (2003). *The economics of exchange rates*. Cambridge University Press.

Schmitt-Grohé, S. and Uribe, M. (2022). The effects of permanent monetary shocks on exchange rates and uncovered interest rate differentials. *Journal of International Economics*, 135.

Stenner, N. (2022). The Asymmetric Effects of Monetary Policy: Evidence from the United Kingdom. *Oxford Bulletin of Economics and Statistics*, 84(3):516–543.

Triandafil, C. and Richter, C. (2012). Testing the UIP theory in the CEE countries: evidence from the GARCH models. *Germany International Network for Economic Research*.

Valchev, R. (2020). Bond convenience yields and exchange rate dynamics. *American Economic Journal: Macroeconomics*, 12(2):124–166.

Appendix

The Appendix displays additional figures, referenced in the main part of the paper.

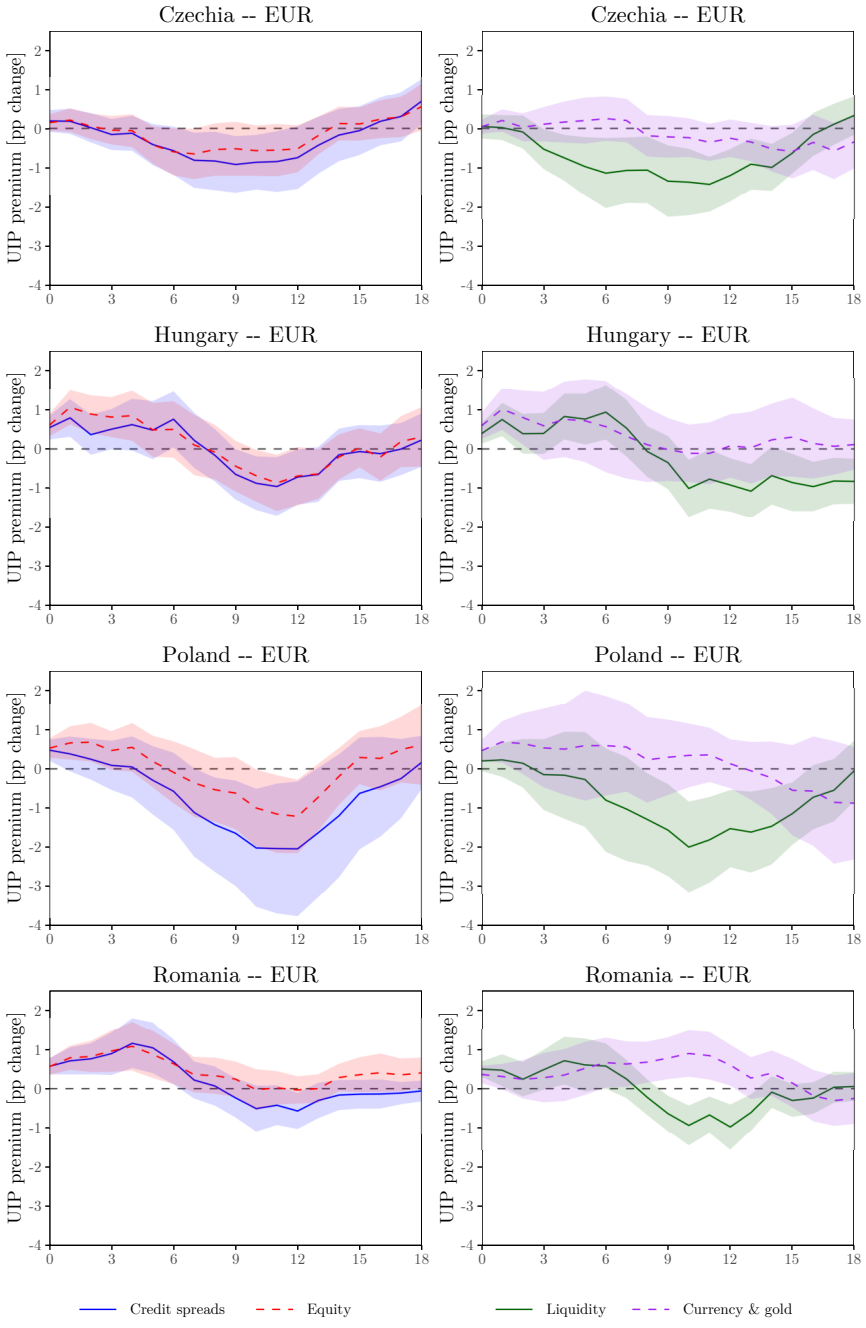

Figure A.1: Impulse response functions of UIP premia to the components of the global risk-on/risk-off measures (currency excess returns vis-à-vis the euro)

Notes: The figure plots the impulse response functions of UIP premia in CEE economies calculated vis-à-vis the euro to four components of the global risk-on/risk-off measure. See Figure 4 for further discussion. Bands around the base estimates show 90-percent confidence intervals obtained using the Newey-West standard errors.

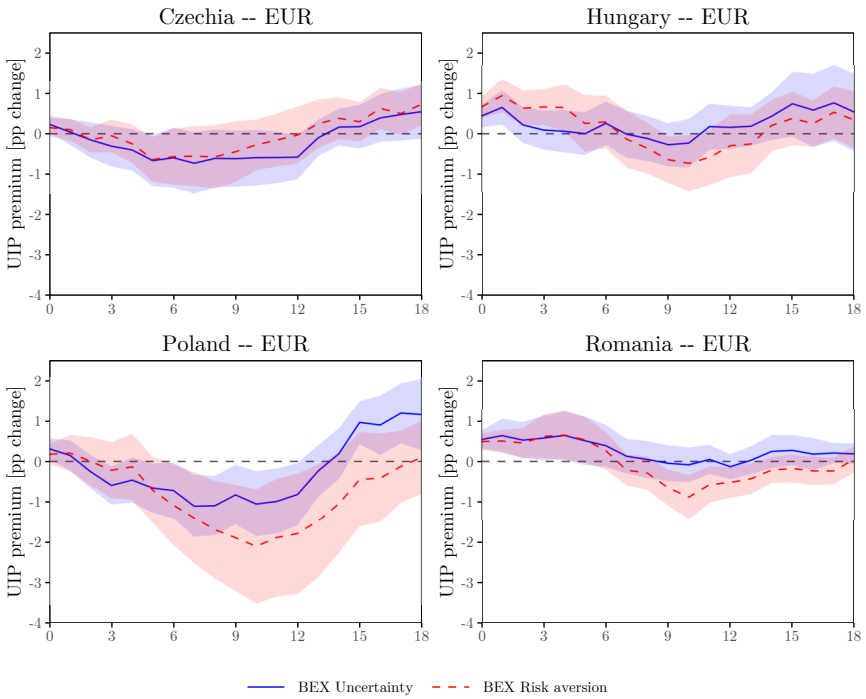

Figure A.2: Impulse responses of UIP premia to BEX uncertainty and risk aversion measures (currency excess returns vis-à-vis the euro)

Notes: The figure plots the impulse response functions of UIP premia in four CEE economies vis-à-vis the euro to the BEX measures of global uncertainty and risk aversion. See Figure 5 for further discussion. Bands around the base estimates show 90-percent confidence intervals obtained using the Newey-West standard errors.

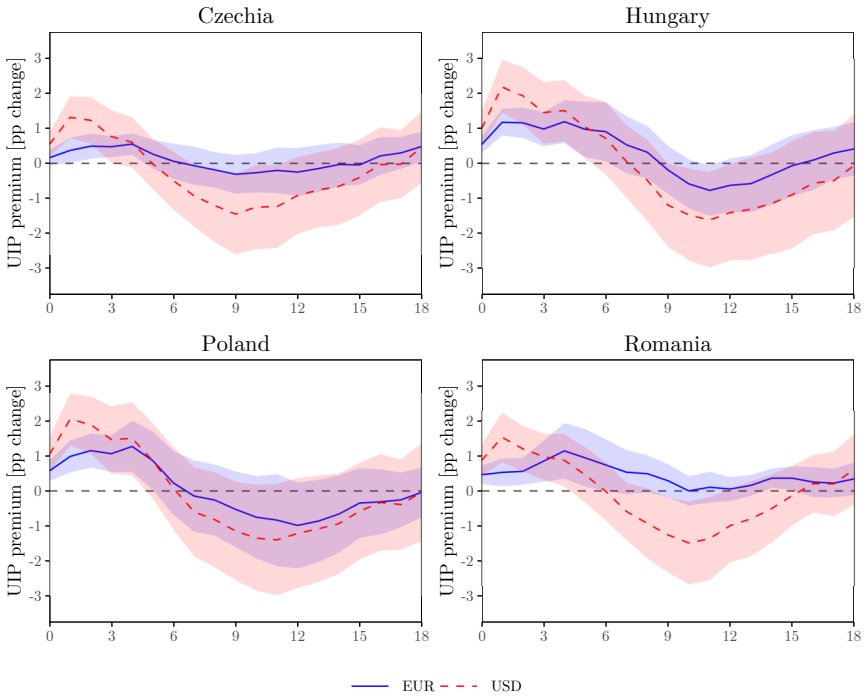

Figure A.3: Sensitivity analysis: alternative number of lags in local projections

Notes: The figure shows the sensitivity analysis to the baseline results in which the number of lags for the UIP premium, the risk-on/risk-off shocks, and all the control variables is set to 6 instead of 12. Bands around the base estimates show 90-percent confidence intervals obtained using the Newey-West standard errors.

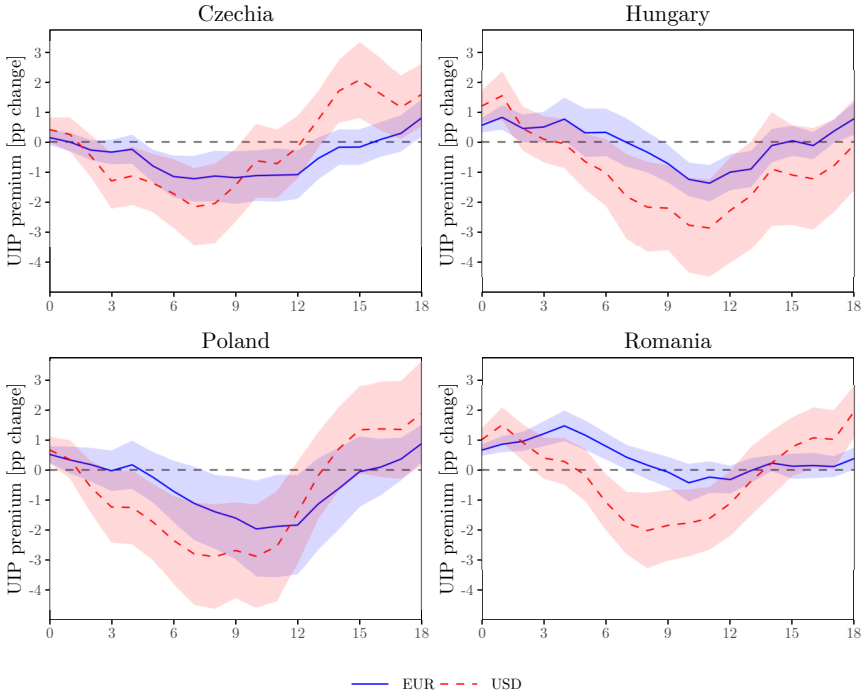

Figure A.4: Sensitivity analysis: inclusion of contemporaneous values of global control variables

Notes: The figure shows the sensitivity analysis to the baseline results in which contemporaneous controls of global growth, the US monetary policy shocks, the EMU monetary policy shocks, and changes in oil prices are included in local projections. Bands around the base estimates show 90-percent confidence intervals obtained using the Newey-West standard errors.

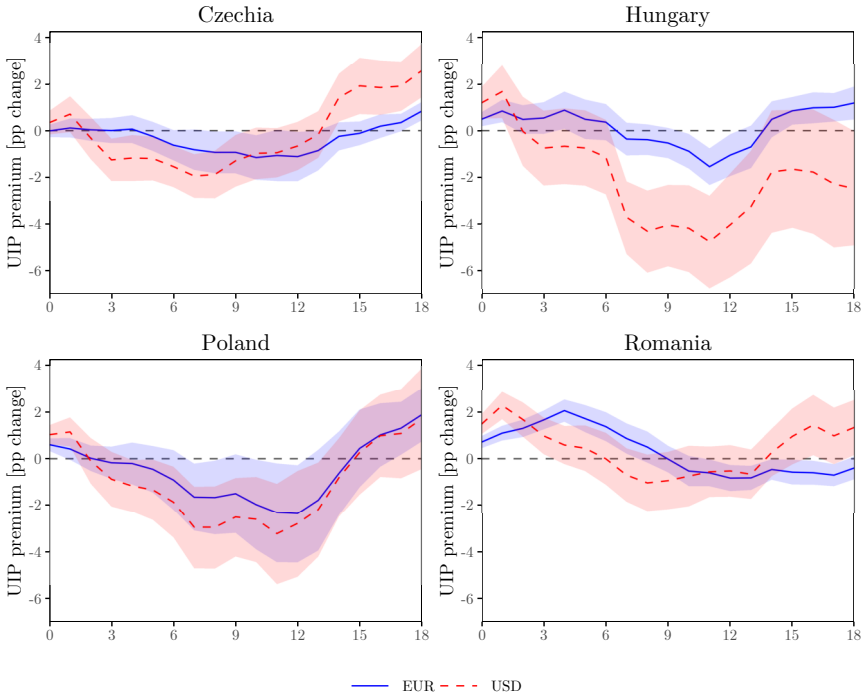

Figure A.5: Sensitivity analysis: sample restricted to the pre-Covid-19 period

Notes: The figure shows the sensitivity analysis to the baseline results in which the estimation sample excludes the post-Covid-19 period (2003-2019). Bands around the base estimates show 90-percent confidence intervals obtained using the Newey-West standard errors.

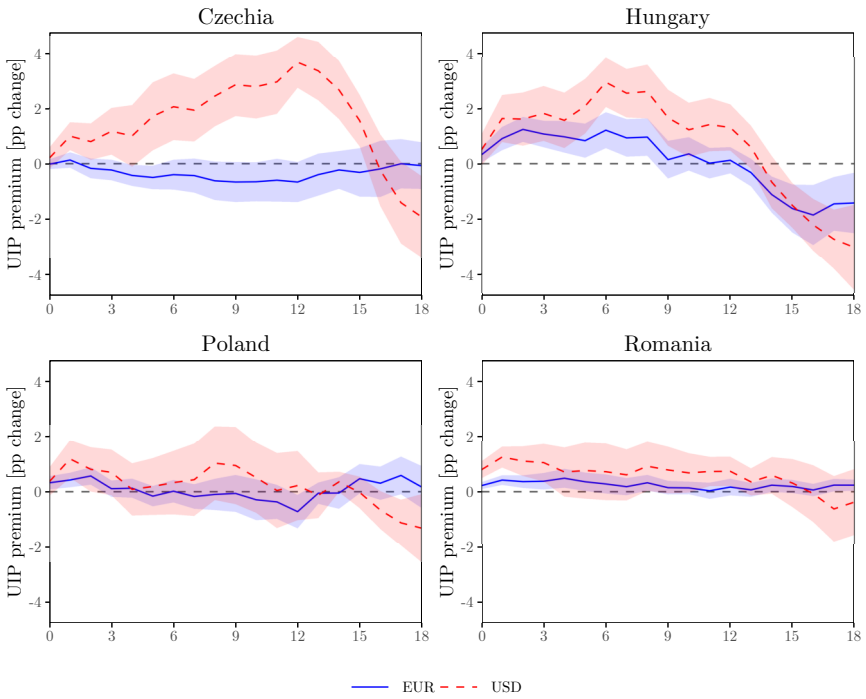

Figure A.6: Sensitivity analysis: sample restricted to the post-GFC period

Notes: The figure shows the sensitivity analysis to the baseline results in which the estimation sample is restricted to the post-Global Financial Crisis (2010-2024) period. Bands around the base estimates show 90-percent confidence intervals obtained using the Newey-West standard errors.

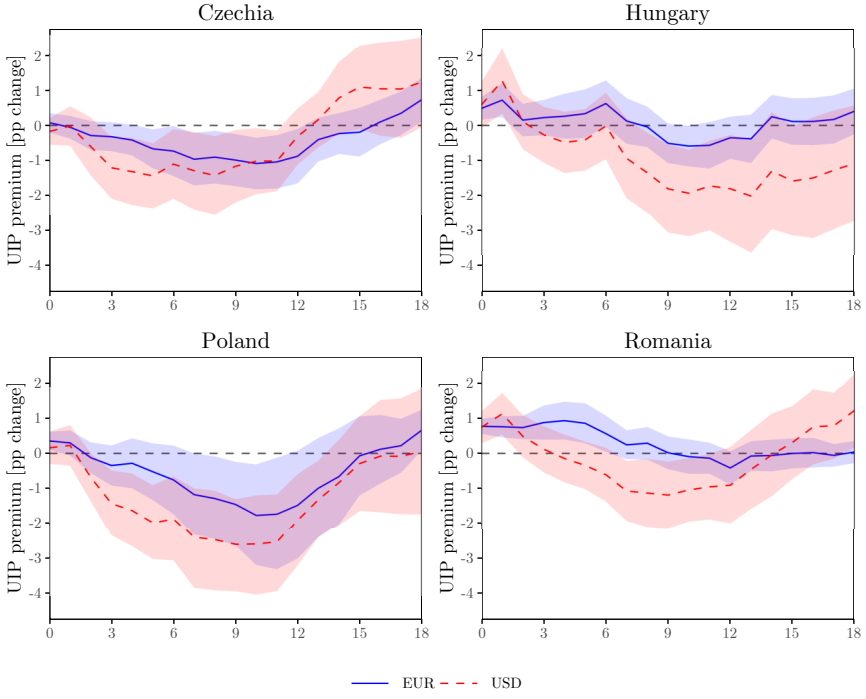

Figure A.7: Sensitivity analysis: excess bond premium as the global risk measures

Notes: The figure shows the sensitivity analysis to the baseline results in which the excess bond premium (Gilchrist and Zakrajšek, 2012) is used as a proxy for the global financial risk, instead of the risk-on/risk-off measure. Bands around the base estimates show 90-percent confidence intervals obtained using the Newey-West standard errors.

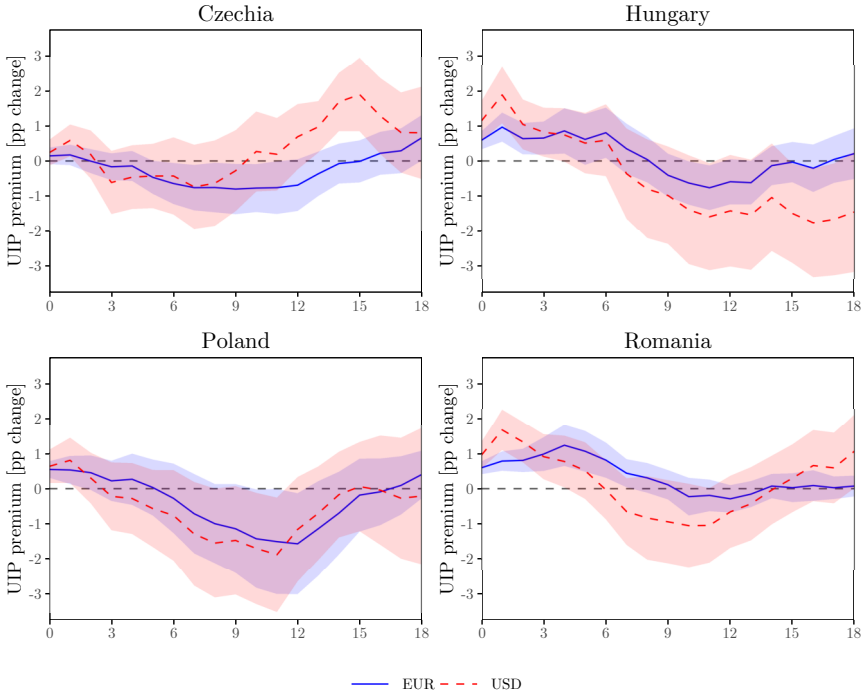

Figure A.8: Sensitivity analysis: UIP premia based on 3-month interest rates

Notes: The figure shows the sensitivity analysis to the baseline results in which the UIP premia in CEE economies are calculated using annualized 3-month interest rates, instead of 12-month rates. Bands around the base estimates show 90-percent confidence intervals obtained using the Newey-West standard errors.

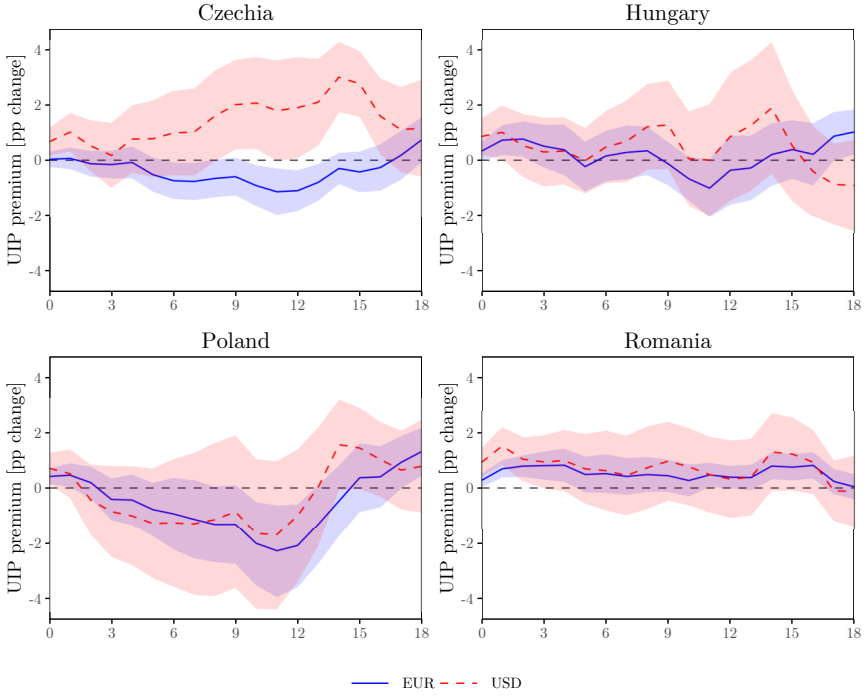

Figure A.9: Sensitivity analysis: controlling for nonlinearities in the risk-on/risk-off measure

Notes: The figure shows the sensitivity analysis to the baseline results in which the local projections for the UIP premia include an additional control variable, cubed risk-on/risk-off shocks ($roro_t^3$), both contemporaneous and lagged values. Bands around the base estimates show 90-percent confidence intervals obtained using the Newey-West standard errors.