DANCE OF RATES: INSIGHTS INTO UNCOVERED INTEREST RATE PARITY IN UKRAINE

by

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Kyiv School of Economics

Abstract

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This thesis investigates the applicability of Uncovered Interest Rate Parity (UIP) in Ukraine, a key theoretical framework in international finance that posits a relationship between interest rate differentials and expected exchange rate changes. By analyzing historical data on Ukrainian interest rates and exchange rates, this study aims to determine whether UIP holds in the context of Ukraine's emerging market economy. Empirical tests, including regression analysis and cointegration techniques, are employed to evaluate the validity of UIP.

This research contributes to a better understanding of the factors affecting exchange rate movements in Ukraine and highlights the need for further investigation into the role of risk premiums and market expectations. The results have significant implications for policymakers and investors engaged in the Ukrainian financial markets.

TABLE OF CONTENTS

LIST OF FIGURES

Number *Page*

LIST OF TABLES

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Additionally, I appreciate all my research workshop professors for their critical discussions and academic support, which have greatly enriched my study.

LIST OF ABBREVIATIONS

EME. Emerging Market Economy.

UIP. Uncovered Interest Parity.

NBU. National Bank of Ukraine.

VIX. Global Volatility Index.

LIBOR. London Interbank Offered Rate.

SOFR. Secured Overnight Financing Rate.

Chapter 1

INTRODUCTION

Uncovered Interest Rate Parity (UIP) stands as a fundamental concept in international finance that has garnered substantial attention from macroeconomists over time. According to UIP theory, a domestic currency boasting a higher interest rate tends to depreciate against a foreign currency with a lower interest rate. More strictly, the nominal interest rate differential between two economies must be equal to the expected change in exchange rate. The theory assumes a direct correlation between the interest rate differential and the change in the exchange rate. Despite extensive research, empirical evidence supporting UIP remains elusive for many studies.

The ambiguity created by the abundance of research, along with the availability of contradictory results, and dependencies on factors like level of economic development (Alper, Ardic and Fendoglu 2009), monetary policy (Backus, et al. 2010), investment horizons (Chinn and Meredith 2005), make the utilization of UIP condition a nontrivial task. Nevertheless, the uncovered interest rate parity remains a pivotal component in macro-finance research and model construction. Notably, New Keynesian semi-structural models, such as the Quarterly Projection Model (QPM), are employed by central banks and international financial organizations, for instance, the models utilized by the International Monetary Fund (IMF) (IMF 2017) and the National Bank of Ukraine (NBU) (Grui and Vdovychenko, Quarterly Projection Model for Ukraine 2019). Both models integrate the UIP condition into their exchange rate equations, albeit with distinct modifications. These applications underscore the great importance of the uncovered interest rate parity condition among macroeconomists worldwide, despite its known empirical uncertainties.

This thesis seeks to illuminate the applicability of uncovered interest parity and provide insights into the relevance of this condition for the Ukrainian economy. The importance of such research could be justified by the necessity to conclude the period of the floating exchange rate regime in Ukraine, which lasted from 2015 till the beginning of 2022. The central research question is whether the UIP condition holds for Ukraine and, if so, the circumstances under which its validity becomes more apparent. The primary objective is to contribute to a credible assessment of UIP theory in the context of the national economy, aiding researchers in academia, government, and other interested parties considering its application.

To my knowledge, comprehensive research on the applicability of UIP theory to the Ukrainian economy has not been undertaken. However, a few studies have touched upon this topic, notably the research (Conway 2012), which examined the NBU's anchored exchange rate policy from 1999 to 2005, noting deviations from the uncovered interest parity condition. More recent work (Grui 2020) utilized a modified UIP condition equation in a semi-structural model, allowing for FX interventions. Importantly, this model revealed systematic deviations from UIP, even after accounting for terms of trade. These findings align with the initial guess of this thesis. These works are two examples of the high applicability and importance of the studied condition for the diverse research within Ukraine.

According to my initial research hypothesis, on average, the relation between the exchange rate change and the interest rate differential does not meet the UIP criteria. However, the condition is expected to be more likely to hold during specific periods.

The second hypothesis is based on the assumption that the introduction of a risk premia component would mitigate the divergence between obtained results and theoretically sound relation. In this work, the risk component is modeled with the help of a proxy variable.

The third research hypothesis proposes more compelling results favoring UIP emergence over a longer observation period rather than in the short term. Moreover, the investigation aims to explore the impact of structural breaks (such as regime shifts and nonresidents' access to hryvnia-denominated government bonds since 2018). Addressing this issue involves employing a regime-switching model capable of accommodating time variation in parameters. The underlying assumption is that utilizing a model capable of distinguishing between short- and long-run effects while considering regime-specific values may yield more coherent results aligned with the theory, ultimately confirming its validity.

The rest of this thesis is structured in the following way. Chapter 2 presents the most crucial and relevant empirical findings of UIP research. A detailed description of the methodology is presented in Chapter 3. This chapter provides the specification and logic behind each regression. Chapter 4 is dedicated to the data that is used in this thesis. All important findings are presented in Chapter 5 which is followed by conclusions in Chapter 6.

Chapter 2

LITERATURE REVIEW

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The emergence of the Uncovered Interest Rate Parity (UIP) theory gained prominence in the 1970s following the collapse of the Bretton Woods system and the subsequent global adoption of floating exchange rate regimes. According to the strict definition of UIP, the difference between market interest rates in two economies must be equal to the expected change in exchange rate expressed in percentage points. In practical terms, holding UIP provides no room for arbitrage trade. Therefore, investors should be indifferent between an opportunity to invest in local currency with a local interest rate and exchange local currency for a foreign one, invest with foreign interest rates, and exchange back at the end of the investment period. Described parity could be expressed as the following equation:

$$(1+i_{k,t}) = \frac{E_t(S_{t+k})}{S_t}(1+i^*_{k,t}) \quad (1)$$

Where $i_{k,t}$ is the domestic interest rate for horizon k at time t, $i^*_{k,t}$ is a foreign interest rate for the horizon k at time t, S_t is the current spot exchange rate at time t (units of domestic currency for 1 unit of foreign currency), and $E_t(S_{t+k})$ is the expected future spot exchange rate at time $t+k$. After the log transformation, (1) is represented with the following parity:

$$E_t(s_{t+k}) - s_t = i_{k,t} - i^*_{k,t} \quad (2)$$

The left side of (2) shows the appreciation/depreciation of local currency with respect to the foreign currency during the investment horizon k, and the right side is the interest rate differential. Under the rational expectations assumption, we can rewrite the expected exchange rate component as follows:

$$s_{t+k} = E_t(s_{t+k}) + \varepsilon_{t+k} \tag{3}$$

Where ε_{t+k} is a random error term with a mean equal to zero. By substituting (2) into (3), the following representation of UIP is obtained:

$$s_{t+k} - s_t = (i_{k,t} - i^*_{k,t}) + \varepsilon_{t+k} \tag{4}$$

This expression could be easily converted to the regression form which has been widely used since the original Fama research (Fama 1984):

$$s_{t+k} - s_t = \alpha + \beta\big(i_{k,t} - i^*_{k,t}\big) + \varepsilon_{t+k} \tag{5}$$

Under the UIP, the hypothetical value of beta in regression (5) is a figure of unity, alpha is equal to 0, and the error term is white noise.

Initially, it was anticipated that currencies tied to higher interest rates would depreciate, yet empirical observations revealed contradictory outcomes. Notably, one of the first surveys (McCallum 1994) highlighted an unexpected trend where the coefficient β in the exchange rate change versus interest rate differential regression assumed negative values, at times plummeting to as low as -3. This contradicted the expected depreciation associated with higher domestic interest rates, challenging the theoretical assumptions of UIP. This discrepancy was noted in the early studies (Fama 1984), coining it the "forward premium puzzle" (Fama puzzle) in subsequent studies.

To better understand the nature of revealed contradiction the main assumptions of regression form (5) should be examined. The most important one is arguably the efficient market hypothesis. It states that prices reflect all available information and adjust immediately. Therefore, every new market condition is immediately reflected in the exchange rate and provides no arbitrage opportunities for investors. The second assumption is risk neutrality, which implies that investors are indifferent between investing in local and foreign economies with corresponding interest rates despite the different risk levels, and focus exclusively on potential returns. This is a very strong assumption, given that in real world investors consider and account for all types of risk they find relevant and ask the justified risk premia. This additional return could be attributed to geopolitical uncertainty, oil prices, monetary policy, and the development of government institutions (Kallianiotis 2016). Finally, the rational expectations hypothesis affects UIP, assuming that agents invest with a specific exchange rate at the end of their investment horizon in mind. This assumption has already been illustrated with equation (3). Therefore, on average, the future exchange rate at period $t + k$ will be equal to the expected exchange rate at this period during t. The main implication of this assumption is the choice between survey data and the actual future exchange rate. Under the assumption of rational expectations, the researcher can choose any of the two, as the results of regression (3) should be the same. However, it has been shown (Bussiere, et al. 2022) that relaxation of rationality assumption in equation (3) (expressed in the assumption of non-zero mean expectations error) leads to different results. In particular, the variation of expected depreciation was much smaller than the actual change in exchange rate. For instance, for EUR/USD pair *ex post* difference was three times larger than *ex ante*.

The discrepancy between theoretical predictions and real-world observations might be attributed to various factors (Lothian and Wu 2011). Firstly, early studies predominantly focused on the 1970s and 1980s, characterized by high inflation in major economies, notably the US. Additionally, authors claimed that while UIP tends to hold better over longer periods (with a study using a 200-year dataset), deviations from parity are more pronounced in shorter intervals. Furthermore, while small deviations may persist for extended periods, larger deviations often lead to a stronger restoration of the parity condition. That was confirmed by another study (Alexius 2001) that investigated UIP using long-term government bond yields for the US and other developed nations. Despite encountering data-related challenges such as unspecified bond maturities and unclear investment periods, the results hinted that, depending on how coupon payments were factored, coefficient β exhibited positive trends for certain countries. This work highlighted the premature dismissal of UIP as a purely theoretical concept.

While UIP studies primarily focused on developed economies, the rise of emerging market economies (EMEs) and financial globalization prompted assessments of these markets. The survey of EMEs before the Great Recession noted substantial heterogeneity between EMEs and developed economies (Alper, Ardic and Fendoglu 2009). EMEs were observed to exhibit more UIP-like behavior, attributed largely to higher inflation and its volatility in developing countries. Recent findings introduced the inclusion of risk premia in the UIP condition for emerging economies, significantly supporting the theory (Kumar 2019). However, the later research on countries of Eastern and Central Europe (Filipozzi and Staehr 2012) demonstrated the negative betas for all studied economies except Romania (although not always statistically significant) during the first 10 years of the 21st century. Overall, there is no consensus regarding the compliance of EMEs to uncovered interest rate parity.

Considering risk premia in EMEs, the role of financial market liberalization became pivotal for research. The impact of liberalization reforms in EMEs on UIP compliance through excess currency returns in local markets was investigated (Francis, Hasan and Hunter 2002). Their results varied among analyzed countries, with Asian economies showing reduced excess currency returns, indicating lower deviations from UIP, while Latin American economies demonstrated increased gaps from the UIP condition, signaling a demand for higher risk premia.

Applying uncovered interest rate parity to the developed economies is also far from being straightforward. Although initially the Fama puzzle has been shown for Western markets (Fama 1984), these results were reexamined for more recent economic conditions (Bussiere, et al. 2022). The authors showed a distinct break attributed to the global financial crisis and implementation of low market interest rates, which resulted in positive, while much greater than 1, slope coefficients for advanced economies during the 2006-2014 period.

An area of significant interest that received less attention in early research pertains to the impact of monetary policy regimes on uncovered interest rate parity. An important event that triggered UIP research from this angle was the already mentioned financial crisis of 2007-2008.

As discussed earlier, the fulfillment of the UIP condition is often more pronounced in the long term. This observation underscores the importance of research methodologies that can account for shifts in monetary policy, particularly within a 20-30-year horizon.

In a study concerning South Africa (Lacerda, Fedderke and Haines 2010), emphasis was placed on exploring long-term relationships while accommodating shifts in both monetary policy and political regimes. The authors argue that the failure of prior research to substantiate the UIP theory can be attributed to econometric models that neglect to consider regime shifts, thereby inadequately assessing the relationship between exchange rates and interest rates. This work demonstrated that employing the Markov-switching vector error correction model (VECM) instead of the standard linear VECM resulted in significantly improved data fit and residual distribution, enhancing the ability to model the relationship effectively.

Some research (Beyaert, García-Solanes and Pérez-Castejón 2007) even highlighted the inadequacy of using linear models and stressed the importance of employing non-linear models that are more appropriate and hence better specified. They utilized a non-linear dynamic bivariate VAR model where all parameters were regime-dependent. A notable outcome of their study was the behavior exhibited by the Spain-United Kingdom pair, where the UIP condition was strongly upheld, presumably due to Spain's acceptance into the European Union, leading to capital flow liberalization. This finding underscores the significance of monetary policy in the context of UIP, even for developed economies.

Similarly, the other study (Flood and Rose 2002) observed no significant difference between emerging market economies and developed markets. Their research during the financial crisis of the 1990s revealed a compelling finding: a majority of economies adhered more closely to the UIP condition during this crisis compared to two decades prior.

The literature review collectively points out the growing necessity for non-linear models capable of capturing the nuances and changes within an economy. This shift towards non-linear modeling practices has become a prevailing trend, enabling a more comprehensive understanding of the effects of monetary policy and its pivotal role in the uncovered interest parity theory.

Chapter 3

METHODOLOGY

In order to formulate a preliminary guess about the compliance with UIP the simple OLS regression model, the same as equation X, has been used:

$$s_{t+k} - s_t = \alpha + \beta\left(i_{k,t} - i^*_{k,t}\right) + \varepsilon_{t+k} \tag{6}$$

Where the left side represents the depreciation of UAH against USD in percent terms during investment horizon k which is regressed on the right side differential of interest rates in Ukraine and the US. According to the uncovered interest rate parity, the estimated α should equal to 0, and β should equal 1. Importantly, such results are expected under three assumptions: 1) full capital mobility without any transaction costs, 2) unbiased expectations of the investors, and 3) risk neutrality.

When the sign of relation is revealed, the decomposition of an independent variable (differential) might be helpful. Although UIP doesn't specify the singled coefficients for both domestic and foreign interest rates, we would expect the slope of the Ukrainian interest rate equal to 1, while the higher US rates should be associated with lower depreciation of UAH implying the corresponding slope to be equal to -1. To check this theory, regression (7) will be run.

$$s_{t+k} - s_t = \alpha + \beta_1 i_{k,t} + \beta_2 i^*_{k,t} + \varepsilon_{t+k} \tag{7}$$

This decomposition is also helpful in establishing the how sensitive exchange rate is to specific changes in either domestic or foreign rates, not just differential of returns.

Besides the average estimates, this work aims to evaluate how UIP regression parameters change with time. To do so, the rolling window analysis has been implemented. I used a 3-year-long rolling window, which corresponds to 156 observations or data points.

Additionally, to account for the great volatility of exchange rate returns, the simple regime switching model has been created:

$$s_{t+k} - s_t = \alpha + \beta_{under} spread_{under,k} + \beta_{above} spread_{above,k,t} + \varepsilon_{t+k} \quad (8)$$

It has already been mentioned that some research found evidence for a more likely UIP-kind relation during the periods of higher interest rate spread (differential). Transaction and other hidden costs are likely to make investors abstain from investing if the spread is small and have a much lower effect when the differential is huge enough to offset them. To check it, I used the model inspired by research on small open transition economies (Filipozzi and Staehr 2012). The switch between regimes is based on the value of spread at time t with respect to the average value for the whole observation period, and could be specified as follows:

$$spread_{under,k,t} = \begin{cases} i_{k,t} - i^*_{k,t}, if\ i_{k,t} - i^*_{k,t} < average(i_k - i^*_k) \\ 0, otherwise \end{cases} \quad (9)$$

$$spread_{above,k,t} = \begin{cases} i_{k,t} - i^*_{k,t}, if\ i_{k,t} - i^*_{k,t} > average(i_k - i^*_k) \\ 0, otherwise \end{cases} \quad (10)$$

Therefore, the estimated β_{under} is expected to be different and lower than β_{above}.

Finally, I modeled the UIP condition modified by the introduction of the risk premia component. For this purpose, the proxy variable was used. One of the most commonly used proxy is the global volatility index (VIX) (Bussiere, et al. 2022). It is a volatility index derived from option prices on the S&P500 and represents the global volatility. The new UIP specification is as follows:

$$s_{t+k} - s_t = \alpha + \beta\left(i_{k,t} - i^*_{k,t}\right) + \gamma VIX_{t,k} + \varepsilon_{t+k} \tag{11}$$

Where $VIX_{t,k}$ is the global volatility index at period t adjusted for the period k. The larger VIX implies greater financial uncertainty and, therefore, more substantial depreciation of UAH.

Chapter 4

DATA DESCRIPTION

The core dataset used for this research consists of two groups of time series: interest rates and exchange rates, the relation between which is essentially a topic of this thesis. Any study on the uncovered interest rate parity requires two research entities: the domestic economy with its currency and interest rates and the foreign market with the same attributes. The primary object of this research is the effect of the difference between the interest rates in Ukraine and the US on the expected exchange rate of hryvnia relative to the US dollar.

The minimal dataset for UIP research must contain at least three time series: interest rates in both domestic and foreign economies and the expected or actual exchange rates. As already discussed in the literature review, the UIP condition normally implies the usage of the expected exchange rate at a given period, while we assume that the rational expectations hypothesis holds. This suggestion allows for the treatment of the actual exchange rate in a future period as the expected one in the past. For this research, the actual *ex post* exchange rates have been used. This simplification is advocated mainly by the scarcity of reliable survey data for the expectations on the UAH/USD pair.

For this research, four investment horizons were studied: 1 month, 3 months, 6 months, and 12 months. Correspondingly, the depreciation /appreciation of UAH is also studied for these four periods. This choice is justified by an attempt to compare the UIP conditions for different periods without sacrificing the substantial part of the dataset. Also, the money markets with studied horizons are among the most liquid, and, therefore, have real-world relevance. Finally, while the

3-month horizon is arguably the most researched one, the results on the other three horizons would allow us to have a broader picture of the money market.

All the data used for the research covers the period: 01.12.2015 – 22.02.2022. Observations are made with weekly frequency. Although the majority of research works with monthly data, the typical time frame spans more than 10 years providing an adequate number of observations. Therefore, the choice in favor of higher frequency data has been made. The dataset has been adjusted to the missing observations during holidays in Ukraine and the US. The total number of observations is 325. As will be discussed later, this number will decrease with the greater duration of the investment horizon.

The choice of the US as a reference economy and USD as a reference currency has been made due to the greater availability of data on market rates compared to the Eurozone and EUR. The interest rates for both countries were derived from the corresponding modeled zero-coupon yield curves. This approach is advantageous to using benchmark interest rates like LIBOR or SOFR for a few reasons. First, bonds are a much more common investment instrument (at least in Ukraine) than repurchase agreements that define benchmark rates. Also, the yield of government bonds could be considered as default risk-free and provides a clear term structure. The main drawback of the zero-coupon yield curve is its synthetic nature implying extensive use of interpolation and extrapolation, which results in interest rates that are calculated rather than observed. Another issue is the comparability of rates obtained through different methods and their suitability for a particular bond market.

USD interest rates for specified maturities were obtained with a non-parametric kernel smoothing method (Liu and Wu 2020). The authors maintain regularly updated online table with calculated yields for maturities from 1 to 360 months starting from 1961. These outputs are derived from all available Treasury bills, notes, and bonds at a given point in time across specified maturities.

The UAH interest rates were obtained from the zero-coupon yield curve for the Ukrainian government debt bonds but derived with a more traditional Nelson-Siegel model. The National Bank of Ukraine publishes a weekly set of calculated parameters $(\beta_0, \beta_1, \beta_2, \tau)$ needed for model estimation starting from 01.12.2015. The yields were modeled with the equation (12) in Python.

$$y(t) = \beta_0 + \beta_1 \left(\frac{1 - e^{-t/\tau}}{t/\tau} \right) + \beta_2 \left(\frac{1 - e^{-t/\tau}}{t/\tau} - e^{-t/\tau} \right) \qquad (12)$$

Where t is maturity or investment horizon.

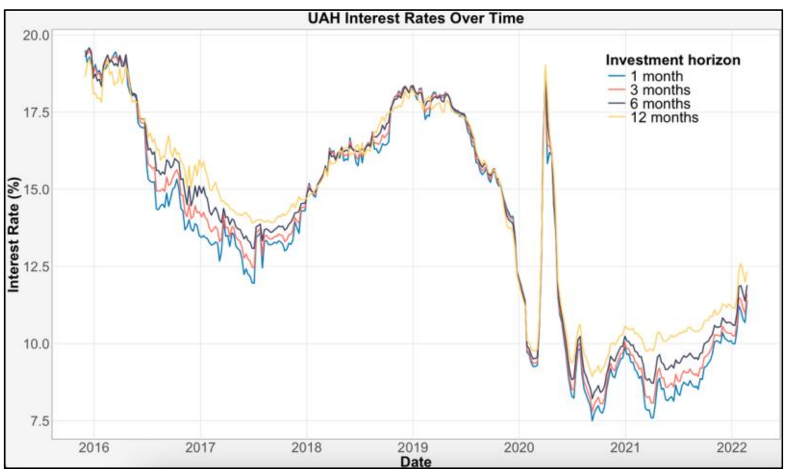

Figure 1. Time series of UAH interest rates for different investment horizons, 2015-2022

Figure 1 demonstrates the change in Ukrainian interest rates over the observed period for all studied horizons. While it is difficult to distinguish a clear trend, it is worth mentioning that the spread between maturities is not constant. Moreover, we can observe periods of low/negligible spreads and periods of greater yields for longer horizons. More specifically, during 2016-2017, and since the middle of 2020 the increased investment horizons have demonstrated higher returns, while during the other periods, the returns were approximately the same across all studied maturities. Interestingly, the sharp increase in yields to almost 19% occurred during early 2020 which rapidly normalized by the middle of the year.

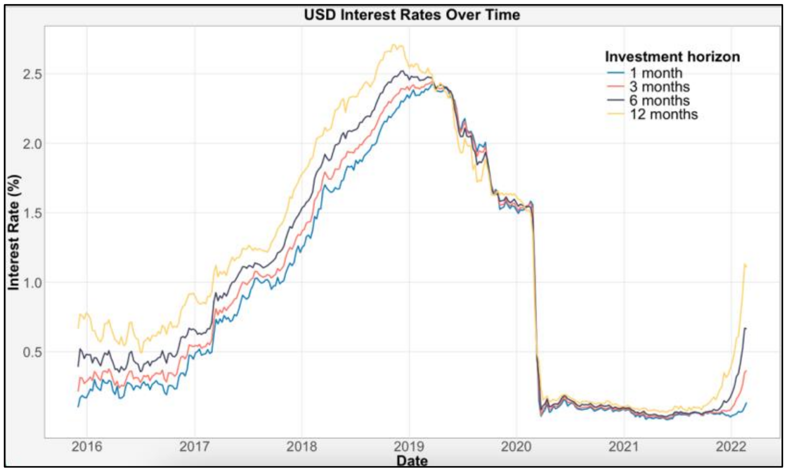

Figure 2. Time series of USD interest rates for different investment horizons, 2015-2022

As could be seen from the Figure 2, the US interest rates, apart from being much lower than the Ukrainian ones, also demonstrate the difference in spreads. In fact, they are more consistent, with the magnitude of spreads holding for longer periods. Clearly, from late 2015 till early 2019, longer horizons provided investors with greater returns, while the subsequent two years could be characterized by much smaller spreads. Importantly, the returns started to diverge rapidly in 2021, resulting in the greatest spreads for the whole observation history. The trend component is present only during 2017-2019 which was followed by the sharp decrease and stabilization of returns for more than one year. Finally, a strong upward trend emerged at the end of 2021.

Importantly, the trend direction of Ukrainian and US interest rates doesn't always coincide. Specifically, for the whole of 2016 and the first half of 2017, the directions were strictly opposite. Also, there is a clear discrepancy in the first half of 2020, when the Ukrainian interest rates spiked for a short period of time without similar behavior in the US.

The weekly exchange rate data has been obtained from Investing.com. The rate is expressed in units of UAH for 1 unit of USD, which represents Monday's average price.

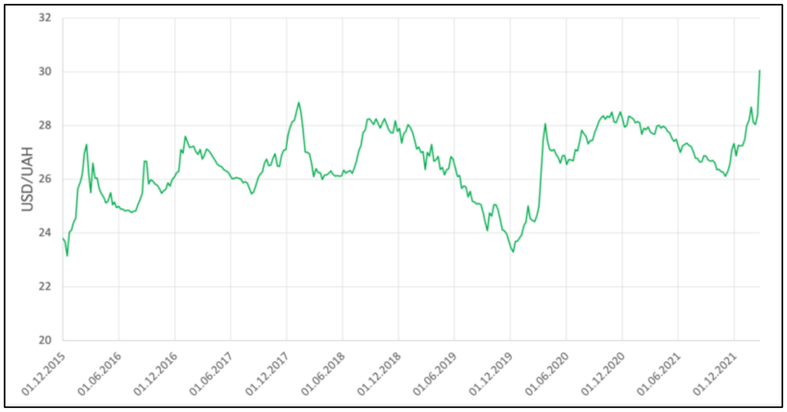

Figure 3. Time series of USD/UAH exchange rate during 2015-2022

As can be seen in Figure 3, for the observed period, UAH showed a modest depreciation trend, while appreciating to less than 24 UAH for 1 USD during 2019. It is worth mentioning that the exchange rate hasn't witnessed changes that would be comparable to the already observed interest rate variables, and moved within a relatively narrow range during 2015-2022.

A comparison of interest rate differential and expected return/losses from UAH depreciation/appreciation should also be discussed. According to UIP, these two measures should be on average equal.

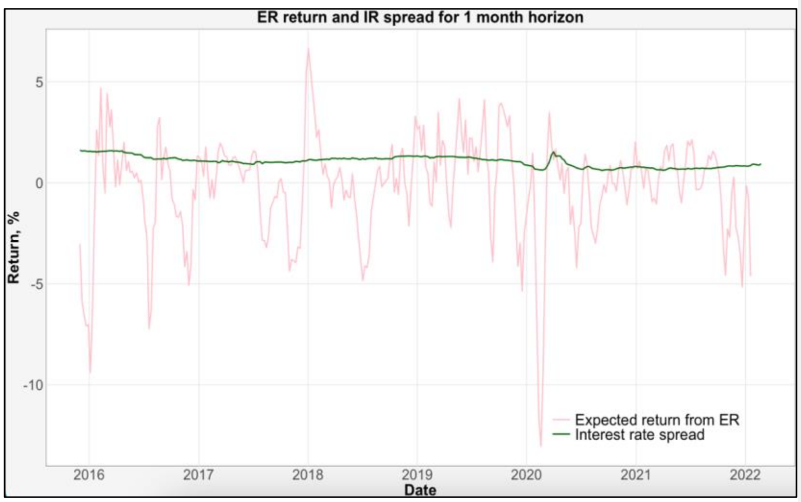

Figure 4. Comparison of FX return and interest rate spread for 1-month investment horizon, 2015-2022

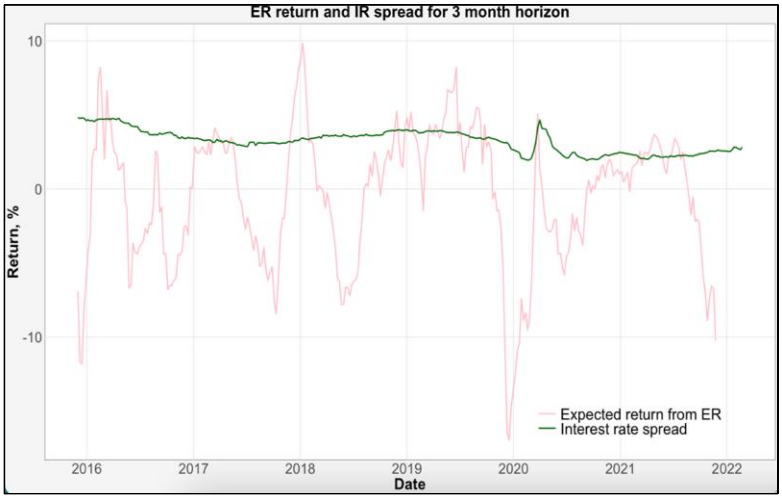

Figure 5. Comparison of FX return and interest rate spread for 3-months investment horizon, 2015-2022

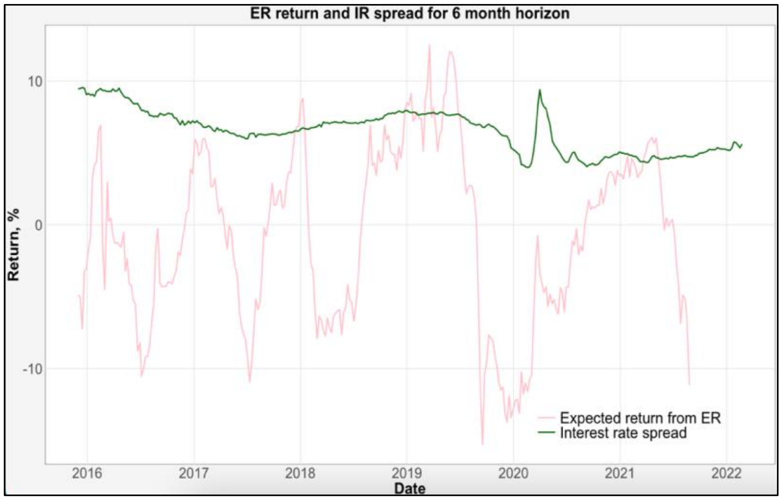

Figure 6. Comparison of FX return and interest rate spread for 6-months investment horizon, 2015-2022

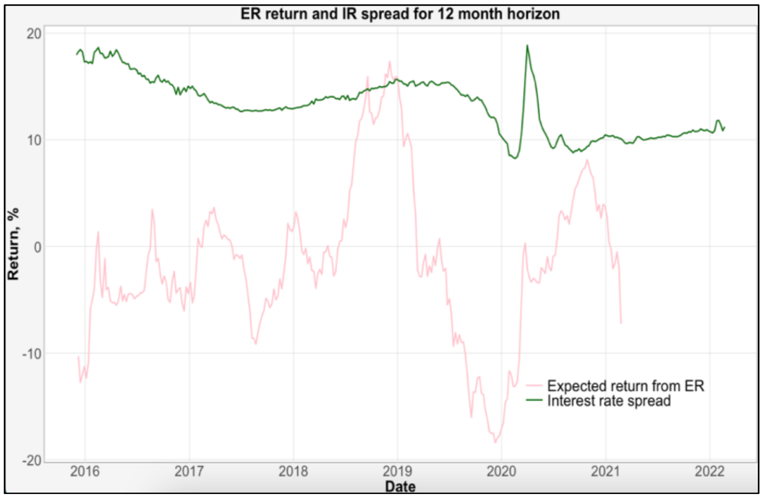

Figure 7. Comparison of FX return and interest rate spread for 12-month investment horizon, 2015-2022

Figures 4-7 compare the theoretical returns from the currency weakening/strengthening and the interest rate spreads. The latter is clearly much less volatile for all maturities. Importantly, for all investment horizons, except probably 1 month, the average difference between the Ukrainian and US rates is noticeably greater than the average return from UAH appreciation. For 12 month horizon, this discrepancy is so significant, that there are only two short periods when the strengthening of hryvnia resulted in higher gains than the difference between interest rates. We can also observe that there is much less noise in expected returns from exchange rates for longer periods.

Table 1. Descriptive statistics of the studied variables

FX returns, %					
Horizon	Min	Max	Mean	Median	N
1 month	-6.644	13.043	0.238	-0.191	321
3 months	-9.823	16.965	0.452	-0.555	312
6 months	-12.509	15.291	0.643	0.249	299
12 months	-17.356	18.404	1.373	2.014	272
Interest rate spreads, %					
Horizon	Min	Max	Mean	Median	N
1 month	0.616	1.617	1.064	1.089	325
3 months	1.921	4.815	3.230	3.354	325
6 months	3.980	9.541	6.539	6.750	325
12 months	8.260	18.870	13.220	13.430	325

The descriptive statistics presented in Table 1 are calculated for the corresponding investment horizons and are not annualized (except for 12 months of course). Overall, it supports the findings from the graphs. The ranges for FX returns are significantly larger than the ones for interest rate spreads for a given period.

The stationarity of studied variables has been examined with the help of the Augmented Dickey-Fuller test. All eight time series (four FX returns, and four spreads) were checked in R by "adf.test" function from "tseries" package. The lag order is chosen automatically by the Schwartz Bayesian Information Criterion.

The results are reported in Table 2. The null hypothesis (unit root) can not be rejected for some series, particularly for longer investment horizons. Although in this case, non-stationarity is likely to be addressed to the nature of used financial data, the analysis further would benefit from accounting for structural breaks or seasonality.

Table 2. Results of ADF test for studied variables

	FX returns, %			Interest rate spreads, %		
Horizon	Statistic	p-value	Lags	Statistic	p-value	Lags
1 month	-6.552	<0.01	6	-2.795	0.241	6
3 months	-3.781	0.02	6	-2.747	0.262	6
6 months	-2.653	0.301	6	-2.720	0.273	6
12 months	-2.183	0.499	6	-2.950	0.176	6

Chapter 5

ESTIMATION RESULTS

The estimated slope and intercept coefficients for a classical UIP regression (Equation (6)) are all different from the theoretical parity. As could be seen from Table 2, for all investment horizons except 12 months, the results are in line with "Fama puzzle", which has also been observed for some economies in Central and Eastern Europe (Filipozzi and Staehr 2012). However, there is some evidence that UIP is more likely to hold, or at least show a positive relation if the spread between rates is larger. In this regard, positive slope coefficients were expected given the almost exclusively double digits rates in Ukraine during 2015-2022.

Table 3. Simple OLS regression results

$Horizon$	α	(s. e.)	β	(s. e.)
1 month	1.508*	0.599	-1.192*	0.546
3 months	3.408**	1.118	-0.908**	0.335
6 months	3.792*	1.623	-0.473*	0.238
12 months	1.892	2.517	-0.038	0.180

It is worth mentioning that the intercept term is positive, significant for shorter investment horizons, and tends to increase with investment duration. Given the model assumption, this non-zero term could be attributed to the risk premia or barriers to capital mobility components. Interestingly, with the increase of investment horizon, the value of β approaches 0. While the positive slope coefficient could be anticipated for horizons over 12 months, the substantial part of the dataset has to be sacrificed meaning that results would not be comparable.

The results of interest rate differential decomposition are presented in Table 3. The split of rate components led to the loss of slope significance for shorter horizons. However, the exchange rate seems to be relatively sensitive to changes in the US rates for longer investment periods. The sign of this effect is in accordance with UIP. The effect of Ukrainian rates is mostly insignificant and much less pronounced. Large positive intercepts persist.

Table 4. Results for separate UAH and USD effects with OLS

$Horizon$	α	(s. e.)	β_1	(s. e.)	β_2	(s. e.)
1 month	1.409*	0.605	-0.924	0.593	-1.607	2.501
3 months	3.150**	1.121	-0.645.	0.360	-1.852	1.465
6 months	3.456*	1.614	-0.248	0.252	-1.921*	0.967
12 months	2.241	2.453	0.134	0.181	-2.239***	0.602

Even though the observation period is not very long, it is crucial to see how does UIP relation hold across time. The rolling estimates of intercept and slope with 2 standard errors confidence intervals are depicted in Figure 8 and Figure 9. I used the simple OLS model (6) for these estimations. The horizons with the most significant estimates (Table 4), namely 3 and 6 months, were studied. For both periods, α and β are almost symmetrical with respect to the time axis. Moreover, the patterns among the same horizons are also very similar with 3 months horizon being more volatile. While it is clear that the series doesn't show UIP-like behavior in any time frame, the substantial drop in estimated slope (and substantial growth in estimated intercept) during late 2019-early 2020 attracts attention. These changes may be attributed to the increased risk premia. I relate this dynamic to the unattractiveness of the Ukrainian market for foreign investors during COVID-19 times.

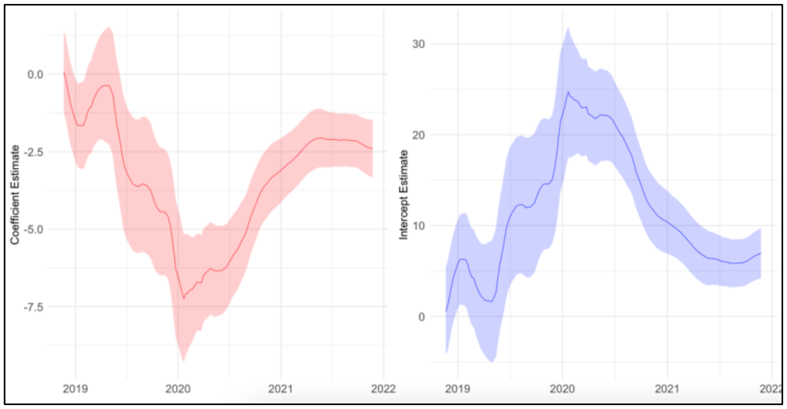

Figure 8. Estimated slope and intercept for 3-month investment horizon, 3-year rolling window

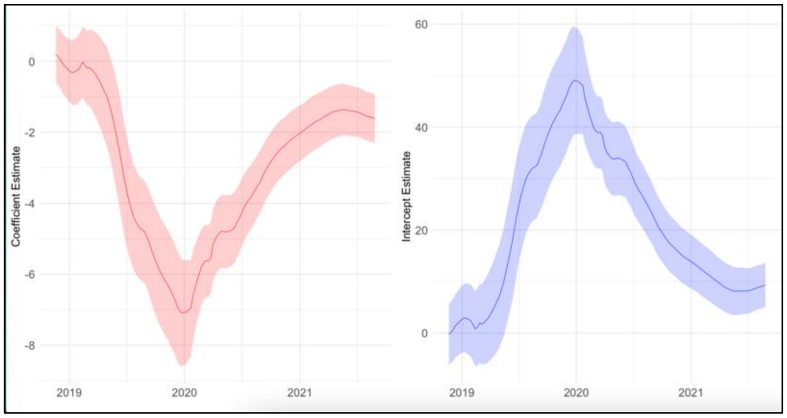

Figure 9. Estimated slope and intercept for 6-month investment horizon, 3-year rolling window

Table 5. Results of regime switching model

$Horizon$	α	(s. e.)	β_{under}	(s. e.)	β_{above}	(s. e.)
1 month	-0.049	0.992	0.885	1.188	-0.067	0.789
3 months	-2.350	1.804	1.592*	0.704	0.474	0.475
6 months	0.045	2.594	0.307	0.484	-0.027	0.339
12 months	-7.882*	3.740	0.900**	0.323	0.543*	0.243

The results of regression (8) are reported in Table 5. Interestingly, neither low, nor high spreads exhibit explanatory power. It can also be observed that slopes for 12 month horizon are statistically different, meaning that we can not normally differentiate for two regimes. Clearly, the simple regime switching model which is specified based on average values is unable to provide a good distinction between periods when UIP is likely to hold, and when it is not.

Table 6. Results of OLS model with risk premia component (VIX)

$Horizon$	α	(s. e.)	β	(s. e.)	γ	(s. e.)
1 month	1.380.	0.736	-1.166*	0.553	0.067	0.222
3 months	4.078**	1.352	-0.954**	0.339	-0.116	0.132
6 months	3.475.	1.930	-0.461.	0.242	0.027	0.087
12 months	4.664	2.865	-0.101	0.182	-0.107*	0.054

As can be observed from Table 6, an introduction of risk proxy didn't change results dramatically. Reported intercept and slope estimates are not much different from the basic OLS regression results. However, it is worth mentioning, that some intercepts became less significant. This finding assumes the time-invariant part to lose its explanatory power in the presence of a risk proxy. We can conclude that the risk premia component represented by VIX has insignificant explanatory power. Moreover, for 12 months horizons it has counterintuitive sign.

Chapter 6

CONCLUSIONS AND POLICY RECOMMENDATIONS

This thesis presents the results of multiple empirical tests for uncovered interest rate parity for Ukraine with the US economy as a reference. As anticipated, the UIP doesn't hold in Ukraine, moreover, the direction of the relation violates the logic of parity and is in line with the Fama puzzle, implying that on average Ukraine, as a country with higher interest rates faces an appreciation of hryvnia.

The initial results clearly demonstrated that the uncovered interest rate parity doesn't hold for Ukraine in its strict definition. This result is coherent with the initial hypothesis. Moreover, for most of the studied horizons, we fail to claim that higher Ukrainian rates lead to the depreciation of hryvnia on average.

I also found no support for the hypothesis of UIP in Ukraine as an economy with high interest rates with regard to the US as an economy with low interest rates. A huge interest rate spread is not a sufficient condition for UIP to hold in developing markets.

The risk premia component, expressed in this work by VIX, doesn't seem to constitute a substantial explanatory power. Moreover, the direction of its effect, when statistically significant, is counterintuitive. Arguably, the VIX can have little effect due to the irrelevance of S&P 500 volatility to arbitrage opportunities within the Ukrainian economy. Therefore, an alternative risk proxy should be found to mitigate an existing gap in parity.

While this research covers nearly the entire period of a floating exchange rate regime which was abruptly ended in February 2022, it is still significantly shorter than the periods covered in the existing literature, which typically span at least 10 years. Presumably, the longer observation period would allow for additional findings and patterns. However, more advanced regime-switching models should be applied to the researched time series.

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