ANALYZING BOND YIELD SPREAD DYNAMICS IN KAZAKHSTAN AND RUSSIA: A STUDY AMID REGIONAL UNCERTAINTIES

BY

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THESIS

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Abstract

This thesis examines the determinants of bond yield spreads between corporate and government bonds with maturities of 1, 5, and 10 years in Kazakhstan and Russia. The study utilizes regression analysis to explore how macroeconomic factors and their lags influence these spreads, providing insights into the dynamics of fixed-income markets in both countries. Key explanatory variables include growth rates, macroeconomic ratios such as gross international reserves to GDP, and exchange rate volatilities, among others. A significant component of this research focuses on the geopolitical and economic impact of the Russian invasion of Ukraine, captured through the inclusion of a war dummy variable to assess shifts in bond market behavior post-February 2022.

In addition to analyzing bond spreads within each country, the study investigates cross-country dynamics by modeling the differences between Russia's corporate bond index yield and Kazakhstan's corporate bond index yield. To capture the long-term equilibrium relationship between these spreads and macroeconomic determinants, cointegration techniques are used.

The findings suggest that macroeconomic indicators, such as GDP growth rates, international reserve ratios, and exchange rate movements, play a critical role in shaping bond yield spreads. Moreover, the results indicate that the Russian invasion

of Ukraine significantly altered the determinants and behavior of bond spreads, highlighting the sensitivity of financial markets to geopolitical events. This study contributes to the understanding of bond market dynamics in emerging economies and offers a framework for policymakers and investors to evaluate risk and return in the presence of economic and geopolitical shocks.

1. Introduction

The bond yield spreads between the private and public sector bonds serve as an indicator of economic stability, investor sentiment and local market conditions. Bond yield spreads are influenced by a combination of macroeconomic, financial, and geopolitical factors. Understanding the main drivers of these can be essential for decision making processes of policymakers, investors, and researchers, particularly in emerging markets where economic and political risks often lead to heightened volatility.

This paper analyses the determinants of bond yield spreads in Kazakhstan and Russia, and focuses on three key maturities: 1, 5, and 10 years. Both countries present unique and interlinked economic structures that make them very interesting cases to analyze. In the case of Kazakhstan, in addition to reliance on natural resources including oil and gas, the country also experienced regime change from fixed exchange rate to floating exchange rate regime in 2015, which marks critical

moments in its financial markets. Meanwhile, Russia's economy has been affected by global sanctions, oil price changes, and geopolitical situations including its 2022 invasion of Ukraine.

This research focuses on factors influencing bond yield spreads within and between Kazakhstan and Russia. By employing regression and cointegration analyses, the study examines the impact of macroeconomic variables, such as GDP growth, inflation, and exchange rates, alongside global factors like oil prices and U.S. Treasury yields. A specific focus is placed on the 2022 geopolitical crisis by including the war dummy variable, which captures the shifts in bond market behavior pre- and post-invasion.

In addition to the separate country analyses, this paper also investigates cross-country dynamics, by comparing corporate and government bond yield spreads between Kazakhstan and Russia. This approach highlights the unique characteristics of each market, also revealing the interdependence of regional factors and the role of global factors. The findings aim to contribute to the existing literature on bond market dynamics in emerging economies while offering practical insights for managing financial risks in the presence of geopolitical and economic uncertainties.

In the paper, Section 2 reviews the relevant literature. Section 3 describes the data, key variables, and the model used. Section 4 presents regression results, covering

spread dynamics in Kazakhstan and Russia, as well as a cross-country analysis. Section 5 provides a cointegration analysis, and lastly Section 6 concludes with key findings and implications. References and appendices follow.

2. Literature review

In financial economics, the difference between corporate and government bond yields serves as a key metric, indicating the premium investors require for the higher risk of corporate bonds compared to the (in principle) lower risk of government bonds. This spread can reflect default risk, liquidity challenges within a country, or broader macroeconomic conditions (Collin-Dufresne et al., 2001; Gilchrist & Zakrajšek, 2012).

This thesis builds on Elton et. al.'s study, *Explaining the Rate Spread on Corporate Bond*s, and Gilchrist and Zakrajšek's (2012) seminal work, *Credit Spreads and Business Cycle Fluctuations*, which highlight that the spread between corporate and government bond yields is influenced by various macroeconomic, financial, and global factors. Both studies employ a dynamic panel approach, finding that spreads reflect credit market conditions, liquidity, and investor risk appetite. Similarly, this thesis adopts the Autoregressive Distributed Lag (ARDL) model, incorporating the lagged spread while also analyzing the relationship without the lag. The model was

applied to monthly data from 2010 to 2024 for each country individually and cross-country data as well.

Additionally, the methodology employed by Elton et al. (2001), provides a base for understanding the nature of the yield spreads. Their analysis highlights the relationship between the default risk, risk premiums and different variables that influence the yield spreads. These insights were utilized for the exploration of the determinants of the spread for Kazakhstan and Russia. The methodology leverages advanced econometric techniques, such as dynamic panel regressions and error correction models, to capture the short-term dynamics and long-term equilibrium relationships within bond markets. As demonstrated in Wright's (2009) work, incorporating lagged spread values allows for a nuanced understanding of how historical spread dynamics shape future market behavior.

This thesis also exploits Adrian et al.'s (2014) study, which emphasizes the significance of macroeconomic and financial variables in determining bond yield spreads. By incorporating variables such as industrial production, inflation, and oil prices, the analysis investigates their explanatory power in capturing the variation in corporate bond spreads relative to government securities in emerging markets.

The findings of this research contribute to the broader literature by examining the cross-country dynamics of bond yield spreads, particularly in the context of

Kazakhstan and Russia. The unique economic and geopolitical characteristics of these regions including the Russian invasion of Ukraine in 2022 offer a compelling case for understanding how local and global factors contribute to credit risk variations.

3. Model and data

For the analysis, a wide range of reputable sources were used, to ensure robustness and accuracy in analyzing bond yield spreads within and between Kazakhstan and Russia. Key variables were categorized into fundamental factors, such as corporate bond yields, government bond yields, interest rates, inflation, GDP growth rates, external debt, exchange rates, and industrial production indices, as well as common factors like crude oil and gold prices, political stability, and volatility indices.

Corporate bond yields were sourced from KASE and MOEX, while government bond yields for various maturities were retrieved from Bloomberg Refinitiv, Investing.com. Interest rates were obtained from KASE (TONIA) and MOEX (RUONIA), and inflation rates and GDP data were retrieved from national statistical agencies. Additional data on external debt, exchange rates, and international reserves were provided by the national banks of both countries. Common factors such as crude oil and gold prices were accessed via Bloomberg, while volatility indices,

including VIX, were sourced from FRED and local volatility indexes are calculated manually using local market stock index data.

3.1. The model

An autoregressive distributed lag (ARDL) model is used to explain government bond yield spreads in either Kazakhstan or Russia, or across them, at time t:.

$$\mathbf{Spreads_{it}} = \mathcal{F}(\boldsymbol{Fundamentals}, \boldsymbol{CommonFactors}) \qquad (\mathbf{1})$$

$$\mathbf{Spreads_{it}} = \alpha_i + \sum_{j=1}^{p_i} \lambda_{ij} \boldsymbol{Spreads}_{it-j} + \sum_{j=0}^{q_{1i}} \boldsymbol{\beta}_{ij} \boldsymbol{Fund.}_{it-j} + \sum_{j=0}^{q_{ni}} \boldsymbol{\delta}_{ij} \boldsymbol{Com.Fac.}_{it-j} + \boldsymbol{\varepsilon}_{it} \quad (\mathbf{2})$$

In the model i will indicate either Kazakhstan, Russian, or the cross difference of country specific variables.

Constant terms will capture unobservable factors that are constant over time for each country, such as structural economic conditions.

The coefficient of the lagged spread in the model indicates the degree of persistence in spreads, where higher values suggest that spreads are heavily influenced by their own past values.

Domestic Fundamental's coefficients measure the sensitivity of spreads to changes in domestic fundamentals mostly for macroeconomic indicators.

Common Factors is to capture the influence of shared external conditions (e.g., global risk aversion). If coefficients of common factors are significant, it shows that international factors play a crucial role in shaping spreads.

3.2 Summary statistics

Bond Spreads were obtained from the Central Banks of both countries, with monthly frequency. To perform the analysis, the bond spreads were calculated as differences between corporate bond yields and government bond yields across different maturities (1-year, 5-year, and 10-year) for Kazakhstan and Russia. On average: Kazakhstan's spreads range between 2.876% (5-year) and 4.343% (10-year), indicating a moderate risk premium. Russia's spreads are comparatively lower, ranging between 0.915% (10-year) and 1.824% (1-year), reflecting distinct local market conditions.

Table 1. Descriptive Statistics of Spreads in Kazakhstan and Russia

Variable	Obs	Mean	Std. Dev.	Min	Max
bond spread 1y kz	289	4.128	5.255	-9.13	14.26
bond spread 5y kz	289	2.876	4.072	-6.74	11.21
bond spread 10y kz	221	4.343	2.715	.58	10.79
bond spread 1y ru	181	1.824	1.51	-4.16	11.212
bond spread 5y ru	181	1.054	1.105	-1.54	7.044
bond spread 10y ru	181	.915	1.444	-1.483	7.823

For further analysis of the separate country spreads, I used local market performance indicators as well as macroeconomic determinants that play a crucial role in assessing the country's creditworthiness.

For Kazakhstan - Kazakhstan-Specific Economic and Financial Indicators are shown in Table 2. **KASE Indicators**: Corporate bond yields average 11.02%, while market price movements (KASE Price) and daily returns show moderate volatility. **Industrial and Monetary Data** Industrial production (KZ Ind Prod) shows significant variation, while TONIA (interbank interest rate) averages 11.85%.

Currency and Balance of Payments, The KZT/USD exchange rate averages 237.46, reflecting long-term depreciation trends. The current account balance (KZ CA BOP) is negative on average, signaling persistent deficits. As for **external and international reserves** - Gross international reserves average 18.58 billion USD, highlighting a strong buffer for macroeconomic stability.

Table 2. Descriptive Statistics of Variables Used in Kazakhstan's Model

Variable	Obs	Mean	Std. Dev.	Min	Max
KASE Corp Bond Yield	290	11.019	2.633	7.03	17.9
KZ Ind Prod	120	16121.583	10883.997	1087	48007
KZ IR TONIA	125	11.852	7.228	.68	75.92
KASE Price	205	2053.046	1116.405	639.76	5314.86
KASE Daily Return	205	0	.013	-.051	.088
VIX Local StdDev	205	.191	.179	.035	1.585
KZ CA BOP	292	-308.332	2039.828	-5247.933	9885.334
Gross Int Reserves	369	18581.686	13464.101	642	44547
Net Int Invest Pos	283	-40790.234	20217.701	-79703.164	-11113.784
USD to KZT	301	237.462	126.749	118.41	485.04
EUR to KZT	301	275.376	135.061	121.25	534.96
RUB to KZT	301	5.09	.703	2.66	9.1
KZ Ext Debt USD	283	113606.01	55348.755	12634.572	168847.75
GDP KZT	150	5405288.5	2991399.7	1354656.6	16216032

For Kazakhstan - Russia-Specific Economic and Financial Indicators **MOEX Indicators**: The MOEX Index exhibits moderate growth with a daily return near zero, and volatility remains similar to Kazakhstan's local market.

Industrial and Monetary Data: Industrial production (RU Ind Prod) is relatively stable, while interbank rates (8.3% on average) reflect differing monetary policies. **Currency and Balance of Payments**: The RUB/USD exchange rate (45.59 on average) reflects significant depreciation, while the current account shows a surplus (average of 14.56 billion USD).

Reserves and External Debt: Russia's international reserves are significantly higher than Kazakhstan's, averaging 314.97 billion USD, with external debt levels reflecting extensive borrowing.

Table 3. Descriptive Statistics of Variables Used in Russia's Model

Variable	Obs	Mean	Std. Dev.	Min	Max
MOEX Corp Bond Yield	181	9.377	2.487	6.02	18.55
RU Ind Prod(% prev)	307	100.499	6.598	77.8	124.4
RU IR RUONIA	173	8.298	3.864	.42	20
MOEX Index Price	130	2451.196	679.707	1306.01	4150
MOEX Daily Return	130	.001	.022	-.076	.183
VIX Local StdDev	129	.197	.211	.051	1.723
RU CA BOP	364	14560.211	13556.044	-4557.061	79982.852
Gross Int Reserves (RU)	361	314966.94	226563.11	4627	633737
Net Int Invest Pos	283	346586.74	244458.85	-163266.19	887539.52
USD to KZT	297	45.586	20.978	23.429	97.227
RUB to KZT	301	5.09	.703	2.66	9.1
RU Ext Debt USD	259	448423.85	143293.21	151224.98	732779
GDP RU	306	5505.996	4180.483	282.295	18083.844

Global Macroeconomic Indicators. **Commodities and Global Risk**: Oil prices average 54.99 USD, with substantial fluctuations, while gold prices remain high (1338.36 USD on average). The VIX Index (20.03) indicates a moderate level of global market uncertainty.

Political Stability: Data for this variable was obtained from world bank, and last indexes as for 2022 show that, Kazakhstan scores higher (62.87) than Russia (28.99)

in political stability indices, reflecting greater institutional and geopolitical stability.

Global Interest Rates: The 3-month U.S. Treasury Bill rate (2.39% on average).

War Dummy: The dataset includes a war dummy variable (0 = pre-war, 1 = post-war) with an average of 0.094, capturing the period after February 2022.

Table 4. Descriptive Statistics of explanatory variables in Global Context

Variable	Obs	Mean	Std. Dev.	Min	Max
Oil Price USD	370	54.987	28.903	11.22	140
Gold Price USD	236	1338.361	462.147	417.25	2747.56
VIX CBOE	361	20.029	7.751	9.51	59.89
KZ Pol Stability	24	62.87	13.415	42.18	90.047
RU Pol Stability	24	28.987	6.217	16.99	40.094
TBill 3Months	370	2.388	2.124	-.01	6.19
War Dummy	372	.094	.292	0	1

3.3 Target variable choice

The target variable in this analysis is the spread between corporate bond yields and government bond yields across different maturities, derived from data on local stock exchanges. The figure 1. indicates a sharp decline in early 2015, coinciding with the Kazakhstani central bank's transition to a floating exchange rate regime. Similar declines are observed during the COVID-19 pandemic and Russia's invasion of Ukraine, with the 1-year spread notably dropping below zero, reflecting heightened market volatility and shifting risk perceptions during these events.

Kazakhstani Bond Yield data is available from early 2000 till 2024 based on the monthly frequency.

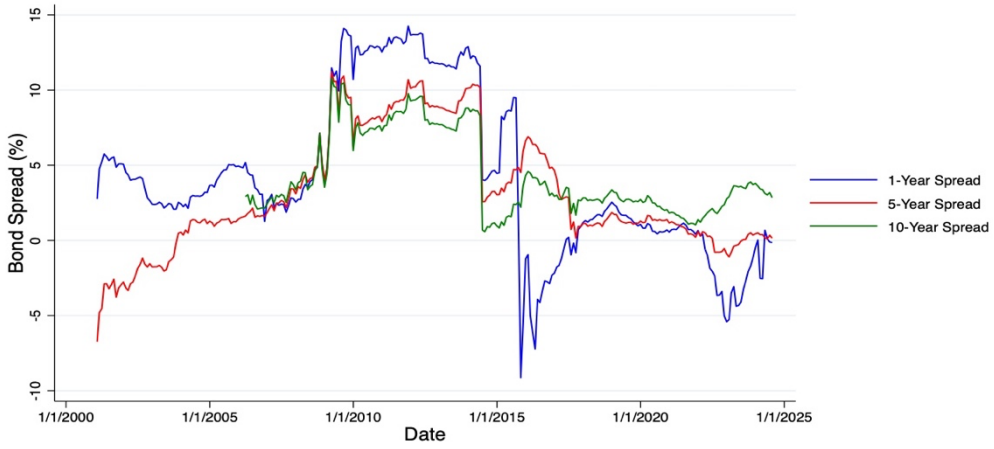

Figure 1. Credit spreads of Kazakhstan for different maturities

The Russian spread data, beginning in 2008, Figure 2, exhibits notable volatility driven by multiple economic and geopolitical factors. A notable drop in the spreads between 2014 and 2016 is attributable to key events such as the annexation of Crimea, the subsequent imposition of economic sanctions, a sharp decline in global oil prices, and a significant devaluation of the ruble. These developments collectively heightened market uncertainty, impacted fiscal stability, and disrupted the bond market dynamics.

Post-2022, spreads across all maturities again fell below zero, highlighting the critical role of geopolitical tensions—primarily rising from Russia's invasion of Ukraine. The geopolitical context clearly shaped the trajectory of Russian spreads, determining their overall volatility and trends.

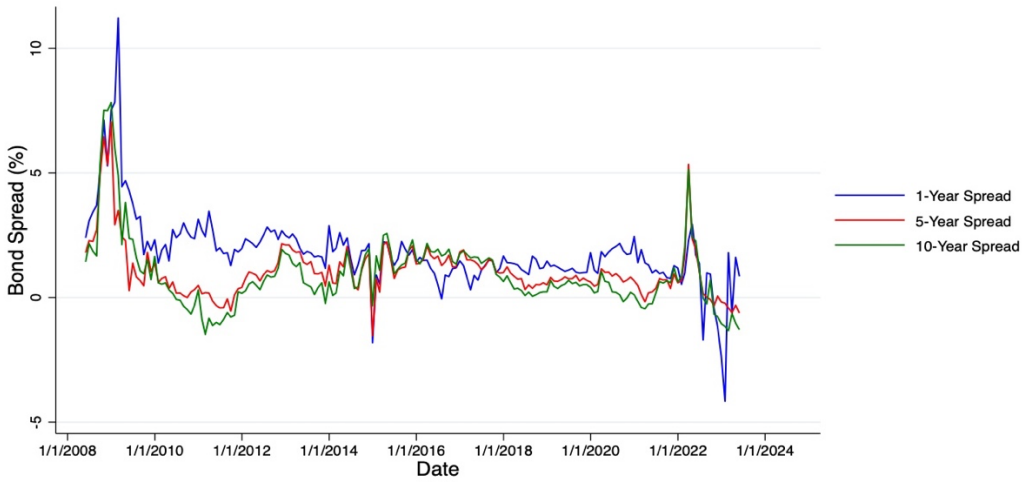

Figure 2. Credit spreads of Russia for different maturities

In Figure 3, the Corporate Bond Index Yields reveal contrasting trends between Kazakhstan and Russia. Following the regime change in Kazakhstan, yields experienced a significant decline, dropping from approximately 15% to 8%. In contrast, the MOEX Index for Russia shows an opposing trend, with yields rising from around 8% to 15%. During the war period, the MOEX Index also exhibits a sharp increase, highlighting the impact of geopolitical tensions on Russian corporate bond yields.

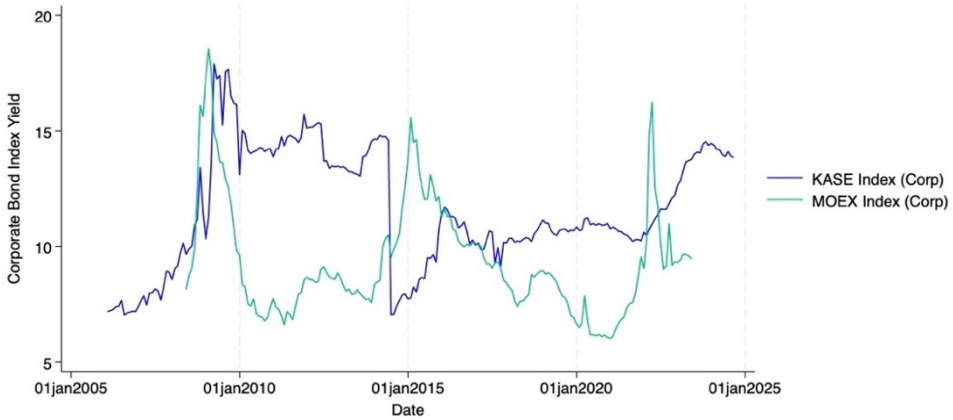

Figure 3. Corporate Bond Index Yields dynamics

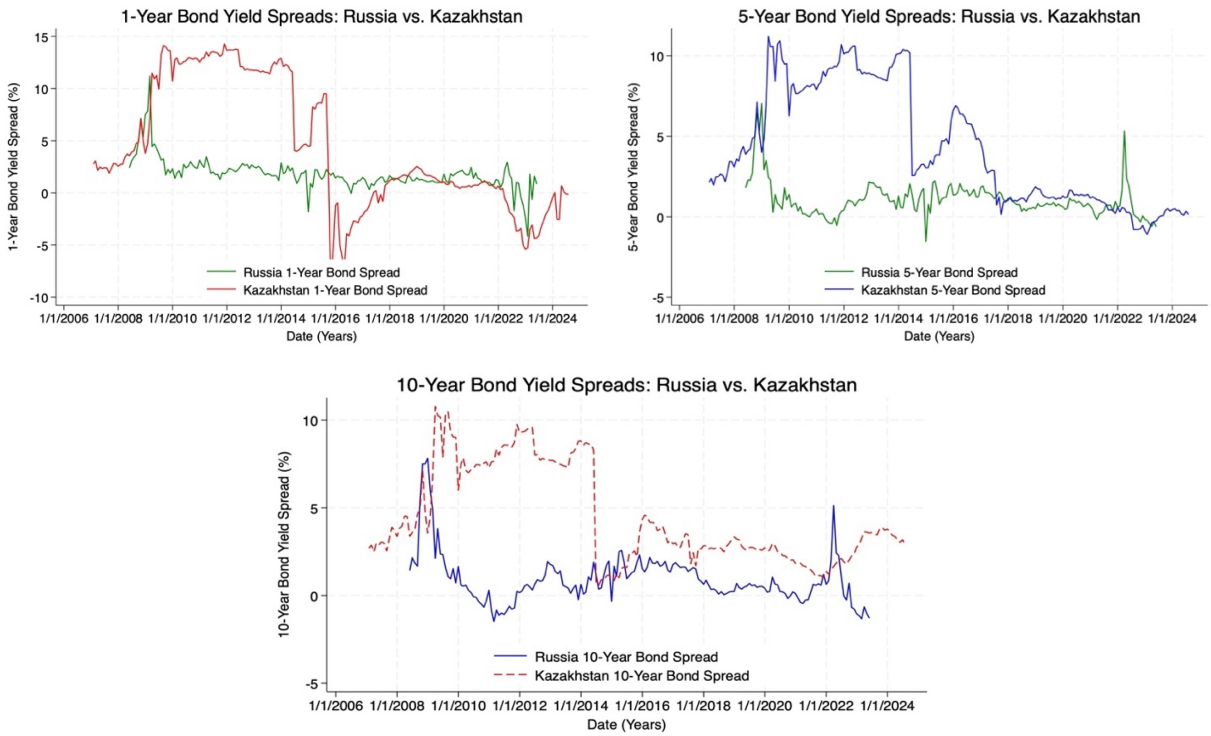

Figure 4. Dynamics of Spreads over-time (cross – country)

Figure 4. illustrates the dynamics of bond yield spreads for both countries on a single graph. As evident from the graph, Kazakhstan's spreads across various maturities were significantly higher until early 2015. However, following that period, the spreads of both countries began to move in closer alignment with each other.

Figure 5. highlights contrasting trends in bond yields for Kazakhstan and Russia. In Kazakhstan, the transition from a fixed to a floating exchange rate regime had a significant impact on short-term government bond yields, evident in the sharp spike observed during this period. In contrast, yields on longer-term bonds displayed a more muted response to the regime change. For Russia, the data

reveal a consistent pattern across all bond types, with notable spikes corresponding to major events such as the Global Financial Crisis, the annexation of Crimea, the Global Pandemic, and the invasion of Ukraine. Russian yields generally exhibit higher variance coefficients, indicating greater volatility, while Kazakhstani yields tend to follow a smoother and more stable trajectory.

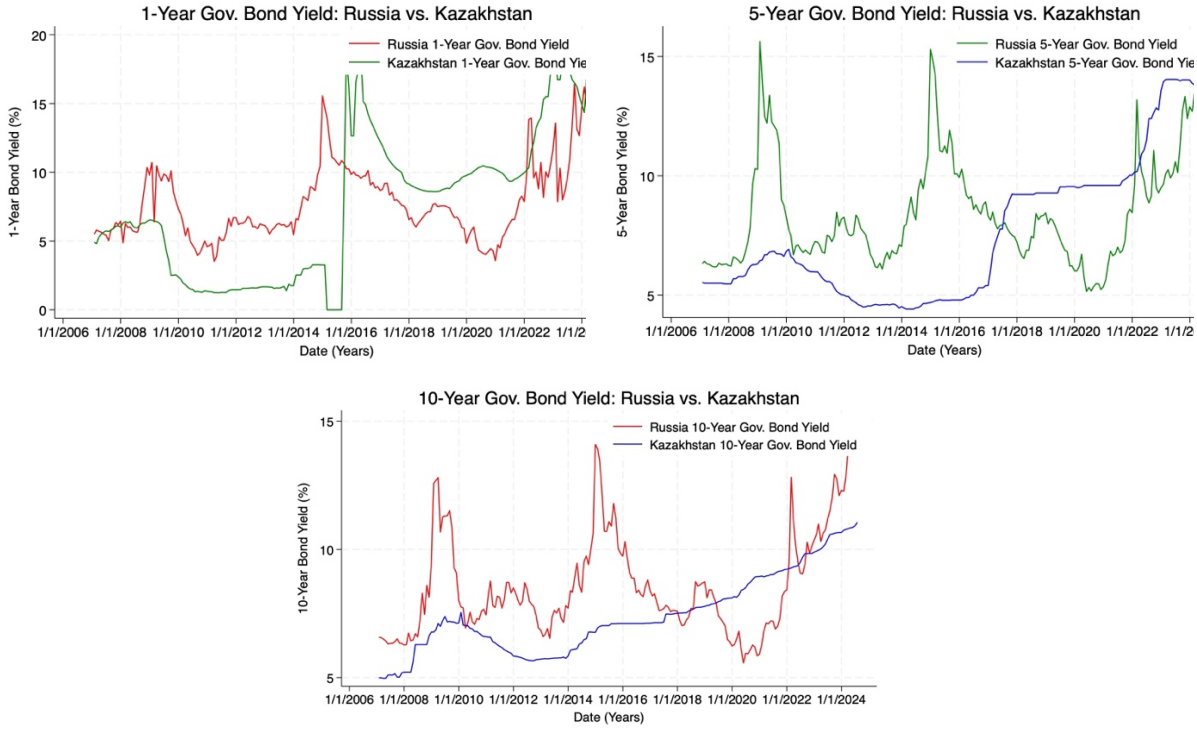

Figure 5. Dynamics of Government Bond Yields over-time (cross – country)

4. Regression results

In this section, we will present the results of the regressions conducted for the fixed markets of Kazakhstan and Russia separately, as well as the cross-country analysis,

where the differences in corporate bond yields and government bond yields with the same maturities for both countries serve as the response variables.

4.1 Spread dynamics in Kazakhstan's fixed-income market

a) Regression results, best model for short term spread (Table 1)

This analysis applies the variables that best explain the short-term 1-year spread to models for the medium-term 5-year and long-term 10-year spreads. However, while these variables effectively capture short-term variations, they may not fully account for the dynamics of medium- and long-term spreads due to differing factors influencing these maturities. The main variables utilized in this part of the analysis include: kase_daily_return, current_account_to_gdp, gross_res_to_gdp, int_investment_kzt, rub_in_kzt_growth_yoy, inflation_yoy_kzt, gdp_growth_yoy, war_dummy, tbill_3months, oil_growth_rate_yoy.

An increase of 1% in the daily return of the local stock index leads to an increase in the spread of 49.37 basis points for 1-year bonds and 23.5 basis points for 5-year bonds, significant at the 1% and 10% levels, respectively. From an economic and financial perspective, two key arguments support this finding. Elton et al. (2001) and Gilchrist et al. (2012) suggest that strong stock market performance boosts investors' risk appetite, reducing demand for corporate bonds. This decline in demand lowers bond prices, raises yields, and consequently widens the spreads. Additionally, the implementation of tighter monetary policies to address inflationary pressures

increases borrowing costs for firms, further contributing to the widening of spreads with the time delay.

Next three variables collectively can be used as a metrics for macroeconomic stability and growth. Those are the *Current account, Gross International Reserves, and International investment as a percentage of GDP*. Basically, the higher the ratios the better, since they represent external balances, financial stability and liquidity, role of foreign direct investment respectively and they capture the effect of variation from the point of view macroeconomics. The main significant variables in this analysis are the *current account to GDP ratio and international investment to GDP*.

The current account to GDP is significant at the 1% level for the 1-year and 10-year spreads, and at the 5% level for the 5-year spread. A 1% increase in the current account to GDP ratio is associated with an increase in the spreads by 7.57 basis points for the 1-year spread, 3.61 basis points for the 5-year spread, and 5.13 basis points for the 10-year spread.

Meanwhile, the ***international investment to GDP ratio*** is significant at the 1% level for all maturities. A 1% increase in the international investment to GDP ratio leads to an increase in the spreads by 0.894 basis points for the 1-year spread, 2.073 basis points for the 5-year spread, and 0.996 basis points for the 10-year spread. These results demonstrate that while both variables significantly affect bond spreads, the current account to GDP ratio has a stronger influence on the short-term and long-

term spreads, whereas the international investment to GDP ratio has a consistent but smaller impact across all maturities. It aligns with the findings As **Elton et al. (2001)** state, when a country has a healthy current account surplus, and strong foreign account, it can signal **economic stability** and **lower borrowing costs**. However, **Gilchrist and Zakrajšek (2012)** argue that this can also lead to tighter liquidity conditions in the credit markets, where investors may shift their focus to less risky government securities, thus increasing spreads.

Third macro variable is the ***Gross international reserves to GDP***. An increase of 1% in the ***Gross International Reserves to GDP*** ratio leads to a narrowing of the short-term 1-year spread by 5.487 basis points on average. This is because higher international reserves indicate a stronger liquidity position, meaning the country has more resources available to cover short-term financial obligations. As a result, the perceived risk decreases, which makes corporate bonds less risky and lowers their yields.

According to the results, the ***inflation rate*** in the country has a negative effect. A 1 percentage point increase in the inflation rate narrows the 1 year spread by 33.39 basis points. Inflation's effects on spread can vary, depending on expectations and economic conditions. While it can widen spreads due to higher borrowing costs, it can also narrow spreads if inflation is controlled or driven by growth.

Exchange rate fluctuations between the Kazakhstani Tenge (KZT) and Russian Ruble (RUB) significantly impact bond spreads. A 1% increase in the RUB/KZT exchange rate narrows the 1-year spread by 1.88(10% significance level) basis points but widens the 5-year and 10-year spreads by 1.77(10% s.l) and 2.22(1% s.l) basis points, respectively. This aligns with Elton et al. (2001), who highlight that exchange rate changes affect bond yields differently across maturities.

Regional and global factors, such as the ***war dummy variable, the 3-month T-bill rate, and the year-over-year growth rate of oil prices,*** significantly explain variations in bond spreads across all maturities (1-year, 5-year, and 10-year). During the post-war period (after February 24, 2022), spreads narrowed by 2.94, 2.31, and 1.94 percentage points for 1-year, 5-year, and 10-year bonds, respectively. This can be attributed to heightened uncertainty prompting fiscal and monetary interventions by governments, which collectively reduce credit risk and market premiums. As a result, these measures contribute to a narrowing of spreads.

The 3-month US T-bill rate, a proxy for the risk-free interest rate, serves as a benchmark for other yields, including corporate bond yields. In Kazakhstan, US T-bills represent a low-downward-risk investment, and their yield influences liquidity and risk premiums. Findings align with Elton et al. (2001) and Fama and French (1993), which demonstrate that liquidity and credit risk premiums decline during periods of economic recovery, shifting preferences toward short-term debt.

Specifically, a 1-percentage-point increase in the T-bill rate narrows the 1-year and 5-year spreads by 72.4 and 40.3 basis points, respectively, but widens the 10-year spread by 31.0 basis points due to greater long-term uncertainty and increased risk premiums. This reflects the distinct dynamics of short-term liquidity preferences versus long-term risk aversion.

Table 1. Regression results for Kazakhstan, where the significant variables for the 1-year spread are applied to all spread maturities.

VARIABLES	1 Year Spread	5 Year Spread	10 Year Spread
kase_daily_return	49.37***	23.50*	22.55
	(15.89)	(14.04)	(14.00)
current_account_to_gdp	7.568***	3.613**	5.127***
	(1.946)	(1.570)	(1.670)
gross_res_to_gdp	-5.487***	1.006	-0.345
	(0.799)	(0.725)	(0.604)
int_investment_kzt_to_gdp	0.894***	2.073***	0.996***
	(0.251)	(0.190)	(0.174)
rub_in_kzt_growth_yoy	-1.880*	1.772*	2.215**
	(1.038)	(1.013)	(1.053)
inflation_yoy_kzt	-0.334***	0.017	0.007
	(0.072)	(0.056)	(0.050)
gdp_growth_yoy	2.311	-0.848	-1.686
	(2.123)	(1.031)	(1.164)
war_dummy	-2.935***	-2.314***	-1.943***
	(0.941)	(0.533)	(0.528)
tbill_3months	-0.724***	-0.403***	0.310***
	(0.141)	(0.0887)	(0.0950)
oil_growth_rate_yoy	-0.958*	-0.290	0.0401
	(0.571)	(0.397)	(0.417)
Constant	20.99***	9.527***	8.123***
	(1.327)	(1.514)	(1.502)
Observations	135	135	135
R-squared	0.867	0.770	0.502

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

b) Regression results, best model for medium- and long-term spread (Table 2)

In this part of the analysis, we employed similar variables, but selected the overall set of variables, that suits the medium- and long-term period. We examine how key variables affect bond spreads across short-term (1-year), medium-term (5-year), and long-term (10-year) maturities. The first variable is ***KZ_IR_TONIA,*** an indicator that depicts the overnight index average rate, and according to the KASE stock exchange source it is considered a relatively risk-free rate by the market participants in the money market. The interbank rate does not significantly influence the 1-year spread but has a positive and significant effect on the 5-year and 10-year spreads. Specifically, a 1-percentage point increase in TONIA raises the 5-year and 10-year spreads by 4.3 and 2.0 basis points, respectively. These results suggest that higher interbank rates increase borrowing costs, impacting medium- and long-term debt more substantially due to their higher risk and longer duration, this finding aligns and supports the previous conclusion we made in section 4.1 a, where tighter monetary policy widens the spread.

Local Stock market performance is represented as ***KASE Daily Return***. While not significant for the 1-year and 5-year spreads, a 1% increase in the daily return of the KASE index widens the 10-year spread by 8.60 basis points at 5% significance level. This aligns with Elton et al. (2001) and Gilchrist et al. (2012), who argue that strong stock market performance reflects increased risk-taking behavior, reducing demand

for long-term corporate bonds and widening their spreads. In reference to the finding of Fama (1981), this pattern is in line with market behavior where equity market movements often have a stronger impact on longer-term securities.

Macro determinants Gross Reserves to GDP, International Investment to GDP, RUB/KZT Growth (Month-over-Month), USD/KZT Growth (Month-over-Month) also play crucial role in explaining the variations in the spread.

In the case of ***Gross Reserves to GDP*** 1% increase in gross reserves to GDP narrows the 1-year spread by 7.78 basis points but widens the 5-year and 10-year spreads by 2.91 and 1.87 basis points, respectively. While higher reserves signal short-term stability and liquidity, they may encourage long-term government spending or investment, failing to decrease for longer maturities. This also aligns with the conclusion in the previous section. Whereas for ***International Investment to GDP***, International investment has a mixed impact: 1% increase in the ratio ***of International Investment to GDP*** has no significant effect on the 1-year spread but a widening effect on the 5-year and 10-year spreads by 1.40 and 0.20 basis points, respectively. This suggests that medium-term spreads are more sensitive to foreign investment flows, which may increase funding costs.

Exchange rate fluctuations (appreciation of ruble) in the case of ***RUB/KZT*** significantly widen the 5-year and 10-year spreads by 3.07 and 1.57 basis points,

respectively, but do not affect the 1-year spread. This reflects heightened exchange rate risks for medium- and long-term debt, as investors demand higher premiums for uncertainty. However, in the case of ***USD/KZT*** month-over-month growth rate, a 1% increase in ***USD/KZT*** growth widens the 1-year spread by 17.52 basis points but narrows the 5-year and 10-year spreads by 2.30 and 2.48 basis points, respectively. This suggests short-term currency risks are priced into immediate maturities, while medium- and long-term spreads benefit from potential stabilization measures.

Among the global factors such as ***3-Months T-Bill Rate, Oil Growth Rate (YOY), War Dummy,*** coefficients are consistent with the theoretical framework and align with the explanations provided in the earlier analysis.

In the case of the ***War Dummy Variable***. The war dummy remains significant across all maturities and corresponds to the same explanation as in the previous section.

These findings underscore the varying impacts of domestic and global factors on bond spreads across maturities. Short-term spreads are more influenced by liquidity measures and immediate risks, while medium- and long-term spreads are to a greater extent shaped by structural economic factors, exchange rate risks, and global uncertainties.

Table 2. Regression results for Kazakhstan, where the significant variables for the long-term spreads are applied to all spread maturities.

VARIABLES	1 Year Spread	5 Year Spread	10 Year Spread

kz_ir_tonia	-0.0443	0.0433***	0.0198***
	(0.0473)	(0.0142)	(0.00538)
kase_daily_return	-3.075	10.68	8.595**
	(18.62)	(7.834)	(4.052)
tbill_3months	-0.518***	-0.213***	0.518***
	(0.153)	(0.0645)	(0.0406)
oil_growth_rate_yoy	0.0117	-0.843***	-0.684***
	(0.502)	(0.229)	(0.124)
gross_res_to_gdp	-7.778***	2.912***	1.874***
	(0.786)	(0.468)	(0.225)
int_investment_kzt_to_gdp	-0.410	1.397***	0.202***
	(0.247)	(0.122)	(0.0611)
rub_in_kzt_growth_mom	3.399	3.074***	1.567**
	(3.482)	(0.914)	(0.754)
usd_in_kzt_growth_mom	17.52**	-2.295	-2.483*
	(6.910)	(2.020)	(1.269)
war_dummy	-4.443***	-1.298***	-0.591***
	(0.695)	(0.252)	(0.167)
Constant	17.39***	1.252*	-1.541***
	(1.570)	(0.719)	(0.379)
Observations	121	121	121
R-squared	0.710	0.816	0.767

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

c) Regression results, lagged dependent variables are included (Table 3).

In this regression, AR1 was utilized, and the variables were selected based on the term of the spreads: short-term variables for shorter-term spreads and long-term variables for longer-term spreads. Each model also includes a lag of the dependent variable, reflecting the monthly nature of the data. Since the data is observed monthly, only one lag was used. The results demonstrate strong historical persistence, particularly for the 1-year and 5-year spreads, consistent with findings by Mankiw et al. (n/a) and Diebold et al. (2006). These studies highlight that financial variables often exhibit persistence and inertia, as well as delayed responses

to macroeconomic policies and shocks. In this analysis, the coefficients for the lagged 1-year and 5-year spreads are 0.601 and 0.587, respectively, both significant at the 1% level. This indicates that a substantial portion of the current spreads is explained by their previous values, underscoring the strong persistence in these markets. Other coefficients are consistent with findings explained earlier in the paper.

Table 3. Regression results for Kazakhstan with Lagged Variables Included in the Model

VARIABLES	1 Year Spread	5 Year Spread	10 Year Spread
L.bond_spread_1y	0.601***		
	(0.103)		
L.bond_spread_5y		0.587***	
		(0.216)	
L.bond_spread_10y			0.235
			(0.173)
growth_rate_yoy_perc_tonia	0.266		
	(0.396)		
kase_daily_return	42.14***	8.134*	7.700**
	(15.25)	(4.734)	(3.449)
current_account_to_gdp	3.374**		
	(1.493)		
gross_res_to_gdp	-1.251	1.035	1.405***
	(0.899)	(0.865)	(0.437)
int_investment_kzt	0.232	0.411*	0.0950*
	(0.151)	(0.238)	(0.0554)
rub_in_kzt_growth_yoy	-2.733***		
	(0.982)		
inflation_yoy_kzt	-0.074		
	(0.081)		
gdp_growth_yoy	1.282		
	(1.484)		
war_dummy	-2.162**	-0.576**	-0.426**
	(0.915)	(0.247)	(0.168)
kz_ir_tonia		0.0314**	0.0204***
		(0.0141)	(0.00586)
tbill_3months		-0.0714	0.397***
		(0.0436)	(0.105)

oil_growth_rate_yoy		-0.623**	-0.604***
		(0.299)	(0.171)
rub_in_kzt_growth_mom		0.894	0.985
		(0.648)	(0.608)
usd_in_kzt_growth_mom		-0.486	-1.756
		(1.233)	(1.104)
Constant	4.964***	-0.0173	-1.434**
	(1.630)	(0.653)	(0.571)
Observations	121	121	121
R-squared	0.871	0.906	0.805

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.2 Spread dynamics in Russia's fixed-income market

a) Regression results, with no lagged variables included (Table 4)

When analyzing the Russian market, we applied the same approach as in the models for Kazakhstan. The first group of variables represents local market performance, including the RUONIA (local overnight interest rate index), the ratio of international investment to GDP, gross international reserves as a percentage of GDP, exchange rates within the region, GDP growth rate, and local stock market volatility. Additionally, the models incorporate global and regional factors, such as oil price growth, a war dummy variable, and the U.S. T-bill rate.

From the local variables, the interest rate change is depicted in the ***RUONIA***, according to the results, variations in the overnight interest rate explains the variations in short term 1 year spread and long term 10 year spread. Specifically, 1% increase in the interest rate narrows the 1 year spread by 1.23 Basis points and widens the 10-year spread by 0.62 basis points. Short term effect of the tightening

monetary policy aligns with the finding in Diebold et al. (2006) whereas the widening effect aligns with Taylor, J. B. (2009), who argues that investors in the long run may anticipate a slowdown and inflationary pressure, which leads them to require higher returns in general.

The model incorporates two key ratios to reflect economic productivity and efficiency: international investment as a percentage of GDP and gross international reserves as a percentage of GDP. ***The international investment-to-GDP ratio*** significantly explains variations across all spreads but shows mixed effects. A 1% increase in this ratio narrows the 1-year spread by 0.03%, while it widens the 5-year and 10-year spreads by 0.03% and 0.05% basis points, respectively. The narrowing of short-term spreads reflects improved liquidity, which lowers short-term borrowing costs, as highlighted by Bernanke et al. (1999). However, the widening of long-term spreads results from increased reliance on external conditions, raising risk premiums for longer maturities.

In contrast, Russia's fixed-income market reacts differently to the ***gross international reserves-to-GDP ratio***. This variable significantly explains long-term spread variations at the 1% level, consistently narrowing spreads. The difference arises from local investors' risk perceptions and economic structures between Russia and Kazakhstan. Kazakhstan's history of frequent regime changes undermines policy credibility, while Russia benefits from more prudent fiscal policies. As noted by the

IMF (2017), high reserves combined with sound fiscal management reduce long-term risk premiums, particularly in economies facing heightened geopolitical risks, such as Russia.

Exchange rates also influence bond spreads, but their effects vary depending on the currency and spread term. When the ruble appreciates against the Kazakhstani tenge, the 1-year spread widens, while the 5-year and 10-year spreads narrow. This suggests that short-term funding risks increase with ruble strength, possibly due to higher borrowing costs in rubles. In contrast, longer-term spreads narrow as markets anticipate greater economic stability or expect policy adjustments to mitigate risks over time. This aligns with findings from Eichengreen and Hausmann (1999), who emphasize that exchange rate movements often reflect short-term volatility but stabilize expectations in the medium to long term.

For the ***U.S. dollar***, the results differ: when the ruble depreciates relative to the dollar, spreads narrow across all terms. This pattern reflects global investor sentiment, where a stronger dollar signal improved external stability for Russia, reducing perceived risks. As Obstfeld and Taylor (n/a) highlight, exchange rate dynamics against major global currencies like the dollar often shape investor confidence, particularly in emerging markets with significant external debt exposure.

The local market volatility index reflects near-term risk perceptions among market participants. In the model, this index significantly widens bond spreads across all maturities, with coefficients highly significant at the 1% level. This behavior aligns with the findings of Zhou and Zhang (2020), which demonstrate that elevated volatility indices are strongly correlated with widening credit spreads due to increased risk premiums.

Third group of variables explain the global fundamentals and regional war dummy, which accounts for the time after the 24th of February 2022. Among global factors, the strongest effect can be attributed to ***US 3 months T-bill rate,*** 1 percentage point increase in T-bill narrows the 1, 5, 10- year spreads by 0.32, 0.23, 0.31 percent's respectively.

An increase in T-bill yields typically reflects higher global asset premiums, which can reduce the demand for emerging market debt as investors shift to safer assets. This relationship aligns with findings by Dominguez et al. (2019), which demonstrate how global financial conditions influence capital flows and sovereign spreads.

Similarly, the ***"war dummy"*** variable narrows bond spreads across all maturities, with coefficients significant at the 1% level. This effect can be attributed to fiscal and monetary interventions aimed at stabilizing the economy during periods of heightened geopolitical risk. These interventions often improve market liquidity,

which reduces spreads. This observation is consistent with Adrian et al. (2021), who highlight that central bank liquidity measures during crises significantly narrow bond spreads.

Table 4. Regression results for Russia's 1, 5, 10-year credit spreads

VARIABLES	1 Year Spread	5 Year Spread	10 Year Spread
growth_rate_yoy_perc_ruonia	-1.225**	0.149	0.618**
	(0.534)	(0.246)	(0.237)
int_investment_rub_to_gdp	-0.000253***	0.000304***	0.000480***
	(9.48e-05)	(7.62e-05)	(9.09e-05)
gross_int_reserves_to_gdp	-8.79e-06	-0.000556***	-0.000887***
	(0.000162)	(8.08e-05)	(8.42e-05)
rub_to_kzt_yoy	1.321***	-0.731***	-1.267***
	(0.358)	(0.265)	(0.259)
usd_to_rub_mom	-5.407***	-2.839**	-2.507**
	(1.689)	(1.247)	(1.077)
gdp_growth_yoy	2.449	-2.414**	-1.749
	(2.463)	(0.992)	(1.100)
ru_volatility_index_yearly	1.785***	1.918**	1.771**
	(0.529)	(0.821)	(0.725)
war_dummy	-0.164**	-0.920***	-1.256***
	(0.431)	(0.240)	(0.261)
oil_growth_rate_yoy	-0.264	-0.00504	-0.399*
	(0.330)	(0.219)	(0.204)
us_tbill_rate	-0.317***	-0.225***	-0.311***
	(0.104)	(0.0462)	(0.0496)
Constant	2.094***	1.946***	2.440***
	(0.435)	(0.348)	(0.379)
Observations	112	112	112
R-squared	0.437	0.589	0.734

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

b) Regression results, with lagged dependent variables included (Table 5)

The Table 5 below presents models incorporating the same variables but includes a one-month lag of the respective bond spreads to account for their historical

dependency. By introducing these lags, the models aim to evaluate the extent to which current spreads are influenced by their past values.

The results indicate that the lagged 5-year spread (coefficient: 0.293, significant at the 5% level) and the lagged 10-year spread (coefficient: 0.408, significant at the 1% level) exhibit strong persistence. This suggests that longer-term spreads are notably affected by their own past values, reflecting greater inertia and historical dependency. Conversely, the 1-year spread lag is not statistically significant, implying that shorter-term spreads contain less inertia and may react more dynamically to new information and short-term market conditions.

These findings are consistent with Zhou and Zhang (2020), who noted that longer-term bond spreads tend to display greater persistence due to their sensitivity to macroeconomic fundamentals and risk premium adjustments.

Table 5. Regression results for Russia's 1, 5, 10-year credit spreads including their own lags

VARIABLES	1 Year Spread	5 Year Spread	10 Year Spread
L.bond_spread_1y_ru	0.133		
	(0.203)		
L.bond_spread_5y_ru		0.293**	
		(0.132)	
L.bond_spread_10y_ru			0.408***
			(0.104)
growth_rate_yoy_perc_ruonia	-1.145**	0.00110	0.211
	(0.554)	(0.232)	(0.256)
int_investment_rub_to_gdp	-0.000215**	0.000204**	0.000251**
	(9.99e-05)	(8.67e-05)	(9.80e-05)
gross_int_reserves_to_gdp	-1.89e-05	-0.000399***	-0.000520***
	(0.000158)	(0.000111)	(0.000119)
rub_to_kzt_yoy	1.249***	-0.454*	-0.695**
	(0.394)	(0.272)	(0.274)

gdp_growth_yoy	2.162	-1.409	-0.356
	(2.213)	(1.004)	(0.964)
ru_volatility_index_yearly	1.710***	1.959**	1.870***
	(0.516)	(0.770)	(0.628)
usd_to_rub_mom	-4.886**	-2.060	-1.568
	(1.950)	(1.485)	(1.212)
war_dummy	-0.161**	-0.865***	-1.029***
	(0.442)	(0.199)	(0.230)
oil_growth_rate_yoy	-0.240	-0.0384	-0.307
	(0.311)	(0.211)	(0.187)
us_tbill_rate	-0.274***	-0.129**	-0.148**
	(0.0908)	(0.0634)	(0.0595)
Constant	1.813***	1.290***	1.328***
	(0.559)	(0.453)	(0.436)
Observations	112	112	112
R-squared	0.449	0.630	0.786

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.3 Cross-country analysis of yield differences (Table 6)

In the cross-country analysis, the dependent variables represent the differences in ***government bond yields of the same maturity and corporate bond yields*** between Russia and Kazakhstan, which is modeled against the ratios or differences of explanatory variables specific to each country. For the corporate bond yield difference model, we added relatively safer variable as the difference between the two countries' 1-year government bond yields.

The results indicate that a 1 percentage point increase in the cross-country 1-year bond spread widens the Corporate Yield Spread by 0.215 ($p<0.05$). This finding underscores the strong link between corporate spreads and short-term risk premiums

in the region. This suggests that corporate spreads in the region are closely tied to the shorter-term risk premium.

The analysis shows that the ratio of ***Russia's international reserves to Kazakhstan's reserve***s has a significant impact on narrowing spreads. When this ratio increases—either because Russia's reserves rise or Kazakhstan's reserves decline—the spreads for the 5-year (-0.498, $p<0.01$), 10-year (-0.278, $p<0.01$), and corporate bonds (-0.263, $p<0.01$) all decrease. Higher reserve levels in emerging markets are seen as a sign of fiscal strength.

Inflation differences significantly widen spreads across all maturities, except for corporate yield spread, with the most substantial impact on short-term spreads (0.489, $p<0.01$).

In terms of the foreign exchange market, exchange rates portray significant results, for example: ***RUB to KZT*** (negative coefficients for all spreads), Ruble appreciation narrows spreads, reflecting Russia's stronger economic standing in the regional context. In the case of the US Dollar, ***USD to RUB*** (negative coefficients for all spreads), similar to the above, ruble depreciation relative to the dollar narrows spreads.

Geopolitical and global factors, such as the 3-month ***U.S. T-bill rate and the war dummy***, show significant impacts on the spreads. An increase in the 3-month T-bill rate widens the 1-year spread but narrows the corporate and 5-year spreads,

consistent with earlier observations that higher global risk-free rates can shift investor preferences.

The ***war dummy*** significantly widens all spreads (ranging from 2.209 to 4.245, $p<0.01$), underscoring the destabilizing effects of conflict periods. This is consistent with prior findings, which attribute these effects to heightened risk aversion and increased credit risk during wartime. Specific reasons for the impact on spreads in Russia and Kazakhstan have been detailed earlier, reflecting differences in fiscal policies, economic structures, and risk perceptions in the two countries.

Table 6. Cross-Country Yield Spread Differences: Kazakhstan vs. Russia for 1-Year, 5-Year, and 10-Year Bonds and Corporate Bond Indices

VARIABLES	(1) 1-year Yield Spread	(2) 5-year Yield Spread	(3) 10-year Yield Spread	(4) Corporate Yield Spread
bond_1year_rukz				0.215**
				(0.0957)
overnight_ineterest_diff_rukz	0.0862	-0.0301*	-0.0145	-0.00573
	(0.0556)	(0.0177)	(0.00963)	(0.0128)
int_res_ration_rutokz	0.187	-0.498***	-0.278***	-0.263***
	(0.129)	(0.102)	(0.0522)	(0.0555)
inflation_diff_rukz	0.489***	0.0974**	0.0828***	0.0480
	(0.0638)	(0.0455)	(0.0236)	(0.0574)
RUB_to_KZT	-3.140***	-2.257***	-1.476***	-1.036***
	(0.360)	(0.276)	(0.163)	(0.319)
USD_to_RUB	-0.146***	-0.104***	-0.0667***	-0.0661***
	(0.0199)	(0.0178)	(0.0103)	(0.0184)
oil_growth_rate_yoy	1.485**	-0.0431	0.129	0.398
	(0.647)	(0.418)	(0.254)	(0.345)
us_tbill_rate	0.472**	-0.660***	0.152	-0.662***
	(0.198)	(0.178)	(0.119)	(0.122)
war_dummy	2.209***	4.051***	2.974***	4.245***
	(0.818)	(0.632)	(0.458)	(0.544)
Constant	22.26***	27.20***	16.82***	13.56***
	(2.087)	(1.810)	(1.119)	(2.493)

Observations	118	118	118	106
R-squared	0.834	0.805	0.812	0.857

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5. Cointegration analysis for each group of observant variables

The cointegration analysis of corporate bond yields between Kazakhstan and Russia indicates no significant long-term relationship based on the corporate bond index yields.

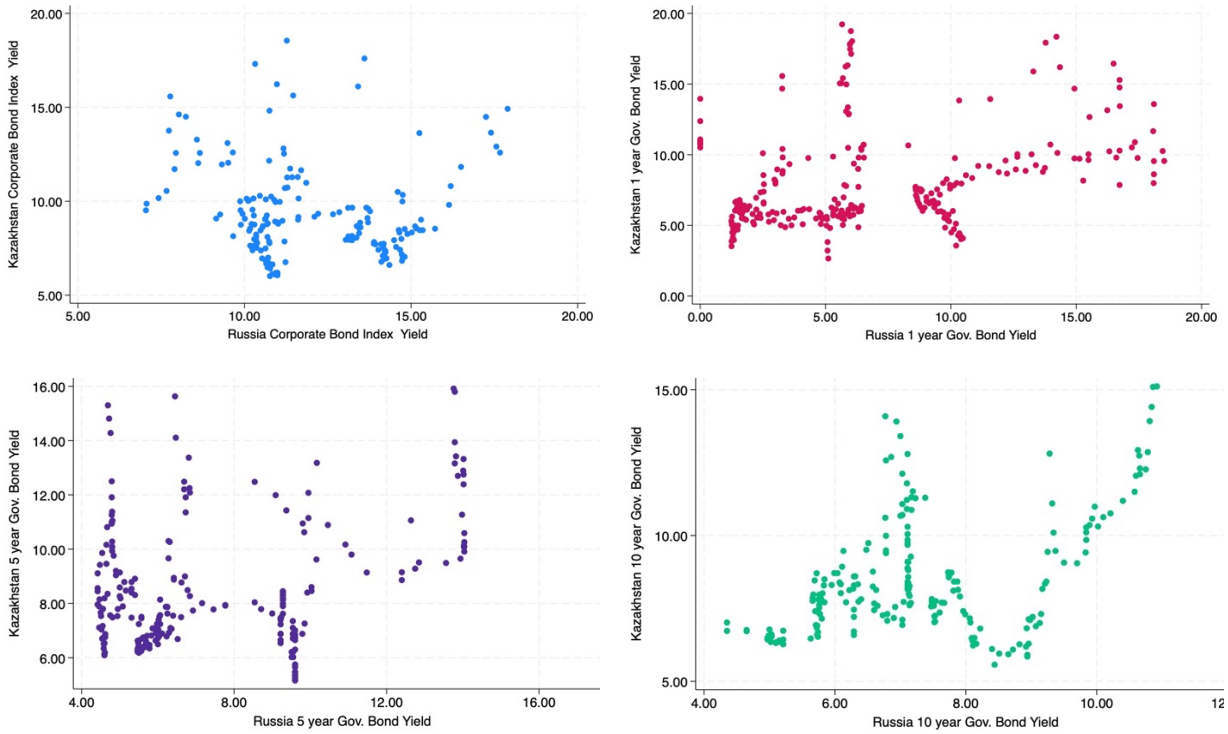

Figure 7. Scatter plot of government bond yields and corporate bond index yields (cross-country)

For government bond yields, there was a clear long-term relationship between the 1-year government bond yields of Kazakhstan and Russia before the war (August 2016

to February 2022). However, this result might not be entirely reliable because the explanatory variable is stationary, which could influence the outcome.

After the war began, this relationship for 1-year yields disappeared, while for 10-year yields, the opposite happened—a long-term relationship appeared only after the war. This suggests that the dynamics between the bond yields changed significantly due to the war.

Using daily data might give better results, as it could show short periods where the relationship appears stable. We decided not to use daily data for the cointegration analysis because the data for Kazakhstan and Russia were too different and couldn't be compared properly. The quality of the data, how often it was updated, and the differences in how their markets work made it hard to find reliable long-term relationships. For example, the way the data was collected and the types of information available didn't match up, which would make the analysis unreliable. However, this stability might depend on excluding certain time periods from the analysis. These findings provide a strong motivation for further investigation into the changing dynamics of bond yield relationships.

Table 7. Cointegration analysis, approximate p-value of the residuals

		Total period	After war	Before war (Devaluation included)	Before war (Devaluation excluded)
1	KZ Gov. Bond Yield 1 year RU Gov. Bond Yield 1 year	-	-	***	-
2	KZ Gov. Bond Yield 5 year	-	-	-	-

	RU Gov. Bond Yield 5 year				
3	KZ Gov. Bond Yield 10 year RU Gov. Bond Yield 10 year	-	*	-	-
4	KZ Corporate Bond Index Yield RU Corporate Bond Index Yield	-	-	-	-

*** p<0.01, ** p<0.05, * p<0.1 ("-" – no significance)
Critical values are -3.9 for 1%, -3.34 for 5%, -3.04 for 10%

6. Conclusion

This thesis analyzed the determinants of bond yield spreads in Kazakhstan and Russia, focusing on three key maturities: 1, 5, and 10 years. By using regression and cointegration analyses, the study explored the influence of macroeconomic, financial, and geopolitical factors on these spreads, providing insights into the fixed-income market dynamics within and between Kazakhstan and Russia.

The results reveal that bond yield spreads in both countries are shaped significantly by domestic macroeconomic indicators, such as GDP growth, international reserves, and inflation rates, as well as external factors like oil prices and U.S. Treasury yields, and exchange rate fluctuations.

The inclusion of a war dummy variable enabled us to expand the analysis by measuring the impact of the Russian invasion of Ukraine in 2022. The findings suggest that geopolitical tensions not only altered the behavior of bond markets in both countries but also introduced significant shifts in the determinants of spreads, particularly through heightened risk perceptions and liquidity interventions by governments.

In the cross-country analysis, differences in corporate and government bond yields between Kazakhstan and Russia were used. The study identified a long-term equilibrium relationship in government bond yields that was disrupted after February 2022. These results emphasize the importance of regional stability in fostering robust financial markets in emerging economies.

Overall, this thesis contributes to the broader understanding of bond market dynamics of Kazakhstan and Russia, particularly in the context of geopolitical and economic challenges. Policymakers and investors can draw on these findings to better assess risks and opportunities in these markets. Future research could extend this work by incorporating higher-frequency data, exploring additional macroeconomic and financial variables to capture the evolving dynamics of bond yield spreads in other emerging economies.

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Appendices

Appendix 1.

The main regression variables—GDP, International Investment Position, and Current Account—were converted from quarterly to monthly data using cubic interpolation. This method is preferred because its cubic nature allows for a smoother and more accurate estimation of values between points compared to linear interpolation. Below is the Python script that implements cubic interpolation for these variables.

```python
import pandas as pd
from scipy.interpolate import CubicSpline
import numpy as np

# Load the quarterly data from your Excel file
# Replace 'your_file.xlsx' with the actual file path and
#'Sheet1' with the correct sheet name
df = pd.read_excel('path', sheet_name='Sheet1')

# Ensure the date column is in datetime format and set it as the index
df['date'] = pd.to_datetime(df['date'])
df.set_index('date', inplace=True)

# Generate a monthly date range from the start to the end of your data
monthly_index = pd.date_range(start=df.index[0], end=df.index[-1], freq='ME')
df_monthly = pd.DataFrame(index=monthly_index)

# Apply cubic spline interpolation for each column
for column in df.columns:
    # Generate the cubic spline based on quarterly data
    cs = CubicSpline(np.arange(len(df)), df[column])
    # Interpolate to monthly data
    df_monthly[column] = cs(np.linspace(0, len(df) - 1, len(df_monthly)))

# Save the monthly interpolated data to a new Excel file
df_monthly.to_excel('path', sheet_name='Monthly Data')

print("new file name'")
```

Appendix 2.

For cointegration analysis, we closely followed the **two-step Engle-Granger approach** for testing cointegration. Thus, two-step Engle-Granger cointegration test is used to examine the long-term relationship between different bond yields in Kazakhstan and Russia across different periods. First, regressions were performed separately for the pre-war period (January 2016–February 2022), post-war period (February 2022–September 2024), and the entire dataset, estimating the long-run relationship between the two bond yield variables. Residuals from these regressions were then extracted and subjected to the Dickey-Fuller test to check for stationarity.

If the residuals are stationary, it indicates the existence of cointegration, implying a meaningful long-term relationship between the variables. This analysis allows you to investigate whether the cointegration relationship breaks or emerges across the specified periods, shedding light on how the war has impacted the economic dynamics between the two countries.