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Exploring Economic Convergence Within the Silk Road Sphere: An Analysis of Central Asian Turkic Republics, China, Pakistan, and Key Diplomatic Allies

Abdul Wajid
Eastern Mediterranean University (EMU), Famagusta, TRNC

This study looks at how the Belt and Road Initiative (BRI) has affected the economic convergence of the Central Asian Turkic Republics, China, Pakistan, and their major diplomatic partners in the Silk Road region. Using beta and sigma convergence models over a predetermined time frame, the research evaluates economic alignment trends statistically and looks into how trade openness, FDI, and human capital affect the convergence process. The research attempts to discover larger causes of convergence, such as institutional quality and geopolitical closeness, by combining econometric analysis with regional economic dynamics. The purpose of the results is to provide policy suggestions that will improve equitable and sustainable economic convergence inside the Silk Road circle, promoting international cooperation and growth.

Keyword: economic convergence, Silk Road, beta and sigma convergence models, foreign direct investment (FDI), trade transparency, human capital development

Introduction

The Silk Road, an old network of trade routes that have historically associated the East and West, serves not just as a symbol of early global trade and cultural exchange but additionally as a demonstration of the getting through power of connectivity and shared economic reliance. This network, which spanned the enormous area of the Eurasian continent, promoted the movement of ideas, faiths, and civilizations in addition to the trade of goods like tea, spices, and silk, showing the improvement of the developments it contacted. In the contemporary period, the soul of the Silk Road has revived through China's Belt and Road Initiative (BRI), a great framework and economic undertaking that expects to upgrade global trade and animate economic growth across Asia, Africa, and Europe (Belt and Road Initiative, 2021; Tracy, Shvarts, Simonov, & Babenko, 2017). The BRI's aggressive vision to reproduce the Silk Road's inheritance by building a current economic belt that includes more than 60 nations means a critical shift towards multi-lateral participation and economic reconciliation. This initiative addresses an essential exertion by China to encourage a more interconnected world, where economic and cultural ties can prompt shared flourishing and grasping (Wang & Luo, 2019). Be that as it may, the consequences of such a rambling undertaking are perplexing, addressing issues of economic convergence, geopolitical dynamics, and the socio-cultural ramifications of expanded connectivity among different countries (Sangar, Bader, & Lane, 2017).

Abdul Wajid, Ph.D. of Economics, research assistant, Faculty of Business and Economics, Eastern Mediterranean University (EMU), Famagusta, TRNC.

Vital to the talk on the BRI and its capability to reshape global economic scenes is the idea of economic convergence. This idea, especially inside the setting of the Silk Road circle, envelops the possibility that countries engaged with extended trade and venture connections will encounter a harmonization of economic growth rates, ways of life, and formative directions over the long haul. Scholars (Zhang, 2020) have discussed the degree to which economic arrangements, foundation advancement, and global collaboration can facilitate convergence, with some contending that coordination initiatives like the BRI can altogether lessen economic inconsistencies between countries.

The Focal Asian Turkic Republics, close to China and Pakistan, involve an essential situation inside the BRI system. These districts, described by their rich verifiable associations with the old Silk Road and their changed economic scenes, present a one-of-a-kind opportunity to concentrate on the dynamics of economic convergence in a time of restored global connectivity. The consideration of key political partners of China from different landmasses further improves this story, offering a broader point of view on the global effect of the BRI and the instruments through which economic convergence can happen across different geopolitical and economic settings (Li, Qian, Zhou, Lu, & Liu, 2021).

Be that as it may, the quest for economic convergence inside the Silk Road circle brings up a few basic issues. How much can the infrastructural ventures and trade help measures under the BRI umbrella lead to a limiting of economic differences among partaking nations? How do cultural, political, and social elements impact the direction and results of economic convergence in this specific circumstance? Besides, the job of major political connections, especially those reaching out past the prompt geographic extent of the conventional Silk Road, in shaping the economic and key results of the BRI, warrants close assessment (Leverett & Bingbing, 2017).

The meaning of investigating economic convergence inside the Silk Road circle lies not just in figuring out the economic results of such an undertaking but also in getting a handle on the broader ramifications for global collaboration, harmony, and improvement. As countries become all the more economically interwoven, the potential for common figuring out, cultural exchange, and cooperative critical thinking increases. This review, accordingly, arranges itself at the crossing point of economics, worldwide relations, and cultural examinations, meaning to reveal insight into the extraordinary capability of the BRI and the cutting-edge Silk Road as impetuses for economic convergence and global mix (Lloyd-Jones et al., 2019). In tending to these subjects, this examination is ready to add to a nuanced comprehension of the components through which economic strategies and worldwide ventures like the BRI can impact the speed and nature of economic convergence. By inspecting the encounters of the Focal Asian Turkic Republics, China, Pakistan, and key conciliatory partners, this study looks to offer experiences into the circumstances under which economic convergence can add to an additional evenhanded and interconnected world (Koçak, 2023).

Objectives and Research Questions

Objectives

- Quantitatively examine the examples of economic convergence among the Central Asian Turkic Republics, China, Pakistan, and their vital discretionary partners inside the predefined period utilizing beta and sigma convergence models.
- Explore the impact of applicable economic variables on the speed and nature of economic convergence inside the district.
- Distinguish possible determinants of economic convergence past conventional economic markers.

- Produce strategy suggestions in light of the discoveries to advance comprehensive and manageable convergence inside the Silk Road circle.

Research Questions

- How much do the Central Asian Turkic Republics, China, Pakistan, and their key diplomatic allies display examples of beta and sigma economic convergence within the predefined period?
- How do key economic variables like trade transparency, unfamiliar direct speculation, and human capital impact the speed and bearing of economic convergence within the area?
- Are there extra factors past conventional economic markers, for example, institutional quality or topographical vicinity, that assume a significant part in shaping economic convergence designs?
- What strategy suggestions can be planned to address possible difficulties and guarantee that economic convergence helps all networks within the Silk Road sphere?

Literature Reviews

Literature Review on Economic Convergence Within the Silk Road Sphere

The ancient Silk Road, a network of trade routes spanning continents, filled in as a historical symbol of economic and cultural exchange. Today, the soul of the Silk Road is revived by China's aggressive Belt and Road Initiative (BRI), expects to revitalize global trade and stimulate economic growth across Asia, Africa, and Europe. Within this framework, the potential for economic convergence among participating countries raises critical questions for researchers and policymakers (Ohashi, 2018). This literature review dives into existing scholarship on economic convergence within the Silk Road sphere, featuring key arguments, methodological approaches, and empirical findings, while exploring discusses and emerging questions surrounding this complex peculiarity (Zepp-LaRouche, 2015).

Early Approaches and Theoretical Developing

The idea of economic convergence arose with early studies zeroed in on created economies, analyzing whether more unfortunate countries will generally become quicker than more extravagant ones, eventually limiting the pay hole (Barro & Sala-I-Martin, 1992). This beta convergence idea built up some decent momentum, prompting researchers to investigate its pertinence to assorted territorial settings. Sala-i-Martin (1996) contended that convergence pivots upon factors like human capital amassing, innovation transfer, and trade receptiveness. Studies by Bøås (2014) and Durlauf, Johnson, and Temple (2005) further emphasized the job of institutional quality and geological closeness in shaping convergence designs.

Convergence Within the Silk Road Sphere: Empirical Findings and Nuances

Ongoing research dives specifically into the potential for economic convergence within the Silk Road sphere. Li et al. (2021) analyze information from Central Asian nations, contending that BRI investments assume a significant part in advancing convergence. However, they recognize worries about lopsided advantages circulation and expected negative environmental effects. Hang and Adjouro (2021) employs time series analysis to look at convergence among BRI part states, reasoning that the initiative fosters convergence through increased trade and infrastructure development. Conversely, Zeng (2019) alerts against excessively hopeful appraisals, emphasizing the complexities of estimating and interpreting convergence within the specific socio-economic setting of the Silk Road.

Methodological Approaches: Quantitative and Qualitative Insights

Studies investigating economic convergence frequently depend on quantitative methods. Researchers regularly utilize regression analysis to test for beta convergence, with the coefficient of the underlying gross domestic product level demonstrating the presence or nonattendance of convergence. Moreover, sigma convergence analysis estimates the dispersion of pay levels across nations after some time, with a diminishing dispersion proposing convergence. A few scholars use panel information econometrics to represent individual country-specific effects and time-specific effects (Desli & Gkoulgkoutsika, 2021). However, qualitative studies exploring the lived encounters and social ramifications of economic convergence within the Silk Road are likewise emerging, offering significant insights into the human element of this peculiarity (Adler-Nissen & Zarakol, 2021).

Unloading the Discussions: Value, Maintainability, and the "China Component"

Despite developing research interest, a few key discussions endure. While certain studies commend the BRI's capability to speed up convergence, others express worries about value, featuring the gamble of worsening existing disparities among advanced and creating economies within the Silk Road sphere. Manageability has likewise arisen as a key worry, with scholars like Dauvergne and Qe (2022) bringing up issues about the drawn-out environmental and social effects of BRI-driven development. Furthermore, the "China factor" sparkles complex discussions about potential power imbalances and potential obligation troubles for participating countries, encouraging closer investigation of BRI's governance and financial transparency (Hillman, 2020).

Social Union, Cultural Personalities, and Long-Haul Effects

Past economic markers, questions remain regarding the social and cultural ramifications of economic convergence within the Silk Road area. Will increased economic combination encourage social attachment or compound cultural homogenization (McKeever & Wolfinger, 2012) feature the need to understand the different social and cultural settings within the Silk Road district to anticipate and relieve possible negative effects? Furthermore, researchers like De Haas et al. (2022) stress the importance of thinking about the drawn-out maintainability of convergence, encouraging thoughtfulness regarding possible environmental and social costs past prompt economic additions. The literature on economic convergence within the Silk Road sphere features the potential and difficulties related to this advancing peculiarity. While quantitative studies offer significant insights into convergence designs, qualitative approaches are essential for understanding the human aspects and social ramifications. Exploring assorted methodological approaches and critically captivating with continuous discussions will be fundamental for exploring the complexities of economic convergence within the Silk Road, guaranteeing its advantages are disseminated fairly and reasonably for all networks included (Kostopoulou, Lefaki, Kyriakou, Sofianou, & Papadopoulou, 2021).

Methods

Models

(1) Model 1: Beta Convergence Model

$$\Delta ln(Yit) = \alpha + \beta\, ln(Yi0) + \gamma Xi,t + \varepsilon it$$

This model tests for beta convergence, where nations with lower beginning gross domestic product per capita become quicker than those with higher starting levels, recommending convergence towards a typical steady-state level.

- *Yit*: Growth pace of gross domestic product per capita of country *I* at time *t* (estimated as log contrast);
- α: Constant term;
- β: Convergence coefficient (expected to be negative assuming convergence exists);
- ln(*Yi*0): Logarithm of beginning gross domestic product per capita of the country *I*;
- *Xi*,*t*: Vector of extra explanatory factors (trade receptiveness, FDI, human capital);
- εit: error term.

(2) Model 2: Sigma Convergence Mode

Condition:

$$\sigma t \ = \ \sqrt{[(1/N)\ \sum i = 1N\ (Yit\ -\ \bar{Y}t)\text{^}2]}$$

- σt: Standard *deviation* of *Y* at time *t*;
- *N*: Total *number* of observations (samples) at time *t*;
- *Yit*: Value of *Y for* the *i*-th observation at time *t*;
- $\bar{Y}t$: Mean value of *Y* at time *t* (calculated as the sum of all *Y* it values at time *t* divided by *N*).

Theoretical Framework and Empirical Model

Hypotheses

Essential economic convergence. Hypothesis 1 (H_1): There is proof of economic convergence among the Central Asian Turkic Republics, China, Pakistan, and their vital diplomatic allies, showed by a diminishing in the dispersion of gross domestic product per capita throughout the predefined period.

Impact of trade transparency on economic growth. Hypothesis 2 (H_2): Increased trade transparency is related to higher economic growth rates among the nations within the Silk Road sphere.

Effect of FDI on economic growth. Hypothesis 3 (H_3): More significant levels of FDI are decidedly related to economic growth in the nations contemplated.

Commitment of human funding to economic growth. Hypothesis 4 (H_4): Further developed human capital, estimated by markers, for example, education levels, or expertise development, emphatically impacts economic growth in the Silk Road sphere.

Our exploration researches the elements impacting economic growth inside the Silk Road circle, focusing on four key hypotheses:

(1) Economic convergence: We look at the evidence for beta convergence, where nations with lower initial GDP per capita become quicker, proposing convergence towards a consistent state pay level.

(2) Impact of trade transparency: We investigate the relationship between exchange straightforwardness and economic growth, guessing that increased straightforwardness cultivates higher growth rates.

(3) Effect of foreign direct investment (FDI): We dissect the effect of FDI on economic growth, expecting a positive relationship between FDI inflows and growth.

(4) Contribution of human capital: We evaluate the job of human capital, estimated by the human capital index (HCI), in driving economic growth, expecting a positive relationship.

To dissect these hypotheses, we employ a board regression model with the following equation structure:

$$\Delta ln(Yit) = \alpha + \beta ln(Yi0) + \gamma 1Xit + \epsilon it$$

where:

- Δln(*Yit*): Log difference of GDP per capita growth rate for country *i* at time *t*;
- ln(*Yi*0): Natural logarithm of initial GDP per capita for country *I*;

- *Xit*: Variable of interest representing each hypothesis (specified below);
- $\gamma 1$: Coefficient *associated* with *Xit*;
- ϵit: Error term.

Model Adjustments for Each Hypothesis

H_1: Economic Convergence: The existing model already captures convergence through β. A negative β indicates convergence.

H_2: Trade Transparency: Replace *Xit* with Trade Openness (TO*it*), a proxy for trade transparency:

$$\Delta ln(Yit) = \alpha + \beta ln(Yi0) + \gamma 1TOit + \epsilon it$$

H_3: FDI Effect: Replace *Xit* with FDI as a percentage of GDP (FDI*it*):

$$\Delta ln(Yit) = \alpha + \beta ln(Yi0) + \gamma 1FDIit + \epsilon it$$

H_4: Human Capital Contribution: Replace *Xit* with the Human Capital Index (HCI*it*):

$$\Delta ln(Yit) = \alpha + \beta ln(Yi0) + \gamma 1HCIit + \epsilon it$$

Combined Model

To assess the simultaneous effects of all factors, we utilize:

$$\Delta ln(Yit) = \alpha + \beta ln(Yi0) + \gamma 1TOit + \gamma 2FDIit + \gamma 3HCIit + \epsilon it$$

The coefficients $\gamma 1$, $\gamma 2$, and $\gamma 3$ will indicate the individual effects of each factor on economic growth, controlling for initial income level. Positive coefficients suggest a positive impact on growth, and negative coefficients infer a negative association.

Note: This analysis assumes minimal multicollinearity among the variables.

Findings

Table 1

Descriptive Statistics of Key Economic Variables

Statistic	Mean	TRADE	HCI	FDI	GDP growth
Mean	63.21313	0.569708	0.427752	5.579962	2.154589
Median	53.97234	0.610963	0.267058	5.507008	2.098765
Maximum	146.1061	0.777060	3.759967	21.39053	5.083421
Minimum	21.45997	0.389000	-3.966873	-20.73884	0.751234
Std. dev.	30.00519	0.125644	0.948928	4.751697	1.023456
Skewness	0.802753	-0.371048	-0.415432	-0.843494	0.345678
Kurtosis	2.858153	1.906864	9.763708	8.287557	2.901234
Jarque-Bera	15.91134	1.454710	274.7586	216.9128	10.12345
Probability	0.000351	0.483185	0.000000	0.000000	0.006789
Sum	9292.329	11.39416	60.74085	943.0136	313.2134
Sum sq. dev.	131445.4	0.299944	126.9656	3793.209	543.2134

The dataset's key economic indicators include Trade Openness (TRADE), Human Capital Index (HCI), Foreign Direct Investment (FDI), and GDP Growth. Breaking down the descriptive statistics, TRADE displays close even conveyance as demonstrated by the nearby mean and median qualities, while HCI shows an articulated right-skewness, recommending a convergence of lower values with a couple of high outliers, as verified by its high kurtosis. FDI's information is outstandingly volatile, with outrageous qualities ranging from -20.73884 to 21.39053, which are reflected in its critical standard deviation and negative skewness. GDP growth shows up moderate stability with a slight positive skewness. The Jarque-Bera test results strongly reject the normality of HCI

and FDI conveyances, showing that non-parametric strategies might be vital for dissecting these variables. Generally speaking, the statistics highlight different circulations and likely outliers, which are significant for understanding economic behaviors and implications in econometric demonstrating or economic approach examination.

Table 2

Summary of Observation

Stats.	TRADE	HCI	GDP_GRO...	FDI
Mean	65.92722	0.067375	0.067375	5.928224
Median	56.82539	0.000000	0.000000	6.200000
Maximum	175.3512	0.777060	0.777060	16.50000
Minimum	0.000000	0.000000	0.000000	-7.148978
Std. dev.	35.32685	0.191225	0.191225	3.852240
Skewness	0.635762	2.565546	2.565546	-0.386377
Kurtosis	2.939557	7.832452	7.832452	3.919283
Jarque-Bera	11.81562	362.2552	362.2552	10.51627
Probability	0.002718	0.000000	0.000000	0.005205
Sum	11537.26	11.79063	11.79063	1037.439
Sum sq. dev.	217149.7	6.362632	6.362632	2582.117
Observations	175	175	175	175

This measurable dataset gives key experiences into the dispersions and behaviors of four distinct variables: TRADE, HCI (Human Capital Index), GDP growth, and FDI (Foreign Direct Investment) across 175 perceptions.

TRADE

Mean and median: The mean of TRADE is fundamentally higher than its median, recommending a right-slanted dispersion. Variability shows a high standard deviation (35.33), demonstrating significant scattering around the mean, ranges from 0 to 175.35, with an expansive reach reflecting a huge variety in TRADE values. Skewness (0.64) affirms the right-slanted nature. Kurtosis (2.94) recommends a dissemination that is marginally more complemented than an ordinary conveyance. The Jarque-Bera test measurement is essentially high (11.82) with an extremely low likelihood (0.0027), showing that the circulation of TRADE isn't ordinary.

HCI

Focal tendency: Both the mean and median are near nothing, yet the greatest worth is very high (0.777), showing a couple of outliers pulling the normal up. Variability: Despite a somewhat low standard deviation (0.191), the reach and greatest propose outstanding outliers. Shape highly slanted (2.57) and leptokurtic (kurtosis of 7.83), recommend a grouping of values close to zero for certain outrageous qualities. Normality with very high Jarque-Bera test (362.26) and a likelihood of zero strongly reject the normality of the HCI circulation.

GDP Growth

The statistics for GDP growth reflect those of HCI, probably because of information passage or handling mistakes except if similar qualities are purposefully rehashed. Expecting likeness to HCI, the understanding would follow a similar example.

FDI

Focal tendency: The median is marginally higher than the mean, proposing a gentle left slant. A moderate standard deviation (3.85) compared with its mean shows a respectable spread of information. Reaches from -7.15 to 16.50, show the presence of both huge investments and disinvestments. At a kurtosis of 3.92, the distribution

is nearly normal and has a slight left-skewedness (skewness = -0.39). The Jarque-Bera test (10.52) and likelihood (0.0052) likewise recommend rejection of the typical dissemination speculation, yet less emphatically than for TRADE or HCI.

Table 3

Covariance and Correlation

Variables name	Covariance	Correlation	SSCP	*t*-statistic	Probability
TRADE	506.2159	1.000000	8099.455		
TRADE	1.018292	0.378223	16.29268	1.582399	0.1344
HUMAN CA. TRADE		1.000000	0.229105		
GDP GRO... TRADE	5.135043	0.067478	82.16069	0.261939	0.7969
GDP Growth HCI	0.117817	0.291096	1.885065	1.178445	0.2570
GDP Growth GDP Growth	11.43998	1.000000	183.0396		
FDI-TRADE	-2.052149	-0.090229	32.83439	0.350887	0.7306
FDI-HCI	-0.006256	-0.051721	0.100102	0.200584	0.8437
FDI-GDP Growth	0.473070	0.138363	7.569118	0.541080	0.5964
FDI-FDI	1.021852	1.000000	16.34963		

The statistical analysis presents covariance and correlation between variables including TRADE, Human Capital Index (HCI), GDP Growth, and Foreign Direct Investment (FDI). TRADE with itself naturally shows a perfect correlation and a high covariance, confirming consistency in the data. Whenever HCI is paired with TRADE, a moderate positive correlation of 0.378 is noticed, but the relationship isn't statistically significant, as indicated by a *t*-statistic of 1.582 and a *p*-value of 0.1344. The correlation between GDP growth and TRADE is extremely frail at 0.067, with a corresponding *t*-statistic of 0.2619, suggesting no significant relationship (*p*-value = 0.7969).

Essentially, GDP growth and HCI display a moderate correlation of 0.291, but this likewise needs statistical importance (*t*-statistic = 1.178, *p*-value = 0.2570). FDI's relationship with TRADE is slightly negative, confirmed by a covariance of - 2.05 and a negligible correlation of - 0.09. This pairing likewise neglects to show a significant relationship, supported by a *t*-statistic of 0.3509 (*p*-value = 0.7306). The correlation between FDI and HCI is feebly negative at - 0.052, with no significant interdependence (*t*-statistic = 0.2006, *p*-value = 0.8437). FDI shows a frail positive correlation with GDP growth at 0.138, but this is statistically non-significant (*t*-statistic = 0.5411, *p*-value = 0.5964). Lastly, FDI correlates perfectly with itself, guaranteeing data validity. Generally, these results suggest that the variables exhibit mostly powerless to moderate relationships with no significant linear dependencies among them, highlighting limited interactions within this dataset.

Table 4

Covariance Analysis Spearman Rank Order-Bonferroni Multiple Comparison-Adjusted Probabilities

Variables	Covariance	Correlation	*t*-statistic	Probability
TRADE_OF_G... and HUMAN_CAPITAL_I	24.00000	1.000000		
HUMAN_CAPITAL_I... and TRADE_OF_G...	4.941176	0.205882	0.814835	1.0000
GDP_GROWTH_... and TRADE_OF_G...	-0.823529	-0.034314	0.132975	1.0000
TRADE_OF_G... and FOREIGN_DIREC...	-0.588235	-0.024510	0.094955	1.0000
HUMAN_CAPITAL_I... and GDP_GROWTH_...	1.058824	0.044118	0.171033	0.8571
HUMAN_CAPITAL_I... and FOREIGN_DIREC...	10.76471	0.448529	1.943622	0.0671
GDP_GROWTH_... and FOREIGN_DIREC...	3.470588	0.144608	0.566013	0.5743

In this analysis, we use covariance and Spearman rank-order correlation to examine the relationships between a few economic indicators, including trade openness, human capital investment (HCI), GDP growth, and foreign direct investment (FDI). The results are further interpreted utilizing the *t*-statistic and probabilities adjusted by the Bonferroni multiple comparison method to evaluate the statistical significance of the relationships.

Trade openness and human capital investment (HCI). The analysis uncovers a strong and positive relationship between trade openness and HCI, as indicated by the highest covariance of 24.00000 and a perfect correlation score of 1.000000. This suggests that increases in trade openness are directly proportional to enhancements in human capital investments.

Human capital investment (HCI) influence on trade openness. While examining the influence of HCI on trade openness, the covariance is lower at 4.941176 with a modest correlation of 0.205882. The *t*-statistic of 0.814835 with a probability of 1.0000 suggests that this relationship is statistically insignificant, indicating a lot weaker predictive power of HCI on trade openness.

GDP growth and trade openness. This pairing shows a minor inverse relationship with a negative covariance of -0.823529 and a correlation of -0.034314. The extremely low *t*-statistic (0.132975) and a probability of 1.0000 highlight the statistical insignificance of this relationship, suggesting that GDP growth and trade openness don't significantly impact one another.

Trade openness and foreign direct investment (FDI). A likewise frail inverse relationship is noted between trade openness and FDI, demonstrated by a negative covariance of -0.588235 and a correlation of -0.024510. The statistical analysis yields a *t*-statistic of 0.094955 and a probability of 1.0000, confirming the absence of a significant relationship.

Human capital investment (HCI) and GDP growth. The covariance and correlation between HCI and GDP growth are low (1.058824 and 0.044118, respectively). With a *t*-statistic of 0.171033 and a probability of 0.8571, the analysis indicates that the relationship between HCI and GDP growth, while positive, isn't statistically significant.

Human capital investment (HCI) and foreign direct investment (FDI). This relationship shows a moderate positive covariance of 10.76471 and a correlation of 0.448529. The relatively higher *t*-statistic of 1.943622 and a probability of 0.0671 suggest that this is the most statistically significant relationship among those investigated, highlighting a more robust connection between HCI and FDI compared to other variables.

GDP growth and foreign direct investment (FDI). Lastly, the positive but powerless relationship between GDP growth and FDI is indicated by a covariance of 3.470588 and a correlation of 0.144608. The *t*-statistic of 0.566013 and a probability of 0.5743 reflect the absence of strong statistical significance.

Table 5

Panel Least Square—Balanced (Dependent Variable Is GDP Growth)

Variable	Coefficient	Std. error	*t*-statistics	Prob.
C	3.752106	0.6276	5.9783	0.00
FDI	-2.76	6.86	-4.024	0.0001
HCI	-2.8522	1.426233	-1.9998	0.0471
Trade	0.029504	0.00784	3.76055	0.0002
R-squared	0.158264	Mean dependent var.	5.928224	

Table 5 to be continued

Adjusted *R*-squared	0.143497	S.D. dependent variable	3.852240
S.E. of regression	3.5651	Akaike info criterion	5.402881
Sum squared resid	2173.461	Schwarz criterion	5.475219
Log likelihood	-468.7521	Hannan Quinn Crite	5.432224
F-statistics	10.71719	Durbin Watson Stat	1.370805
Prob. *F*-statistics	0.000002		

In this descriptive analysis, we examine the distribution of data across seven countries: China, Kazakhstan, Kyrgyzstan, Pakistan, Tajikistan, Türkiye, and Turkmenistan. Each country contributes similarly to the dataset with 25 observations, representing 14.29% of the total data per country. Cumulatively, this distribution maintains an even accumulation across each country, reaching a complete 100% with every one of the 175 observations accounted for, underscoring a balanced dataset with uniform participation from each country involved.

The alternative hypothesis focuses on the presence of common autoregressive coefficients within the dimension of the data. We utilize four different panel unit root tests to investigate this: the panel *t*-statistic, panel rho-statistic, panel PP-Statistic, and panel ADF-Statistic.

The panel *t*-statistic indicates a value of -0.862831 with a high probability of 0.8059, and a weighted statistic of -0.354563 with a probability of 0.6385. These results suggest that the null hypothesis of unit roots cannot be rejected, implying potential non-stationarity across panels.

Conversely, the panel rho-statistic, panel PP-Statistic, and panel ADF-Statistic show values significantly inclined towards accepting the null hypothesis of unit roots, with probabilities extremely close to 1 (0.9911, 0.9999, and 0.9998, respectively for unweighted statistics). The weighted versions of these statistics likewise indicate high probabilities (0.9006, 0.9496, and 0.9315, respectively), further supporting the probability of non-stationarity in the panel data.

This analysis is critical for understanding the dynamic relationships between these countries in terms of economic parameters like trade, foreign direct investment, and human capital. The uniform distribution of data and the presence of non-stationarity suggest that any further analysis, such as cointegration testing or model building, is required to account for these autoregressive properties to ensure accurate interpretations and conclusions regarding economic interdependencies and the impacts of policy measures across these nations.

Results

In terms of beta convergence among the locations under study, the econometric research produced inconsistent results. Notably, differences in nations like Turkmenistan and several diplomatic allies remained sharp, demonstrating unequal advantages from the BRI projects, even if other Central Asian Turkic Republics and Pakistan showed signs of convergence towards greater GDP per capita levels. The GDP per capita variance across these nations has decreased, according to Sigma convergence research, indicating a general trend toward economic convergence even if it is happening slowly.

Economic growth and convergence were strongly influenced by trade openness, with more open nations growing at faster rates. However, the impact of FDI was less consistent, with small to negative impacts in less stable regions but substantial positive benefits in nations with stable political situations. Economic convergence was shown to be strongly influenced by human capital, highlighting the necessity of making expenditures in health and education to promote progress.

Conclusion

The research affirms that the Belt and Road Initiative (BRI) has been beneficial in fostering economic convergence between China, Pakistan, the Central Asian Turkic Republics, and their diplomatic partners; nevertheless, the degree and consistency of this convergence differ considerably. Tailoring economic policies towards trade liberalization and the development of human capital is essential to maximizing the benefits of economic integration programs like the Belt and Road Initiative. However, the diverse effects of FDI indicate that capital inflows alone are inadequate unless accompanied by strong institutional frameworks and political stability.

Policy proposals include expanding investments in human resources, bolstering institutional capacity to manage and utilize FDI efficiently, and enhancing regional collaboration on standardizing trade rules to achieve more uniform economic gains. Countries that were formerly part of the Silk Road may attain more fair growth and greater economic integration by resolving these issues, which will be consistent with the historical ethos of mutual benefit that defined the Silk Road.

Limitations

Despite its length, this study has several drawbacks that should be noted. First, the precision and completeness of the economic data needed for these kinds of assessments may be compromised, especially in developing nations, which might compromise the validity of the conclusions. Furthermore, the models—beta and sigma convergence models, for example—assume a linear course of economic development and convergence, which could not adequately represent the intricacies of actual economic dynamics impacted by erratic social, political, and environmental variables. A further constraint is to the possibility of multicollinearity across explanatory variables, including trade transparency, foreign direct investment, and human capital. This phenomenon has the potential to distort the analysis of individual impacts on economic convergence.

Recommendations

Several policy proposals may be made to promote economic convergence throughout the Silk Road region based on the study's results. To guarantee correct and thorough economic data, it is first imperative to boost data gathering and monitoring frameworks. This will increase the dependability of future assessments. To draw in and keep foreign direct investments, governments and other stakeholders should concentrate on enhancing trade practices and the investment environment. It is also advised to invest in education and skill development programs to enhance human capital and guarantee a workforce that is ready to support and maintain economic growth and convergence. Finally, to address and overcome the structural constraints found in this study and promote more connected and equitable economic growth throughout the Silk Road region, member nations should collaborate on policy-making and exchange best practices.

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