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Article

Research on the Impact of Inflation, Foreign Direct Investment (Fdi) and Trade Openness on Economic Growth Based on Ols (Evidence from Uzbekistan, Russian Federation and South Korea)

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Abstract: This study investigates the impact of Foreign Direct Investment (FDI), inflation, and trade openness on Uzbekistan's economic growth by employing an Ordinary Least Squares (OLS) regression model. The analysis reveals that both FDI and trade openness significantly enhance economic growth, while inflation adversely affects it. Comparative assessments with the Russian Federation and South Korea corroborate these findings, indicating that increased FDI and trade openness bolster economic performance across diverse economies, whereas elevated inflation hampers growth. These results underscore the necessity for Uzbekistan to implement policies that attract FDI, promote trade liberalization, and maintain price stability to foster sustainable economic development. The regression analysis carried out results passed the 5% significance test. While inflation has a significant negative impact on economic growth in all three countries, FDI and trade openness have a significant positive impact on economic growth in these countries. For every 1% increase in inflation, the decrease in GDP in Uzbekistan, Russian Federation and South Korea is 0.416 %, 0.304% and 0.395% respectively. For every 1% increase in trade openness, the increase in GDP in Uzbekistan, Russian Federation and South Korea is 0.88%, 1.11% and 0.72% respectively, while GDP in Uzbekistan, Russian Federation and South Korea grows by 0.599%, 0.412% and 0.981% correspondingly for every 1% increase in FDI. Thus, FDI and trade openness are necessary and effective for these countries while high inflation is undesirable.

Keywords: OLS, Inflation, FDI, GDP, Uzbekistan, Russian Federation, South Korea, Trade openness.

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1. Introduction

Inflation plays a complex role in economic growth, with both positive and negative effects depending on its level, stability, and the overall economic context. Positive effects of inflation on economic growth could be seen in encouraging spending and investment, reducing real debt burden, facilitating wage growth and allowing for flexible monetary policy. However, inflation is largely popular with its negative effect on economic growth as it reduces purchasing power, creates uncertainty, increases interest rate and disproportionately affects lower-income groups[1].

Foreign Direct Investment (FDI) is a critical driver of economic growth, especially in developing and emerging markets. It involves investment by a foreign entity in a country's business sector, either through ownership, partnerships, or establishing new operations.

While FDI inflows into any economy has significant benefits to that economy, they could potentially have negative impacts on economic growth[2]. Benefits of FDI could be seen in capital inflow and economic expansion, technology transfer and innovation, employment generation and skill development, improved infrastructure and industrial growth, boosting exports and foreign exchange earnings as well as strengthening financial markets[3]. However, FDI could potentially have such negative effects as profit repatriation, market domination and local business impact, economic dependence on foreign firms and even environmental and social concerns when some foreign firms exploit natural resources without sustainable practices, harming the environment[4].

Trade openness refers to the extent to which a country allows free trade with other nations by reducing trade barriers such as tariffs, quotas, and import restrictions. It plays a crucial role in economic growth by enhancing market access, increasing efficiency, and fostering innovation. Trade openness drives economic growth by increasing market access and exports, enhancing efficiency and competitiveness and attracting foreign direct investment (FDI). However,

short-term disruptions and structural unemployment, dependence on imports and vulnerability to global shocks are potential challenges associated with trade openness [5].

Overall trends for GDP, inflation, FDI and Trade openness in Uzbekistan, Russian Federation and South Korea.

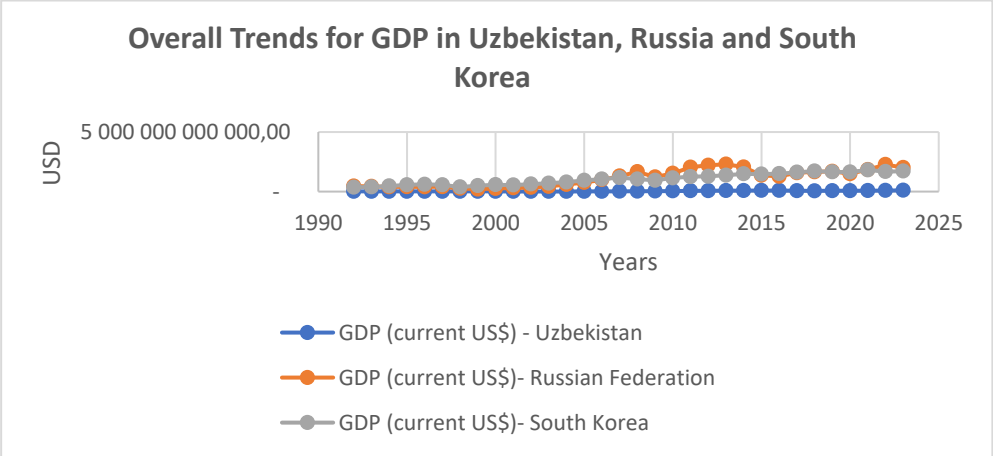

Figure 1 Overall trends for the GDP of Uzbekistan, Russian Federation and South Korea. This line graph is created by the author based on data from World Bank Open Data. https://databank.worldbank.org/

Overall, it can be seen from the graph above that figures for the GDP of Russian Federation and South Korea have been rising since 1992, whereas GDP of Uzbekistan seems to show little change compared to the other two countries. GDP of Uzbekistan has never reached USD500 billion over the entire period, while GDP of Russia and South Korea started at around USD500 billion in 1992 and then the figures for South Korea began rising much faster than those for Russia over the next 15 years, with the GDP of South Korea outstripping that of Russia until the year 2007, after which the GDP of Russia markedly exceeded that of South Korea from 2007 to 2015. Between 2015 and 2020, figures for both countries were almost identical[6]. GDP of Russia was much higher than that of South Korea starting from 2021, although the figures for Russia are expected to decline, while the figures for South Korea are projected to rise[7].

Figure 2 Overall trends for inflation of Uzbekistan, Russian Federation and South Korea. This bar graph is created by the author based on data from World Bank Open Data. https://databank.worldbank.org/

A quick glimpse at the graph of inflation in the three countries show that Russia and Uzbekistan have always been susceptible to inflation, although inflation rate has declined over the period given. By contrast, South Korea was better able to control inflation over the whole period, far below the inflation in Russia and Uzbekistan. Inflation was particularly big problem for Russia and Uzbekistan at the beginning of the period, in the first three years[8].

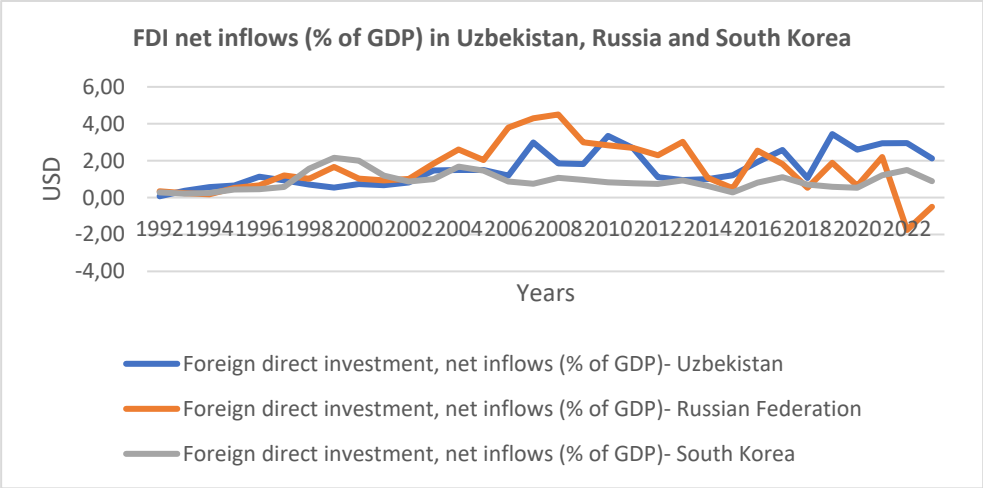

Figure 1 Overall trends for FDI for Uzbekistan, Russian Federation and South Korea. This line graph is created by the author based on data from World Bank Open Data. https://databank.worldbank.org/

As can be seen from the graph that figures for FDI as a percentage of GDP followed quite similar patterns in Uzbekistan and Russia, while there was almost stability in FDI net inflows as a percentage of GDP in South Korea over the period shown. All countries began at almost identical figures in 1992, but FDI figures grew much faster in Russia and Uzbekistan than South Korea. In particular, FDI net inflows reached a peak of higher than 4% of GDP in Russia in 2008, while Uzbekistan hit nearly 4% of GDP in 2019. FDI net inflows never reached 3% of GDP in South Korea, although FDI inflows into this country was just over 2%, the highest figure over the whole period[9].

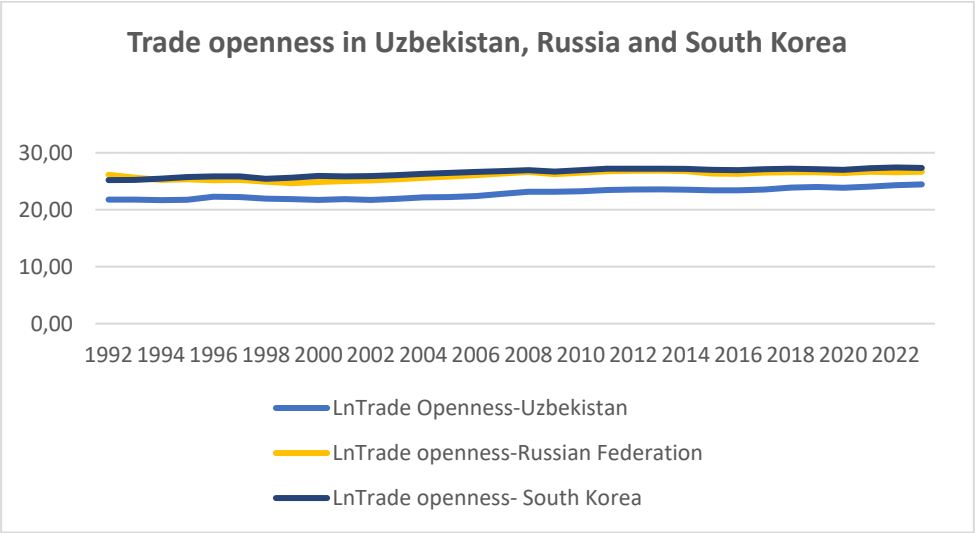

Figure 4 Overall trends for trade openness for Uzbekistan, Russian Federation and South Korea. This line graph is created by the author based on data from World Bank Open Data. https://databank.worldbank.org/

Trade openness is measured as the ratio of exports and imports of goods and services combined to GDP. As can be seen from the graph that trade openness index rose slowly, but surely in Uzbekistan, with the index ranging between 20 and 25 over the whole period, although this country was less open to trade than the other two countries. By contrast, Russia and South Korea followed almost identical pattern in trade openness, starting at around 25 and reaching about 27 after experiencing stable and gradual increase in trade openness index[10].

Literature review

Empirical studies provide varying results on the impact of Foreign Direct Investment (FDI) on economic growth. Several studies confirm a positive relationship, emphasizing that FDI inflows enhance productivity, create employment, and foster technological advancement . For instance, Borensztein et al. found that FDI contributes positively to economic growth, particularly in economies with a well-developed human capital base .

However, other studies highlight that the impact of FDI is conditional on specific factors such as institutional quality, financial development, and absorptive capacity. Alfaro et al. argue that the benefits of FDI are more pronounced in countries with robust financial systems that efficiently allocate resources[11] . Similarly, Carkovic and Levine suggest that FDI alone does not guarantee economic growth unless complemented by sound macroeconomic policies and governance structures . Certain studies also suggest that FDI can have neutral or even negative effects on economic growth. For example, Aitken and Harrison found that in some developing countries, FDI can crowd out domestic investment and limit local firm expansion , while Rodrik argued that FDI benefits are often overstated, particularly in the absence of strong domestic institutions . Conversely, Herzer, Klasen, and Nowak-Lehmann provided evidence of instances where FDI led to economic dependency rather than sustainable growth .

Empirical studies present mixed findings regarding the impact of inflation on economic growth. Some research indicates a negative relationship, especially when inflation exceeds a certain threshold. For instance, Barro found that a 10% increase in inflation reduces GDP growth by approximately 0.2-0.3 percentage points . Similarly, Bruno and Easterly demonstrated that high inflation episodes significantly slow down economic growth [12].

Other studies, however, suggest a non-linear relationship. Khan and Senhadji identified threshold effects, indicating that inflation below a certain level (e.g., 3-6% for developed economies and 7-11% for developing economies) has little or no negative

impact on growth, whereas inflation beyond these thresholds is harmful . Similarly, Bhatta and Mishra found that inflation's effect on growth depends on the stability and credibility of monetary policies[13] .

Empirical studies provide mixed evidence on the impact of trade openness on economic growth. Several studies support the view that trade openness fosters growth by increasing access to larger markets, enhancing competition, and facilitating technology transfer . For instance, Sachs and Warner found that countries with open trade policies experienced significantly higher growth rates compared to those with protectionist policies .

However, other studies caution against a simplistic positive relationship between trade openness and growth. Rodriguez and Rodrik argue that the benefits of trade openness depend on complementary factors such as institutional quality, infrastructure, and macroeconomic stability. Similarly, Chang contends that premature trade liberalization in developing countries can hinder industrialization and economic development .

Regarding research on inflation, FDI, and trade openness in Uzbekistan, most of it is based on theoretical analysis and lacks the integration of empirical analysis. Although many scholars worldwide have focused on Uzbekistan's economic development, inflation, trade openness, and FDI attractiveness, they have not provided a scientific and reasonable explanation with quantitative thinking. This research combines economic theories and applies Ordinary Least Squares (OLS) to test the impact of inflation, trade openness, and FDI on economic growth in Uzbekistan. Different from previous research focusing on inflation, trade openness, and FDI in Uzbekistan, this article adds research content by making comparisons in three countries (Uzbekistan, Russian Federation, and South Korea). Therefore, this article provides a valuable supplement to the research on the effects of inflation, FDI, and trade openness in Uzbekistan. The findings suggest that expanding FDI and trade openness while lowering inflation in Uzbekistan is beneficial, as rising levels of inflation hurt the economy not only in Uzbekistan but also in the Russian Federation and South Korea. Conversely, expanding FDI and trade openness promotes economic growth in these countries.

As a developing country in Central Asia, Uzbekistan has practical needs to promote growth, expand the market, and curb inflation. Is FDI necessary for Uzbekistan? How much effect can FDI have on Uzbekistan's economic growth? How much effect can trade openness have on Uzbekistan's economic growth? How adversely can high inflation affect economic growth in Uzbekistan? What about the Russian Federation and South Korea? These are the questions that this research aims to answer. In the OLS model constructed in this study, inflation, FDI, and trade openness are the independent variables, and GDP is the dependent variable. The model verifies the impact of inflation, FDI, and trade openness on economic growth and concludes that FDI and trade openness are necessary for Uzbekistan's economic growth, while inflation is to be avoided.

2. Materials and Methods

Variable description

The method of this study is to disentangle and capture the impact of inflation, trade openness and FDI on GDP through ordinary least squares (OLS). The data obtained from the World Bank Database is used for doing the analysis from 1992 to 2023. The independent variables of the model are inflation, FDI net inflows as a percentage of GDP and trade openness (the ratio of total exports and imports combined to GDP). The dependent variable is GDP. To take account of the economic significance of the model, the natural logarithm of the variable data is considered.

Model Specification

The model used is going to verify whether inflation, FDI and trade openness have an impact on GDP and also estimate and measure the scale of the impact. According to the theoretical basis, the functional forms of the models related to inflation and GDP, FDI and GDP as well as trade openness and GDP used in this study are specified as follows:

Model 1: The regression model of the impact of FDI on GDP in Uzbekistan, Russian Federation and South Korea:

$$〖Ln(GDP)〗_{ij}=\alpha_1+\beta_1\ 〖Ln(FDI)〗_{ij}+e_1$$

Model 2: The regression model of the impact of trade openness on GDP in Uzbekistan, Russian Federation and South Korea:

$$〖Ln(GDP)〗_{ij}=\alpha_2+\beta_2\ 〖Ln(Trade\ Openness)〗_{i}+e_2$$

Model 3: The regression model of the impact of inflation on GDP in Uzbekistan, Russian Federation and South Korea:

$$〖Ln(GDP)〗_{ij}=\alpha_3+\beta_3\ 〖Ln(Inflation)〗_{i}+e_3$$

In the formula, i represents a certain country and j represents a certain year of observation. For the double logarithmic model, the economic significance of the variable coefficients is very clear. α is intercept term. β represents the elasticity coefficients of FDI, inflation and trade openness relative to GDP. And e is random disturbance term.

3. Results and discussion

Model testing

Ordinary least squares (OLS) method of regression was used to evaluate the slope of the coefficients of the autoregressive model. The use of OLS relies on the stochastic process being stationary. In the case where the stochastic process is not stationary, the use of OLS can result in invalid estimates. These estimates are called 'spurious regression' results thus high adjusted R^2 values and high t-ratios yielding results with no economic meaning. Python is used for estimation, and the statistical significance level of 5% is uniformly set in the model. A total of 31 observations are included from 1992 to 2023 and 3 models are estimated to capture the impact of inflation, trade openness and FDI on GDP of Uzbekistan, Russian Federation and South Korea [14].

Estimation of Model 1:

The estimation of model 1 being the FDI on GDP is expressed in the functional form below as:

Model 1:

$$〖Ln(GDP)〗_{ij}=\alpha_1+\beta_1\ 〖Ln(FDI)〗_{ij}+e_1$$

Adopting Python, the estimation result is provided below.

OLS Estimation of FDI on GDP in Uzbekistan, Russian Federation and South Korea from 1992 to 2023

The impact of LnFDI net inflow (% of GDP) on LnGDP in Uzbekistan

Regression Statistics	
Multiple R	0,568141174
R Square	0,322784393
Adjusted R Square	0,30021054
Standard Error	0,702749447
Observations	32

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	7,061677023	7,061677023	14,29903816	0,000693701
Residual	30	14,81570357	0,493856786		
Total	31	21,87738059			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	24,00378953	0,128210462	187,2217689	1,38194E-47	23,74194884	24,26563023
LnFDI net inflow	0,598759053	0,158342931	3,781406902	0,000693701	0,275379646	0,922138461

The impact of LnFDI net inflow (% of GDP) on LnGDP in South Korea

Regression Statistics	
Multiple R	0,7512739
R Square	0,564412473
Adjusted R Square	0,555337733
Standard Error	0,887115434
Observations	50

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	48,94661643	48,94661643	62,19599288	3,27037E-10
Residual	48	37,77474207	0,786973793		
Total	49	86,72135851			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	27,39429237	0,153740322	178,1854752	2,24671E-69	27,08517673	27,70341
LnFDI net inflow	0,980950994	0,124384455	7,886443614	0.00000000032703 7	0,730859285	1,231043

The impact of LnFDI net inflow (% of GDP) on LnGDP in Russian Federation

Regression Statistics	
Multiple R	0,454299134
R Square	0,206387703

Adjusted R Square	0,178044407
Standard Error	0,706539412
Observations	30

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3,635015324	3,635015324	7,281711384	0,011670975
Residual	28	13,97754233	0,49919794		
Total	29	17,61255765			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	27,31902127	0,135591247	201,4807143	8,16783E-46	27,04127519	27,59676734
LnFDI net inflow	0,411837412	0,152619162	2,698464635	0,011670975	0,09921123	0,724463594

Explanation of the Model:

Dependent variable: 〖Ln(GDP)〗_ij → Log of GDP for country i in year j

Independent variable: 〖Ln(FDI)〗_ij→ Log of FDI for country i in year j

Intercept (α_1) → Represents the baseline level of GDP when FDI is at 1 (in log scale)

Coefficient (β_1)→ Measures the elasticity of GDP with respect to FDI (i.e., the % change in GDP for a 1% change in FDI)

Error term (e_1) → Captures unobserved factors that influence GDP

Estimation of Model 2:

The estimation of model 2 being trade openness on GDP is expressed in the functional form below as:

Model 2:

〖Ln(GDP)〗_ij=α_2+β_2 〖Ln(Trade Openness)〗_ij+e_2

Adopting Python, the estimation result is provided below. OLS Estimation of trade openness on GDP in Uzbekistan, Russian Federation and South Korea from 1992 to 2023

The impact of LnTrade Openness on LnGDP in Uzbekistan

Regression Statistics	
Multiple R	0,955131188
R Square	0,912275587
Adjusted R Square	0,909351439
Standard Error	0,25292821
Observations	32

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	19,95820021	19,95820021	311,9800582	2,11451E-17
Residual	30	1,919180379	0,063972679		
Total	31	21,87738059			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	4,018334919	1,139154113	3,527472598	0,001372806	1,69187185	6,344797987
LnTrade Openness	0,880640454	0,049858041	17,66295723	0.0000211451	0,778816749	0,982464159

The impact of LnTrade Openness on LnGDP in Russian Federation

Regression Statistics	
Multiple R	0,977705146
R Square	0,955907352
Adjusted R Square	0,954437597
Standard Error	0,168631172
Observations	32

ANOVA

	df	***SS***	***MS***	***F***	***Significance F***
Regression	1	18,49467013	18,49467013	650,3855308	6,83002E-22
Residual	30	0,853094169	0,028436472		
Total	31	19,3477643			

	Coefficients	***Standard Error***	***t Stat***	***P-value***	***Lower 95%***	***Upper 95%***
Intercept	-1,459967747	1,135634826	-1,285596138	0,20841972	-3,779243474	0,859307979
LnTrade Openness	1,11378423	0,043673262	25,50265733	0.00683002	1,024591531	1,20297693

The impact of LnTrade Openness on LnGDP in South Korea

Regression Statistics	
Multiple R	0,979616163
R Square	0,959647828
Adjusted R Square	0,958302755
Standard Error	0,106275586
Observations	32

ANOVA

	df	***SS***	***MS***	***F***	***Significance F***
Regression	1	8,058110747	8,058110747	713,454396	1,8036E-22
Residual	30	0,338835003	0,0112945		
Total	31	8,39694575			

	Coefficients	***Standard Error***	***t Stat***	***P-value***	***Lower 95%***	***Upper 95%***
Intercept	8,478288398	0,714593926	11,86448428	7,40734E-13	7,018892906	9,93768389

LnTrade Openness	0,719958324	0,026954064	26,71056712	0.0018036	0,664910782	0,775005865

Explanation of the Model:

Dependent variable: 〖Ln(GDP)〗_ij → Log of GDP for country i in year j

Independent variable: 〖Ln(Trade Openness)〗_ij→ Log of trade openness for country i in year j

Intercept (α_2) → Represents the baseline level of GDP when trade openness is at 1 (in log scale)

Coefficient (β_2)→ Measures the elasticity of GDP with respect to trade openness (i.e., the % change in GDP for a 1% change in trade openness)

Error term (e_2) → Captures unobserved factors that influence GDP

Model 3:

〖Ln(GDP)〗_ij=α_3+β_3 〖Ln(inflation)〗_ij+e_3

Adopting Python, the estimation result is provided below.

OLS Estimation of inflation on GDP in Uzbekistan, Russian Federation and South Korea from 1992 to 2023

The impact of LnInflation, consumer prices (annual %) on LnGDP in Uzbekistan

Regression Statistics	
Multiple R	0,681900775
R Square	0,464988668
Adjusted R Square	0,447154957
Standard Error	0,624623795
Observations	32

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	10,17273405	10,17273405	26,0735786	1,72586E-05
Residual	30	11,70464654	0,390154885		
Total	31	21,87738059			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	25,55994185	0,302176922	84,58601562	2,95949E-37	24,94281425	26,17706946
LnInflation	-0,416160515	0,081500552	-5,106229392	0.0000172586	-0,582606848	-0,249714182

The impact of LnInflation, consumer prices (annual %) on LnGDP in Russian Federation

Regression Statistics	
Multiple R	0,604898976
R Square	0,365902771
Adjusted R Square	0,344766197
Standard Error	0,639488434
Observations	32

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	7,079400569	7,079400569	17,3113564	0,00024509
Residual	30	12,26836373	0,408945458		
Total	31	19,3477643			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	28,37585068	0,240686949	117,8952612	1,43907E-41	27,88430236	28,86739901
LnInflation	-0,304530142	0,073192189	-4,160691818	0,00024509	-0,454008534	-0,15505175

The impact of LnInflation, consumer prices (annual %) on LnGDP in South Korea

Regression Statistics	
Multiple R	0,565572473
R Square	0,319872222
Adjusted R Square	0,297201296
Standard Error	0,436310137
Observations	32

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	2,685949693	2,685949693	14,1093585	0,000742668
Residual	30	5,710996057	0,190366535		
Total	31	8,39694575			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	27,92243763	0,123756892	225,6232933	5,14451E-50	27,66969234	28,17518292
LnInflation	-0,395958488	0,105413449	-3,756242604	0,000742668	-0,611241472	-0,180675505

Explanation of the Model:

Dependent variable: 〖Ln(GDP)〗_ij → Log of GDP for country i in year j

Independent variable: 〖Ln(Inflation)〗_ij→ Log of inflation for country i in year j

Intercept (α_3) → Represents the baseline level of GDP when inflation is at 1 (in log scale)

Coefficient (β_3)→ Measures the elasticity of GDP with respect to inflation (i.e., the % change in GDP for a 1% change in inflation)

Error term (e_3) → Captures unobserved factors that influence GDP

Result analysis

Through the analysis of the impact of FDI and trade openness on economic growth in Uzbekistan, Russian Federation and South Korea, the following conclusions have been reached: When this study applied OLS for verification, the regression analysis results passed the 5% significance test, which ensured the validity of the results in the economic sense. β_1 is equal to 0.599 in Uzbekistan, 0.410 is Russian Federation and 0.98 in South Korea, meaning 1 % increase in FDI leads to a 0.599%, 0.410% and 0.98% increase in GDP in these three countries respectively. Adjusted R Square is equal to 0.30 in Uzbekistan, 0.18% in Russian Federation and 0.55% in South Korea, meaning about 30%, 18% and 55% of the variation in log GDP is explained by FDI in these three countries respectively. P-value is equal to 0.000, meaning the effect of FDI on GDP is highly significant.

When it comes to trade openness, adjusted R Square is equal to 0.90 in Uzbekistan, 0.95 in Russian Federation and 0.95 in South Korea, meaning 90%, 95% and 95% of the variation in LnGDP is explained by LnTradeopenness in these countries respectively. β_1 is equal to 0.88 in Uzbekistan, 1.13 in Russian Federation and 0.71 in South Korea, meaning 1% increase in trade openness is associated with an approximately 0.88%, 1.13% and 0.71% increase in GDP in these countries respectively. P-value for LnTradeopenness is equal to 0.00, meaning the relationship is statistically significant.

Inflation, however, has an opposite effect on GDP. β_1 is equal to -0.42 in Uzbekistan,

-0.30 is Russian Federation and -0.40 in South Korea, meaning 1 % increase in inflation leads to a 0.42%, 0.30% and 0.40% decrease in GDP in these three countries respectively. Adjusted R Square is equal to 0.45 in Uzbekistan, 0.34% in Russian Federation and 0.30% in South Korea, meaning about 45%, 34% and 30% of the variation in log GDP is explained by inflation in these three countries respectively. P-value is equal to 0.000, meaning the effect of inflation on GDP is highly significant[15].

The above results show that trade openness and FDI have a significant role in promoting economic growth and market expansion in Uzbekistan, Russian Federation and South Korea. FDI is necessary and effective for these countries.

4. Conclusion

Overall, Trade openness and FDI have positive impacts on a country's economic growth and market expansion, whereas inflation has the reverse impact. Our conclusion supports their certainty in Uzbekistan, Russian Federation and South Korea. Based on the premise that FDI, trade openness and inflation play crucial roles in raising standards of living and increase GDP per capita and in order to promote FDI and contribute to economic growth in Uzbekistan, it is paramount to develop a reliable methodology that could be used to evaluate the financial models of projects into which FDI is attracted. Investors and/or sponsors as well as the government that is attracting FDI will use this methodology to determine bankability of projects into which FDI is attracted and carry out value-for-money analysis for potential projects.

When sponsors evaluate the performance of a project, they make comparisons and calculations based on their cost of capital. For example, they compare the project's annual return (annual effective IRR) to their cost of capital and expect the return to be higher. When calculating the project's value, they discount the project's free cash flow using their

cost of capital and expect the value to be a positive figure. In the discount payback period calculation, they also discount each periodic free cash flow using their cost of capital.

Hence, the cost of capital calculation is critical as it is used to measure the project's performance from the sponsors' point of view. The capital injected by the sponsors consists of equity and debt. Their percentages in capital formation can differ, and debt is generally higher than equity. Since the weights of equity and debt are different, the cost of capital is calculated using their relative weights, which is why it is called the Weighted Average Cost of Capital.

Considering the above, the following methodologies have been developed and are recommended to evaluate whether FDI should be attracted into project:

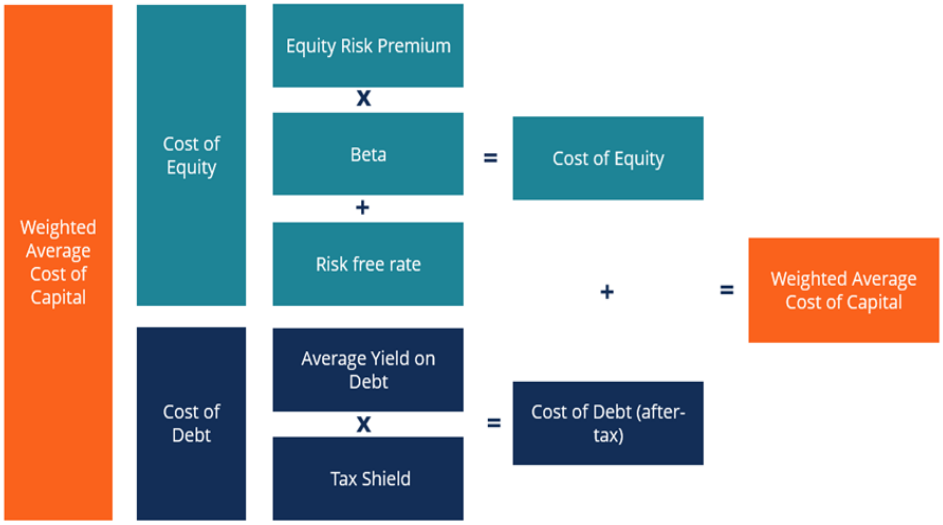

Figure 5 is created by the author to show how to calculate Weighted Average Cost of Capital (WACC).

Based on the Figure 1, the following methodology should be used to accurately calculate Weighted Average Cost of Capital (WACC) WACC = Equity % x Cost of Equity + Debt % x Cost of Debt. (Equity % = Equity / Capital and Debt % = Debt / Capital).

The methodology to calculate the cost of equity is Cost of Equity = Risk-Free Rate + Beta x Market Risk Premium + Country Risk Premium (the Cost of Equity depends on various factors. The first one is the risk-free rate, which is the base of the calculation as it reflects the lowest return expected out of any investment. Then, the risk of investing in a project should be considered, which incorporates the market risk premium of mature markets like the USA and the Beta factor, which shows the relative volatility of the specific industry being invested in to the overall stock index (the market). Finally, the country risk premium of the project needs to be considered to calculate the cost of equity.

The methodology to calculate the cost of debt is Cost of Debt = (Base interest rate + Credit Spread) x (1 – Corporate Tax) (The cost of debt calculation also starts with a base interest rate of SOFR for 180 days. Since the repayments are every six months, the interest rate should be taken accordingly. The credit spread reflects both the risk of the project and the creditworthiness of the project's sponsors, as this is the debt on the balance sheet of the sponsors. Finally, the cost of debt needs to be multiplied by (1- Corporate Tax Rate) to adjust it, considering the tax shield effect and get the after-tax value of Interest as long as sponsors have a net income instead of a loss. If the sponsors borrow in a mature market on their balance sheet and the corporate tax rates are higher, then the credit spread can be expected to be lower and the corporate tax rate to be higher, which could lower the total

cost of debt. The cost of debt for the sponsors can also be affected by borrowing terms, which we can expect to be shorter than the debt term of special purpose vehicle (SPV))

The methodology to calculate the Internal Rate of Return (IRR) is as follows:

$$0=NPV=\sum_{t=1}^{T}\left[C_t/\left[(1+IRR)\right]^t -C_0\right]$$

Where:

C_t=Net cash inflow during the period t

C_0=Total initial investment costs

IRR=The internal rate of return

T=The number of time periods

It measures the project's profitability from the sponsors' perspective. Using IRR shows the return on investment periodically and should be converted to an effective annual basis to compare the ratio with sponsors' WACC. The value should be higher than WACC to meet the sponsors' target return. The higher the IRR value, the better it is for the sponsors).

The methodology to calculate Debt Service Coverage Ratio (DSCR) is as follows:

DSCR=(Net operating income)/(Total debt service)

Where:

Net operating Income=Revenue-COE

COE=Certain Operating Expenses

Total Debt Service=Current Debt Obligations

DSCR is one of the most essential criteria for financial institutions to decide when lending to a project. DSCR is the ratio of net cash flow to the debt service periodically, where net cash flow represents all the operational expenses, including tax, to be deducted from the cash inflow periodically. The remaining figure is named Net Cash Flow (NCF) or Cash Available for Debt Service (CFAD). DSCR shows the project's capability to pay back to its lenders periodically. DSCR value is calculated for each repayment period, and the lowest DSCR is expected to meet the financial institutions' expectations. DSCR value is always higher than 1(one) with a margin. The margin of safety represents the riskiness of the project. If the project risks are regarded as high, then the lenders would either not be willing to lend or ask for a higher DSCR. Generally, publicly guaranteed revenue is an excellent indicator of a lower DSCR expectation.

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