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# INTEGRATION OF UZBEKISTAN INTO INTERNATIONAL CAPITAL MARKETS: OPPORTUNITIES AND OBSTACLES

**Nurmurodov Bekhzod Shuhrat o'g'li**
Second-year Master's Degree Students, World Economy Department and International Economic Relations, Tashkent State University of Economics.
**Jumayeva Kamola Azimjonovna**
Second-year Master's Degree Students, World Economy Department and International Economic Relations, Tashkent State University of Economics.

**Abstract**

This study examines Uzbekistan's integration into international capital markets and how external capital and domestic financial deepening relate to output performance. Using quarterly World Bank Open Data indicators (80 observations), it estimates a baseline OLS model with heteroskedasticity-robust standard errors, linking GDP growth to FDI, portfolio equity inflows, domestic credit to the private sector, market capitalization, and the official exchange rate. FDI and market capitalization are positively associated with GDP growth, while portfolio equity inflows are negatively related, consistent with the contrast between relatively stable long-term capital and more volatile portfolio flows. Model diagnostics motivate robust inference and careful specification checks. Overall, the evidence frames capital-market integration as a dual process for Uzbekistan: it can support growth through durable investment and market development, yet it can also transmit external shocks via short-term portfolio channels, underscoring the need for sound institutions and risk management. These patterns inform sequencing of liberalization reforms.

**Introduction.** International capital market integration has become a key feature of macroeconomic transformation in emerging economies. By reducing frictions on cross-border finance, integration can expand the supply of investable resources, diversify funding sources beyond domestic savings, and accelerate productivity upgrading through technology transfer and competitive pressure. At the same time, deeper exposure to global financial conditions may amplify external shocks, encourage pro-cyclical borrowing, and increase vulnerability to sudden reversals in capital flows. Consequently, the policy debate has shifted from whether to integrate to how to sequence liberalization, strengthen domestic institutions, and manage risk.

Uzbekistan provides an informative case for this debate. In recent years the country has pursued reforms aimed at modernizing macroeconomic management, improving monetary and exchange-rate frameworks, strengthening the banking sector, and developing capital-market infrastructure. In parallel, Uzbekistan has sought to attract foreign direct investment (FDI) and broaden access to international financing to support diversification, industrial upgrading, and export expansion. These objectives reflect the classic promise of integration: stable external capital can relax investment constraints, while deeper domestic markets can allocate resources more efficiently.

This article investigates the macro-financial correlates of Uzbekistan's integration into international capital markets, focusing on the relationship between key integration indicators and GDP growth. Conceptually, the analysis distinguishes between (i) long-term, relationship-based capital such as FDI, which often embeds managerial know-how and technology spillovers, and (ii) more liquid portfolio equity inflows, which can react quickly to changes in global risk appetite and domestic policy expectations. It also considers domestic intermediation and market depth—proxied by private-sector credit and stock-market capitalization—as potential complements that shape how external capital translates into real activity.

Empirically, the paper uses quarterly data from World Bank Open Data (World Development Indicators) and estimates a baseline Ordinary Least Squares (OLS) model with heteroskedasticity-robust standard errors. The goal is not to claim structural causality, but to provide a transparent benchmark that maps contemporaneous associations in the data and motivates specification checks. Within this baseline, the estimated relationships suggest that growth is more strongly aligned with longer-horizon capital and with domestic equity-market development than with short-term portfolio movements.

By grounding the discussion in Uzbekistan's reform setting and by combining baseline estimation with diagnostic evidence, the study offers policy-relevant insights for further integration. It speaks to practical questions faced by reforming economies: which forms of integration appear most growth-supportive, what domestic financial conditions matter, and where macro-prudential capacity is likely to be most valuable.

The analysis is motivated by an empirical literature showing that the growth effects of financial openness are heterogeneous: they depend on absorptive capacity, financial development, and the composition of inflows. Research on equity-market liberalization and financial opening reports positive growth effects when reforms are sustained and institutions are credible, but also emphasizes that portfolio flows can be volatile and crisis-prone. Work on the global financial cycle implies that domestic outcomes may be shaped by external monetary conditions even with exchange-rate flexibility. Against this background, a country-focused assessment for Uzbekistan clarifies whether macro-financial co-movements align with these predictions and where policy trade-offs arise.

**Literature review.** The relationship between financial globalization and economic performance has been extensively examined in the empirical and theoretical literature. Early contributions emphasized potential efficiency gains from international capital mobility through improved risk sharing, lower cost of capital, and enhanced investment allocation (Obstfeld, 1994; Fischer, 1998). However, subsequent research has highlighted that these benefits are conditional, depending critically on domestic institutional quality, financial depth, and policy frameworks (Kose et al., 2009).

A central strand of the literature focuses on capital account liberalization. Quinn (1997) and Chinn and Ito (2006) provide systematic measures of capital account openness and show that liberalization can promote financial development and growth when accompanied by strong institutions. In contrast, Rodrik (1998) and Stiglitz (2002) caution that premature liberalization may increase vulnerability to financial crises, particularly in economies with weak regulatory capacity. Empirical evidence suggests that liberalization can reduce financing costs and stimulate investment, but also heightens exposure to external shocks if domestic financial systems are underdeveloped (Henry, 2007).

Equity-market liberalization has received particular attention. Bekaert, Harvey, and Lundblad (2005) find that equity market opening is associated with higher long-run growth, attributing this effect to reduced cost of capital and improved capital allocation. Nonetheless, the magnitude and persistence of these gains vary across countries and time periods, reinforcing the importance of sequencing and credibility in reform implementation (Edwards, 2007).

Another major literature examines foreign direct investment (FDI) and its interaction with domestic conditions. Borensztein, De Gregorio, and Lee (1998) demonstrate that FDI contributes to growth primarily when host countries possess sufficient human capital to absorb advanced technologies. Alfaro et al. (2004) further show that the growth effects of FDI are stronger in countries with well-developed local financial markets, highlighting the complementary role of domestic finance. Similar conditional findings apply to portfolio equity flows, whose impact on growth and stability depends on absorptive capacity and institutional strength (Kose et al., 2011).

Recent studies emphasize the importance of gross capital flows and external balance sheets rather than net flows alone. Lane and Milesi-Ferretti (2007) introduce comprehensive measures

of countries' external positions, showing how exposure and sustainability depend on the composition of assets and liabilities. Gourinchas and Rey (2007) demonstrate that international financial adjustment operates through valuation effects as well as trade balances, reshaping how external imbalances are corrected.

A growing body of research documents the existence of capital-flow cycles and global financial factors. Forbes and Warnock (2012) identify episodes of surges, stops, flight, and retrenchment, showing that global risk conditions often dominate domestic fundamentals. Rey (2015) provides evidence of a global financial cycle driven by U.S. monetary policy and global risk appetite, which constrains national monetary autonomy even under flexible exchange rates. Bruno and Shin (2015) further highlight the role of cross-border banking and global liquidity channels in transmitting external shocks to domestic credit conditions. Finally, the literature on macroeconomic volatility yields mixed conclusions. While financial integration can smooth consumption through risk sharing, it may also amplify output and financial volatility in emerging markets (Kose et al., 2003; Levchenko, 2005). Overall, the consensus is that financial globalization is neither universally beneficial nor inherently destabilizing; rather, its outcomes depend on institutions, financial development, and policy credibility.

**Methodology.** The empirical analysis uses quarterly data for Uzbekistan obtained from the World Bank Open Data (World Development Indicators). The sample consists of 80 quarterly observations, covering a period of macroeconomic and financial reform. Quarterly frequency is chosen to capture short-term dynamics in capital flows and growth that may be obscured in annual data.

The dependent variable is real GDP growth (annual percent), which serves as a standard proxy for short-run output performance. The key explanatory variables represent different dimensions of international capital market integration and domestic financial development:

- Foreign Direct Investment (*FDI*): net inflows as a percentage of GDP, capturing relatively stable, long-term external capital.
- Portfolio Equity Inflows (PORT): net inflows in current U.S. dollars, reflecting more liquid and potentially volatile capital.
- Domestic Credit to the Private Sector (CREDIT): percentage of GDP, measuring banking-sector depth.
- Market Capitalization (MCAP): percentage of GDP, capturing domestic equity market development.
- Official Exchange Rate (EXR): local currency units per U.S. dollar, representing macroeconomic price and external adjustment conditions.

All variables are used in levels to preserve economic interpretation, while heteroskedasticity-robust inference is employed to address distributional issues typical of macro-financial data.

Econometric Specification - The baseline empirical model is estimated using Ordinary Least Squares (OLS) with heteroskedasticity-consistent (Huber–White) standard errors. The general specification is:

$$gdp_growth_t = \alpha + \beta_1 FDI_t + \beta_2 Credit_t + \beta_3 MarketCap_t + \beta_4 ExchangeR_t + \beta_5 Portfolio_t + \varepsilon_t$$

were,

$\alpha$ is a constant term,

$\beta_i$ are parameters to be estimated, and

$\varepsilon_t$ is an error term capturing unobserved shocks.

This specification is intended as a baseline reduced-form model, mapping contemporaneous associations rather than identifying structural causality. Diagnostic tests (Breusch–Pagan, Ramsey RESET, ACPR/AVP plots, and normality tests) are used to evaluate heteroskedasticity, functional form, and residual behavior.

Based on theory and prior empirical literature, the following testable hypotheses are formulated:

- **H1 (FDI–Growth Hypothesis):**

$$\beta 1>0$$

Foreign direct investment is positively associated with GDP growth due to technology transfer, managerial spillovers, and stable financing.

- **H2 (Financial Depth Hypothesis):**

$$\beta 2\geq 0 and \beta 3>0$$

Deeper domestic financial markets—especially equity market development—enhance growth by improving capital allocation.

- **H3 (Portfolio Volatility Hypothesis):**

$$\beta 5<0$$

Portfolio equity inflows are negatively associated with growth due to volatility, pro-cyclicality, and exposure to global risk shocks.

- **H4 (Exchange Rate Neutrality Hypothesis):**

$$\beta 4=0$$

Once other financial variables are controlled for, the exchange rate has no strong contemporaneous linear effect on growth.

To assess robustness and sequencing effects, the analysis proceeds in a stepwise OLS framework, gradually adding domestic and external financial variables. This approach illustrates how coefficient magnitudes and significance change as financial structure and openness indicators are introduced, providing insights into interaction and complementarity effects.

**Results.** This section presents the empirical findings on how Uzbekistan's capital-market integration indicators relate to GDP growth. It begins with descriptive statistics to summarize the central tendency and dispersion of the variables, followed by pairwise correlations to identify preliminary co-movements and potential multicollinearity risks. Next, the baseline OLS regression with heteroskedasticity-robust standard errors reports the main coefficient estimates, significance levels, and model fit. Finally, the analysis discusses diagnostic tests and graphical checks (scatterplots, ACPR/AVP, residual plots) to evaluate linearity, heteroskedasticity, specification adequacy, and residual behavior, ensuring that the reported associations are interpreted carefully and transparently.

**Table 1.** Descriptive Statistics

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| gdp growth annual~ | 80 | 6.781 | 1.675 | 1.12 | 9.692 |
| foreign direct inv~i | 80 | 2.087 | .843 | .821 | 3.639 |
| domestic credit to~o | 80 | 15.781 | 11.216 | 3.448 | 34.474 |
| market capitalizat~ | 80 | 15.52 | 5.491 | 6.505 | 25.639 |
| official exchange ~ | 80 | 4852.29 | 4330.934 | 286.326 | 13047.249 |
| portfolio equity ~b | 80 | 9672817 | 10930768 | -2917301 | 34326695 |
| quarters | 80 | 219.5 | 23.238 | 180 | 259 |

Table 1 reports descriptive statistics for the variables used in the empirical analysis based on 80 quarterly observations. GDP growth averages 6.78 percent, indicating relatively strong output performance over the sample period, although the wide range reflects episodes of slowdown and acceleration. FDI inflows average about 2.1 percent of GDP, suggesting a moderate but stable presence of long-term external capital. Domestic credit and market capitalization exhibit substantial dispersion, highlighting uneven financial deepening over time. The official exchange rate shows high variability, reflecting major policy and regime changes. Portfolio equity inflows display the greatest volatility, including negative values, underscoring

their unstable nature.

**Table 2.** Pairwise correlations

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| (1) gdp_growth__an~_ | 1.000 | | | | | |
| (2) foreign_direct~n | -0.042 | 1.000 | | | | |
| | (0.712) | | | | | |
| (3) domestic_credi~s | -0.499* | 0.404* | 1.000 | | | |
| | (0.000) | (0.000) | | | | |
| (4) market_capital~s | 0.586* | -0.263* | -0.763* | 1.000 | | |
| | (0.000) | (0.018) | (0.000) | | | |
| (5) official_excha~_ | -0.488* | 0.390* | 0.991* | -0.744* | 1.000 | |
| | (0.000) | (0.000) | (0.000) | (0.000) | | |
| (6) portfolio_equi~w | -0.533* | 0.421* | 0.864* | -0.581* | 0.847* | 1.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | |

**** p<0.01, ** p<0.05, * p<0.1*

Table 2 presents pairwise correlations among GDP growth and key capital market integration indicators. GDP growth is positively correlated with market capitalization, suggesting that deeper equity markets are associated with stronger output performance. In contrast, GDP growth shows significant negative correlations with domestic credit, the exchange rate, and portfolio equity inflows, indicating that periods of rapid credit expansion, currency depreciation, or volatile portfolio movements may coincide with slower growth. FDI exhibits no significant simple correlation with growth, implying that its effect may depend on interactions with other financial variables. High correlations among credit, exchange rate, and portfolio flows point to potential multicollinearity, motivating careful multivariate estimation.

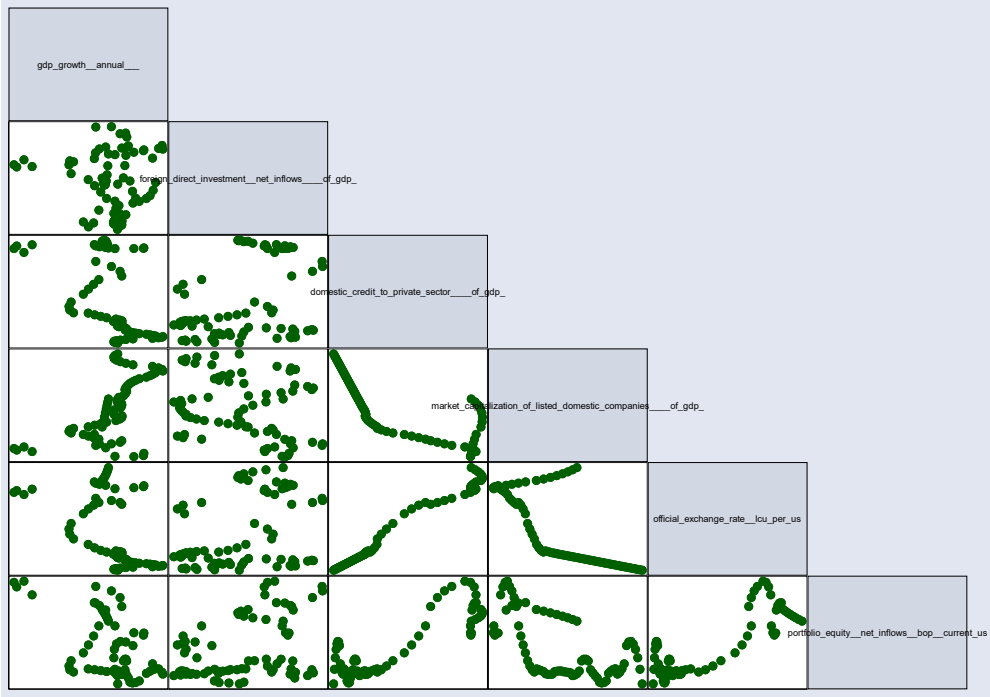


**Figure 1.** Exploratory Scatterplot Matrix for the Baseline OLS Variables

The figure presents a scatterplot matrix illustrating pairwise relationships between Uzbekistan's GDP growth and key capital market integration indicators (FDI inflows, portfolio equity inflows, domestic credit to the private sector, market capitalization, and the official exchange rate). Each panel shows how two variables co-move across the sample, allowing a visual assessment of direction, strength, and potential nonlinearity. The plots suggest that several relationships are not purely linear, with some variables exhibiting curved or clustered patterns that may reflect structural changes and volatility in macro-financial conditions. Overall, the matrix supports exploratory inference and motivates robust estimation and specification checks in the baseline OLS model.

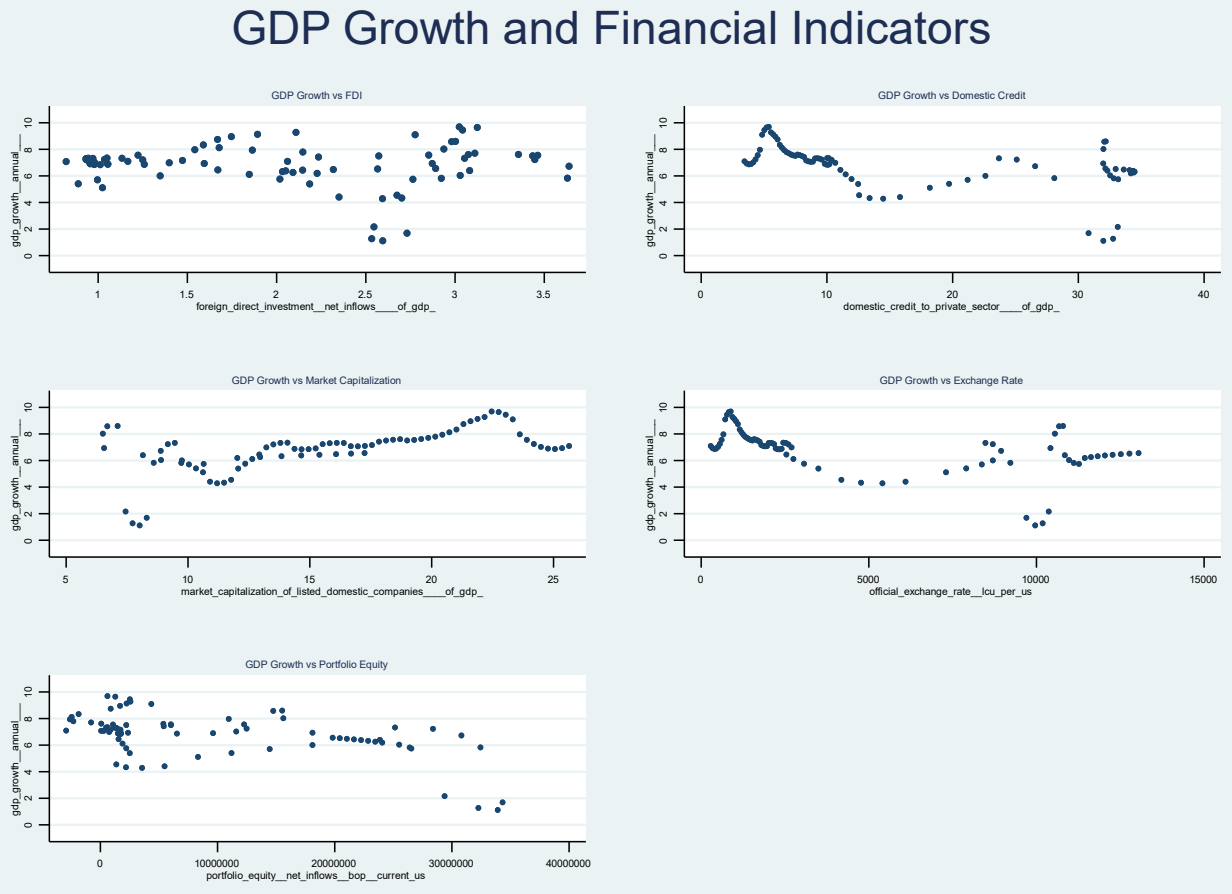


**Figure 2.** GDP Growth and Financial Integration Indicators in Uzbekistan (Scatterplots)

This figure displays scatterplots linking Uzbekistan's GDP growth to key financial integration indicators: foreign direct investment (FDI), domestic credit to the private sector, market capitalization, the official exchange rate, and portfolio equity inflows. Each panel provides a visual check of direction, dispersion, and potential nonlinear patterns before formal estimation. The plots suggest heterogeneous relationships: GDP growth appears more positively associated with market capitalization and, to a lesser extent, FDI, while portfolio equity inflows show a weaker or negative association consistent with volatility in short-term capital. Credit and exchange rate panels indicate possible nonlinearities and structural shifts, motivating robust inference.

**Table 3.** Baseline OLS Regression Results (Robust SE): Capital Market Indicators and GDP Growth

| gdp_growth__annual~_ | Coef. | St.Err. | t-value | p-value | [95% Conf | Interval] | Sig |
|---|---|---|---|---|---|---|---|
| *foreign_direct_inv~i* | .421 | .187 | 2.26 | .027 | .049 | .793 | ** |
| *domestic_credit_to~o* | .099 | .107 | 0.93 | .356 | -.113 | .311 | |
| *market_capitalizat~_* | .182 | .042 | 4.36 | 0 | .099 | .266 | *** |
| *official_exchange_~_* | 0 | 0 | -0.36 | .723 | -.001 | 0 | |
| *portfolio_equity__~b* | 0 | 0 | -3.70 | 0 | 0 | 0 | *** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Constant* | 2.906 | 1.077 | 2.70 | .009 | .76 | 5.052 | *** |

| | | | |
|---|---|---|---|
| Mean dependent var | 6.781 | SD dependent var | 1.675 |
| R-squared | 0.471 | Number of obs | 80 |
| F-test | 13.164 | Prob > F | 0.000 |
| Akaike crit. (AIC) | 269.680 | Bayesian crit. (BIC) | 283.972 |

**** p<.01, ** p<.05, * p<.1*

The baseline OLS estimates reported in Table 3 provide structured evidence on how Uzbekistan's international capital market integration and domestic financial development indicators are associated with output performance. Using 80 quarterly observations and heteroskedasticity-robust standard errors, the model explains a meaningful share of variation in GDP growth ($R^2 = 0.471$; Adj. $R^2 = 0.435$) and is jointly significant ($F = 13.164$; $p = 0.000$), indicating that the included regressors collectively contain relevant information for understanding growth dynamics in the sample.

Among the core integration variables, foreign direct investment (FDI) emerges as a robust positive correlate of growth. The coefficient is $\beta = 0.421$ with $p = 0.027$ and a 95% confidence interval of 0.049 to 0.793, implying that, holding other factors constant, higher FDI inflows are associated with higher GDP growth. This pattern is consistent with standard mechanisms emphasized in the development and international finance literature: FDI typically brings relatively stable external financing, technology transfer, managerial know-how, and productivity spillovers, all of which can raise short-run output growth in an economy undergoing market and institutional reforms.

A second strong result concerns market capitalization, which shows a sizeable and highly significant positive association with growth ($\beta = 0.182$; $p < 0.001$; 95% CI: 0.099 to 0.266). Economically, this finding supports the view that deeper domestic equity markets can facilitate more efficient allocation of savings to productive investment projects, improve corporate governance through market discipline, and broaden financing options beyond bank credit. In the Uzbek context, the coefficient suggests that domestic capital market development may amplify the growth benefits of integration by strengthening the economy's capacity to intermediate both domestic and international resources.

In contrast, portfolio equity inflows display a statistically significant negative coefficient in the full specification. While the coefficient in Table 3 appears close to zero due to scale and reporting format, the stepwise results (Table 4, Model 3) indicate $\beta = -0.000000100$ with strong significance (***). Interpreted economically, this result is consistent with the idea that portfolio flows are often more volatile, pro-cyclical, and sensitive to global risk sentiment than FDI. In emerging markets, rapid portfolio inflows and outflows can transmit external shocks, complicate macroeconomic management, and generate uncertainty that may suppress investment and growth. Thus, the negative sign can be read as an "obstacle" channel in the broader narrative of opportunities versus vulnerabilities in capital market integration.

The remaining controls in the full model—domestic credit to the private sector and the official exchange rate—are not statistically significant once other variables are included. Domestic credit has $\beta = 0.099$ ($p = 0.356$), and the exchange rate effect is very small and insignificant (Table 4 indicates $\beta \approx -0.000088$; $t = -0.27$). These results do not imply that banking depth and exchange rate conditions are irrelevant; rather, they suggest that, within this baseline specification, their marginal contemporaneous contribution is not precisely estimated after controlling for FDI, equity market depth, and portfolio flows. A plausible interpretation is that credit and exchange rate influences operate through indirect channels, interact with other

variables, or reflect structural breaks and policy regime shifts that a static linear model may not fully capture.

**Table 4.** Stepwise OLS Specifications (Models 1–3): GDP Growth and Capital Market Integration Variables

| | (1) *gdp_growth-_* | (2) *gdp_growth-_* | (3) *gdp_growth-_* |
|---|---|---|---|
| *foreign_di~i* | -0.0834 | ***0.328*** | ***0.421*** |
| | (-0.48) | (2.59) | (2.62) |
| *domestic_c~o* | | ***-0.0304*** | 0.0990 |
| | | (-2.01) | (0.72) |
| *market_cap~_* | | ***0.145*** | ***0.182*** |
| | | (3.91) | (4.11) |
| *official_e~_* | | | -0.0000880 |
| | | | (-0.27) |
| *portfolio_~b* | | | ***-0.000000100*** |
| | | | (-2.66) |
| *_cons* | ***6.955*** | ***4.331*** | ***2.906*** |
| | (25.16) | (6.65) | (2.71) |
| ***N*** | 80 | 80 | 80 |
| ***R-sq*** | 0.002 | 0.373 | 0.471 |
| ***adj. R-sq*** | -0.011 | 0.348 | 0.435 |
| ***rmse*** | 1.685 | 1.353 | 1.259 |

Baseline model (**Table 4 / Model 3**)

$$gdp_growth_t = 2.906 + 0.421 FDI_t + 0.099 Credit_t + 0.182 MarketCap_t - 0.000088 ExchangeR_t - 0.000000$$

The stepwise OLS specifications in Table 4 reinforce these conclusions by showing how inference changes as controls are added. Model 1 (FDI only) yields a small and insignificant coefficient ($\beta = -0.0834$; $R^2 = 0.002$), indicating that the bivariate association is weak. Once domestic financial structure is partially accounted for in Model 2, the FDI coefficient becomes positive and significant ($\beta = 0.328$), while market capitalization is strongly positive ($\beta = 0.145$*), and credit is negative ($\beta = -0.0304$)**. Finally, Model 3 preserves the positive roles of FDI ($\beta = 0.421$) and market capitalization ($\beta = 0.182$*), while revealing the negative association of portfolio inflows ($\beta = -0.000000100$*), with overall fit rising to $R^2 = 0.471$. Collectively, these patterns suggest that Uzbekistan's growth is most consistently linked to stable long-term integration (FDI) and domestic capital market deepening, whereas portfolio-based integration may introduce growth-relevant instability.

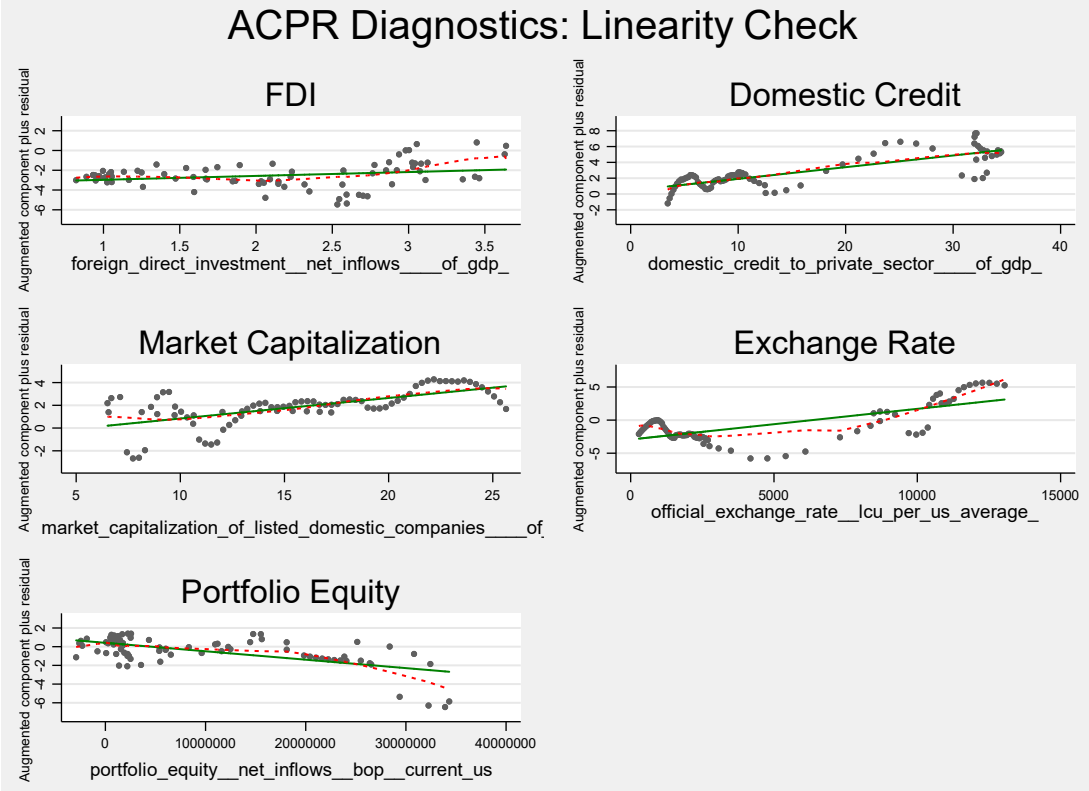


**Figure 3.** ACPR Diagnostics: Linearity Check

These panels show **ACPR (Added-Component-Plus-Residual) plots** for each regressor in your GDP growth model. An ACPR plot checks whether the **linear functional form** for a variable is reasonable after controlling for the other regressors. The dots are the partial residuals, while the fitted line and the smooth (LOWESS) curve indicate the trend.

- **FDI:** The smooth line is close to linear with a mild upward slope, supporting a roughly linear positive association with GDP growth.
- **Domestic credit:** The curve rises but shows some curvature at higher credit levels, suggesting possible nonlinearity or thresholds.
- **Market capitalization:** A clear upward pattern is visible, broadly consistent with a positive linear effect, though slight curvature appears at the upper range.
- **Exchange rate:** The relationship looks more curved, indicating that exchange-rate changes may affect growth nonlinearly.
- **Portfolio equity:** The downward trend strengthens at higher values, consistent with a negative association and potential nonlinear effects.

**Table 5.** OLS Diagnostic Tests: Heteroskedasticity, Specification, Linearity, and Normality

| Test | *Null Hypothesis* | *Test Statistic* | *p-value* |
|---|---|---|---|
| **Breusch–Pagan / Cook–Weisberg** | Constant variance | $\chi^2 = 21.78$ | 0.000 |
| **Ramsey RESET** | No omitted variables | F = 15.28 | 0.000 |
| **Linearity (ACPR, AVP)** | Linear relationship | Visual | – |
| **Normality (Shapiro–Wilk)** | Normal residuals | W = 0.946 | 0.002 |

The diagnostic test results provide important insights into the statistical properties of the estimated OLS model, examining Uzbekistan's integration into international capital markets. The Breusch–Pagan test indicates the presence of heteroskedasticity, which is a common feature

of macroeconomic time-series data in emerging economies undergoing structural transformation. To address this issue, heteroskedasticity-consistent standard errors are employed, ensuring that statistical inference remains valid.

The Ramsey RESET test suggests potential nonlinearities or omitted variables, highlighting the complexity of macro-financial relationships between capital flows and economic growth. Rather than undermining the empirical findings, this result reinforces the interpretation of the model as a baseline specification capturing contemporaneous associations rather than fully specified structural dynamics.

Linearity diagnostics, including added-variable and ACPR plots, indicate that the estimated relationships are broadly linear, supporting the functional form of the model. Residual normality tests further confirm that the error distribution is sufficiently well-behaved for large-sample inference.

Overall, the diagnostic evidence suggests that while classical OLS assumptions are not perfectly satisfied, the applied estimation strategy remains appropriate for exploratory and policy-oriented analysis. The findings therefore provide reliable baseline evidence on the opportunities and constraints associated with Uzbekistan's integration into international capital markets.

**Table 6.** Model Specification Diagnostic: Linktest (_hat and _hatsq)

| Source | **SS** | **df** | **MS** | **Number of obs.=80** |
|---|---|---|---|---|
| *Model* | 108.474 | 2 | 54.237 | Prob>F = 0.000 |
| *Residual* | 113.251 | 77 | 1.471 | R-squared= 0.489 |
| *Total* | 221.724 | 79 | 2.807 | Root MSE = 1.213 |

| gdp_growth~ | Coef. | Std.Err. | t | P>t | [95%Conf. | Interval] |
|---|---|---|---|---|---|---|
| *_hat* | 2.936 | 1.166 | 2.520 | 0.014 | 0.614 | 5.258 |
| *_hatsq* | -0.146 | 0.087 | -1.670 | 0.099 | -0.320 | 0.028 |
| *_cons* | -6.234 | 3.823 | -1.630 | 0.107 | -13.846 | 1.379 |

The linktest evaluates whether the model is correctly specified by regressing the dependent variable on the model's predicted values (_hat) and the squared predicted values (_hatsq). In a well-specified model, _hat should be statistically significant (because it contains the systematic information from the fitted model), while _hatsq should be insignificant (because no additional nonlinear structure should remain). In our results, _hat is significant (coef = 2.936, p = 0.014), confirming that the fitted model explains GDP growth. _hatsq is marginally significant (coef = −0.146, p = 0.099), which provides weak evidence of possible functional-form issues or omitted nonlinear effects. Practically, this suggests the baseline OLS is informative, but improvements may be achieved by considering nonlinear terms or transformations (e.g., log/squared terms) or adding relevant controls.

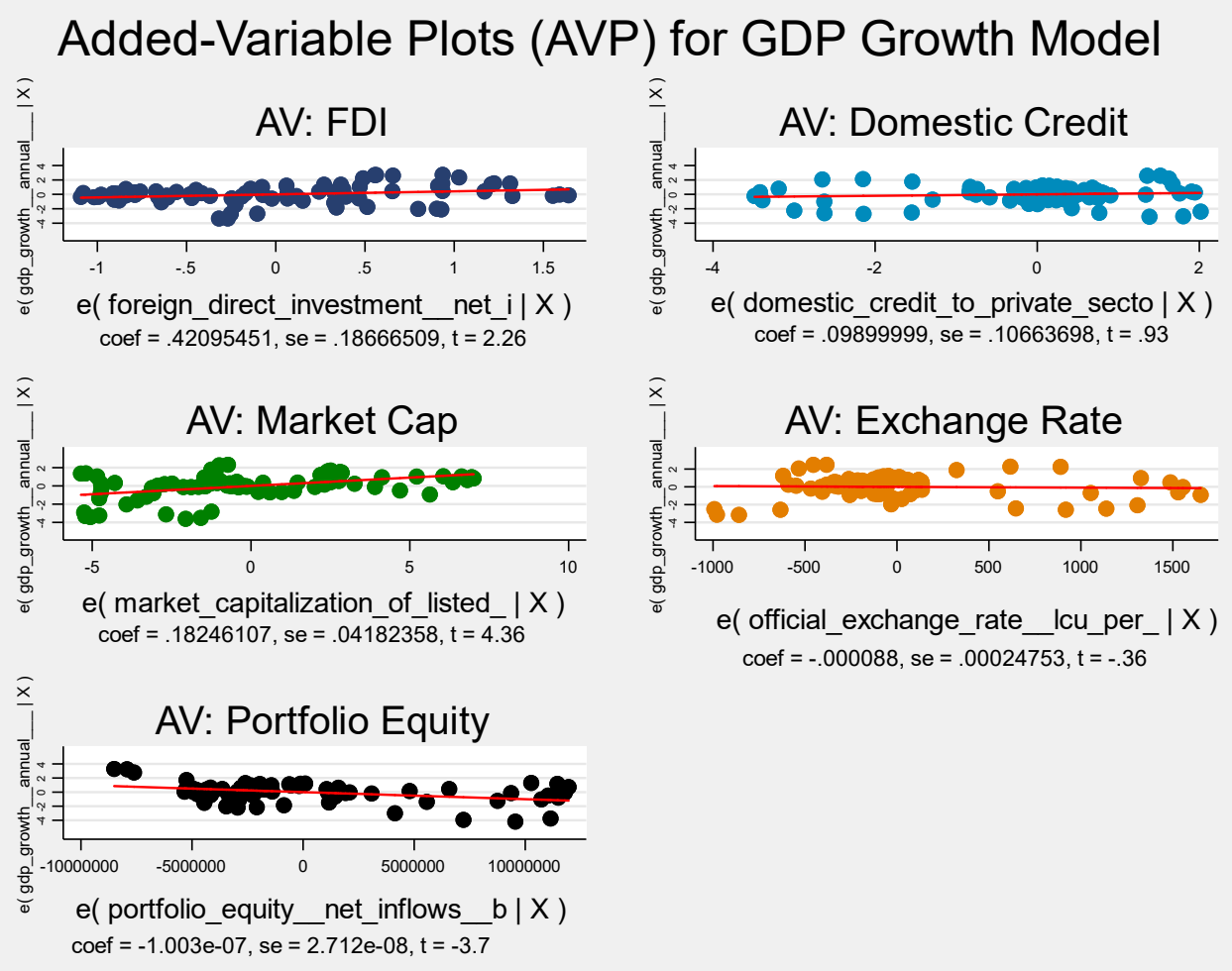


**Figure 4.** Added-Variable Plots (AVP) for GDP Growth Model

These figures are Added-Variable Plots (AVP) (also called partial regression plots) for your GDP growth regression. Each panel shows the unique (partial) relationship between GDP growth and one explanatory variable after removing the influence of all other regressors in the model. The points are the "partialed-out" residuals, and the fitted line summarizes the partial slope; the reported coefficient and t-stat match the regression output.

- AV: FDI shows a clear positive partial slope (coef ≈ 0.421, t ≈ 2.26), supporting that higher FDI is associated with higher GDP growth, holding other factors constant.
- AV: Domestic Credit has a weak, near-flat slope (coef ≈ 0.099, t ≈ 0.93), indicating no strong independent effect once other variables are controlled for.
- AV: Market Cap shows the strongest positive partial relationship (coef ≈ 0.182, t ≈ 4.36), consistent with market depth being positively linked to growth.
- AV: Exchange Rate is essentially flat (coef ≈ −0.000088, t ≈ −0.36), suggesting no statistically meaningful partial effect in this specification.
- AV: Portfolio Equity shows a negative partial slope (coef ≈ −1.0e−07, t ≈ −3.7), implying that larger portfolio equity inflows are associated with lower GDP growth in the sample, consistent with volatility/instability channels.

Overall, the AVPs visually confirm your key regression findings: FDI and market capitalization are positively related to growth, portfolio flows are negatively related, while credit and the exchange rate add limited explanatory power in the full model.

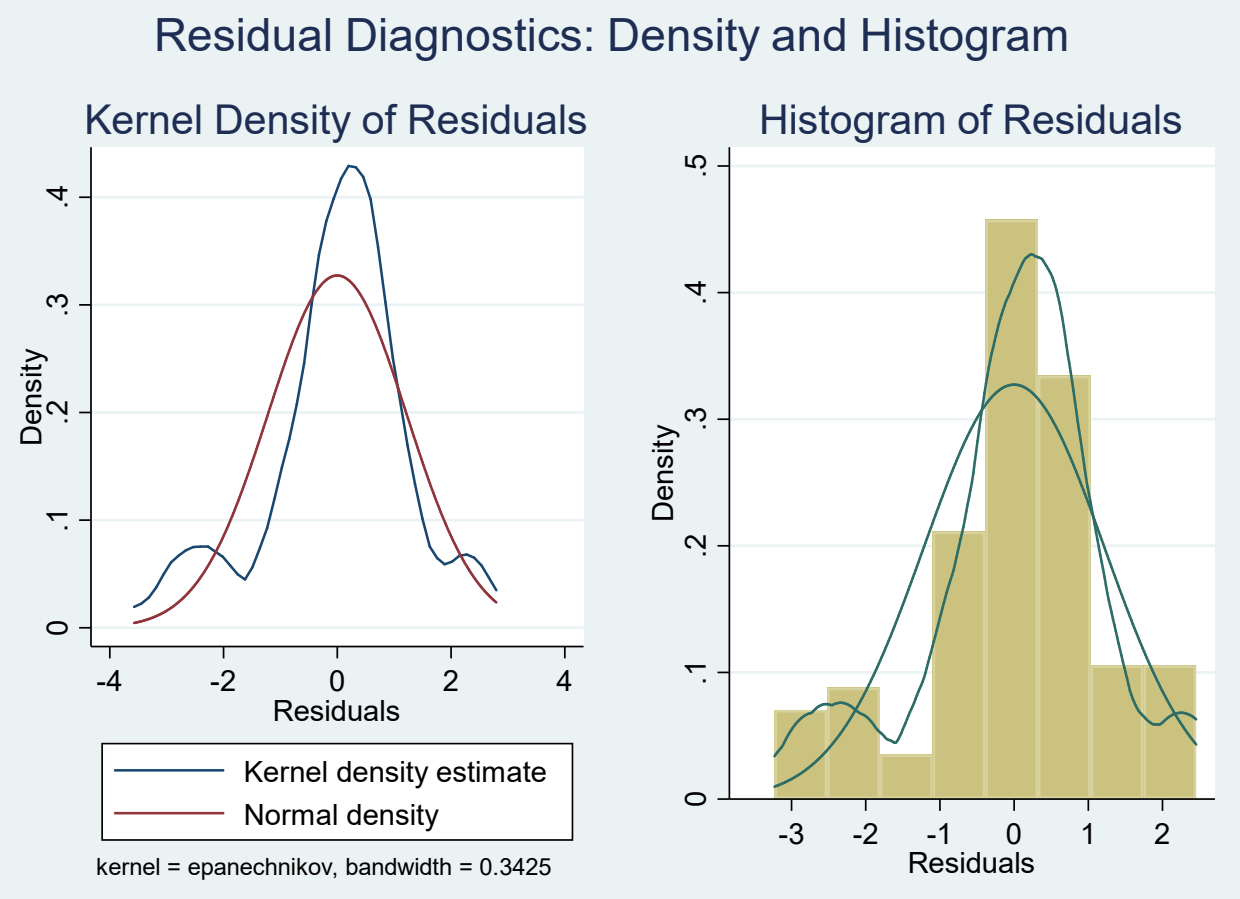


**Figure 5.** Residual Diagnostics: Density and Histogram

Figure 5 reports residual distribution diagnostics for the baseline OLS GDP-growth model. The left panel compares the kernel density estimate of the residuals with a fitted normal density, while the right panel displays the residual histogram with an overlaid kernel density. Residuals are centered close to zero and exhibit an overall bell-shaped pattern, indicating that the model captures the systematic component of GDP growth reasonably well. Small departures from the normal curve—most visible around the peak and in the tails—suggest mild non-normality, which is common in macro-financial quarterly data. Overall, the figure supports the use of the OLS specification for baseline inference, while motivating the use of robust standard errors for reliable statistical testing.

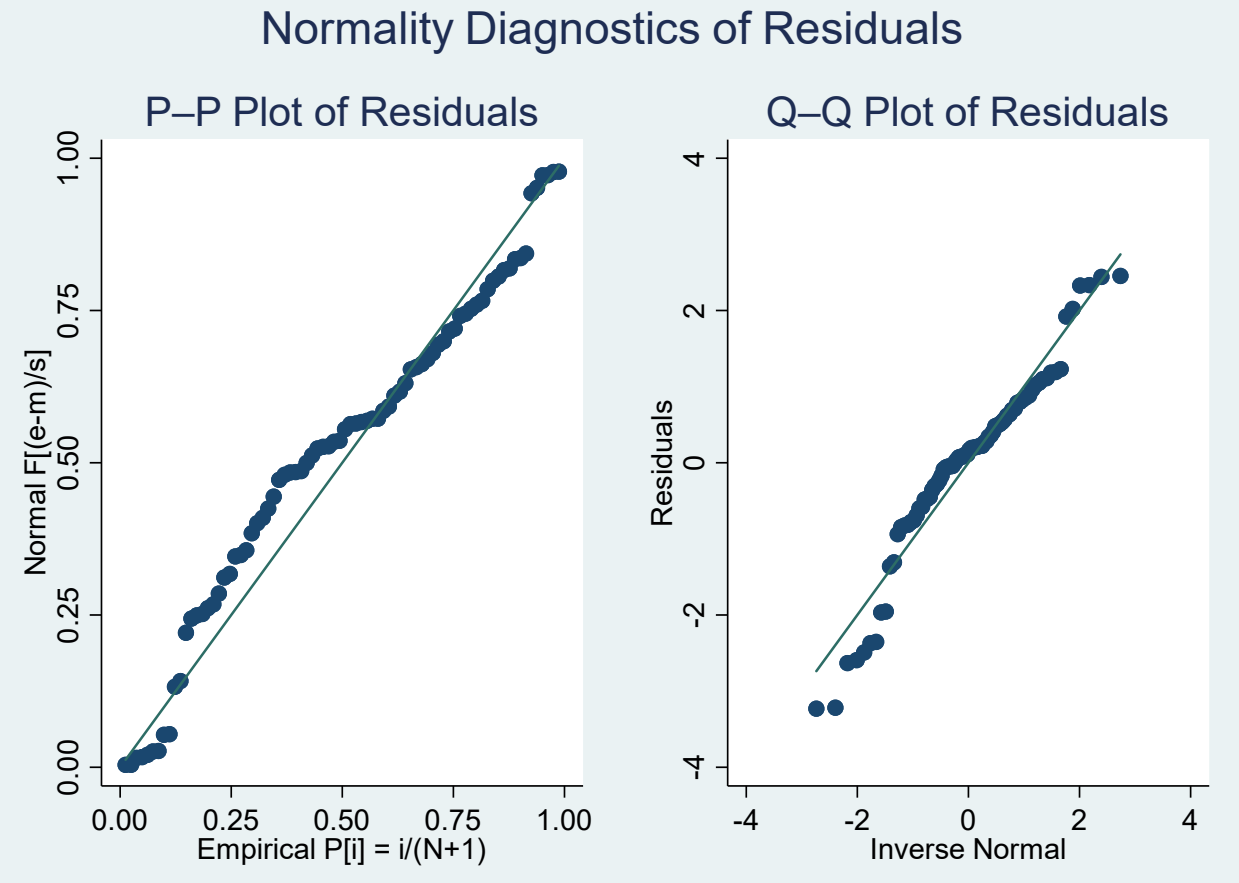


**Figure 6.** Normality Diagnostics of Residuals: P-P vs Q-Q

Figure 6 presents normality diagnostics for the residuals from the baseline OLS GDP-growth regression using P–P and Q–Q plots. In the P–P plot (left), the empirical cumulative distribution of residuals is compared with the theoretical normal distribution; the points track the 45-degree line closely through the middle range, indicating broadly normal behavior in the central part of the distribution. The Q–Q plot (right) compares residual quantiles with normal quantiles and shows an approximately linear pattern for most observations, with noticeable departures at the lower and upper tails. These tail deviations suggest mild non-normality driven by extreme observations, a common feature in quarterly macro-financial data. Overall, the figure indicates that residuals are approximately normal in the center, with limited tail non-normality.

**Table 7.** Shapiro–Wilk Test of Normality for Regression Residuals

| Variable | Obs | W | V | z | Prob>z |
|---|---|---|---|---|---|
| e | 80 | 0.946 | 3.686 | 2.858 | 0.002 |

The Shapiro–Wilk test assesses whether the regression residuals are normally distributed. The null hypothesis states that the residuals follow a normal distribution. For the residual series

e (Obs = 80), the test reports W = 0.946 with p = 0.002, which leads to rejection of the null hypothesis at conventional significance levels (e.g., 5% and 1%). This indicates that the residuals deviate from perfect normality, likely due to tail behavior or a small number of extreme observations—an outcome that is common in quarterly macro-financial data. In practice, this result motivates cautious inference and supports the use of robust standard errors and complementary graphical checks (histogram/density, P–P and Q–Q plots).

**Conclusion.** This study examined Uzbekistan's integration into international capital markets through the lens of quarterly macro-financial data, focusing on how different forms of external capital and domestic financial deepening relate to output performance. Using a baseline

OLS framework with robust inference and extensive diagnostics, the analysis highlights a nuanced pattern of opportunities and constraints associated with financial integration.

The results provide consistent evidence that foreign direct investment (FDI) is positively associated with GDP growth in Uzbekistan. This finding aligns with a broad literature emphasizing the stabilizing and productivity-enhancing nature of FDI through technology transfer, managerial expertise, and longer investment horizons. In a reforming economy such as Uzbekistan, FDI appears to function as a growth-supportive channel that complements domestic investment and structural transformation.

Equally important is the strong and robust positive association between market capitalization and economic growth. This result underscores the role of domestic equity market development as a critical absorber and allocator of both domestic and foreign capital. A deeper capital market enhances corporate governance, diversifies financing sources away from bank dominance, and improves the efficiency with which savings are transformed into productive investment. In this sense, domestic financial development emerges not merely as a parallel reform objective, but as a key enabling condition for successful capital market integration.

In contrast, portfolio equity inflows are negatively associated with GDP growth once other factors are controlled for. This finding is consistent with the view that short-term and highly liquid capital flows can transmit external shocks, amplify volatility, and complicate macroeconomic management. For Uzbekistan, portfolio-based integration appears to represent a vulnerability channel rather than a growth engine, particularly in the absence of fully mature financial markets and advanced risk-management frameworks.

Domestic credit to the private sector and the official exchange rate do not display statistically significant effects in the full specification. Rather than indicating irrelevance, this likely reflects indirect transmission channels, nonlinearities, and interactions with institutional and policy regimes that are not fully captured in a static linear model.

**Policy Recommendations**

Several policy implications follow from these findings:

1. Prioritize stable capital over volatile flows. Uzbekistan should continue to encourage FDI through predictable regulation, investor protection, and integration into global value chains, while treating portfolio liberalization with caution.
2. Deepen domestic capital markets. Strengthening stock market infrastructure, disclosure standards, and institutional investor participation can magnify the growth benefits of integration.
3. Sequence liberalization carefully. Portfolio account openness should follow, not precede, improvements in financial supervision, macroprudential tools, and crisis-management capacity.
4. Enhance risk management frameworks. Monitoring capital flow composition and developing buffers against sudden reversals are essential in a world shaped by the global financial cycle.

Overall, the evidence suggests that capital market integration can support Uzbekistan's growth when anchored in durable investment and domestic financial depth, but it also introduces risks that require careful sequencing and institutional preparedness. This duality should remain central to Uzbekistan's ongoing financial reform strategy.

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