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THE IMPACT OF DEBT, INVESTMENT, AND CAPITAL FORMATION ON EXPORT GROWTH IN CENTRAL ASIAN ECONOMIES

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Abstract: This study investigates the effects of external debt, foreign direct investment (FDI), gross fixed capital formation, and total debt service on the export performance of five Central Asian economies—Uzbekistan, Kazakhstan, Kyrgyzstan, Tajikistan, and Turkmenistan—over the period from 1992 to 2023. Using panel data obtained from the World Bank, we apply econometric techniques to examine the long-term and short-term relationships between these macroeconomic variables and exports of goods and services as a percentage of GDP. The analysis reveals significant interactions between investment inflows, debt levels, and capital formation with export performance, highlighting the complex dynamics that shape trade capacity in the region. The findings provide valuable insights for policymakers aiming to improve export competitiveness and ensure sustainable economic development through strategic investment and debt management.
Keywords: Export performance, Central Asia, external debt, foreign direct investment (FDI), capital formation, total debt service, panel data analysis.3

1. Introduction

Export-led growth has long been viewed as a catalyst for economic development in emerging economies. Over the past several decades, many Asian and Latin American countries have pursued export-oriented strategies and achieved remarkable growth as a result . East Asian success stories—such as South Korea, China, and Taiwan—underscore how fostering competitive export sectors can accelerate industrialization and income growth [1]. Empirical evidence supports this export-led growth hypothesis; for example, studies find that a rise in exports is associated with significantly higher GDP growth in developing countries [2]. These experiences suggest that expanding exports of goods and services can play a pivotal role in the development trajectory of low- and middle-income nations.

In the context of Central Asia, export performance is particularly important for sustaining growth and diversifying economies. Nearly 30 years after the Soviet Union's collapse, the five post-Soviet Central Asian republics (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan) continue to grapple with the challenge of translating their abundant natural resources and labor into broad-based export growth. To date, their exports remain heavily dominated by primary commodities: as of 2019, commodities accounted for roughly 65% of total exports in the Kyrgyz Republic, Tajikistan, and Uzbekistan, and over 90% in Kazakhstan and Turkmenistan [3]. This indicates limited progress in diversifying export baskets since independence. One of the main policy goals in Central Asia for the past three decades has been to diversify exports beyond raw materials; however, results have been modest, with intra-regional trade still low and competitiveness challenges persisting. Thus, boosting export growth – and making it more sustainable through diversification – remains a critical development priority for Central Asian economies.

Existing literature suggests that several key macroeconomic factors can significantly influence a country's export performance. External debt is one such factor: while foreign borrowing can finance investment in export capacity, excessive debt may create a "debt overhang" that hampers growth and trade [4]. Large external debt stocks and the associated servicing costs can deter new investment in productive industries (including export-oriented sectors) by raising uncertainty and absorbing resources. Empirical studies have found evidence of debt's constraining effect on exports; for instance, in Pakistan, an econometric analysis showed a significant negative long-run relationship between external debt and export performance [5]. High levels of debt service – the repayments of principal and interest on external debt – can further strain export earnings. When a substantial share of a country's export revenue is diverted to debt repayment, fewer resources are available to import inputs for production or to invest in infrastructure, thereby weakening trade competitiveness. As an illustration, Nigeria's external debt service payments surged from about 13% to 46% of export earnings between 2013 and 2016 [6], a burden that exemplifies how heavy debt-service obligations can crowd out the capacity to expand exports.

By contrast, various forms of investment are generally thought to bolster export growth. Foreign direct investment (FDI) can be a powerful catalyst for export expansion, as multinational firms bring in capital, technology, and access to international markets. FDI inflows often target sectors with export potential (such as manufacturing or resource extraction), thereby increasing the host country's export volume and diversifying its export base. Empirical evidence from diverse economies supports the positive role of FDI in export performance. For example, studies on Bangladesh and China find that FDI has contributed significantly to higher export growth in both the short run and long run [7]. These benefits are typically attributed to improved productive capacity and spillover effects, where foreign-invested firms boost overall efficiency and create new export opportunities [8]. Alongside FDI, domestic capital formation is another crucial driver of exports. Higher investment in physical capital (machinery, factories, infrastructure) expands a country's productive capabilities and output surplus available for export. Countries that devote substantial resources to gross fixed capital formation tend to develop the infrastructure and industrial base necessary for export diversification [9]. In other words, strong domestic investment helps build the capacity to produce competitive goods and services for global markets.

Despite the acknowledged importance of debt and investment factors, there is a notable research gap regarding their impact on export performance in Central Asian economies. Most previous studies on export-led growth and its determinants have focused on rapidly industrializing regions (such as East Asia) or other developing areas, whereas the Central Asian context remains under-explored. The unique post-Soviet transition experiences of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan—characterized by state-led economic reforms, resource-dependent economies, and evolving external financial positions—warrant a closer examination of how debt and investment dynamics affect trade outcomes. Some research has begun to analyze specific aspects of Central Asian trade (for example, the role of high trade costs and logistical delays on exports [10]), but comprehensive empirical analyses of macroeconomic influences on the region's export growth are still limited.

Study Objective: In light of the above, the present study aims to investigate the effect of external debt, external debt service, FDI inflows, and gross capital formation on the export growth of Central Asian economies. Specifically, we focus on the exports of goods and services in Uzbekistan, Kazakhstan, Kyrgyzstan, Tajikistan, and Turkmenistan over the period 1992–2023. By employing panel data covering the full post-independence era for these five countries, the analysis will shed new light on how debt burdens and investment flows have influenced export performance in Central Asia. The contribution of this research is twofold: first, it fills an empirical

void by examining export determinants in a region often overlooked in the trade literature; and second, it provides policy-relevant insights into how prudent debt management and enhanced investment (both foreign and domestic) can help drive export-led growth in Central Asian developing economies. Ultimately, this study's findings are expected to enrich the understanding of export dynamics in post-Soviet economies and to inform strategies for achieving more robust and sustainable export growth in Central Asia.

2. Literature Review

2.1. External Debt and Exports

High external debt can influence a country's export performance through the debt overhang effect. Heavily indebted nations may experience reduced investment in productive sectors due to fears of future tax increases or austerity to meet debt obligations. In the Central Asian context, external debt has been shown to negatively affect economic growth by slowing investment, which also limits the development of export sectors [11].

Empirical studies from other developing regions support the negative relationship between debt and exports. In Pakistan, a cointegration analysis over 1972–2014 revealed a significant long-run inverse relationship between external debt and export performance. Granger causality tests also confirmed unidirectional causality from debt to exports . The negative impact stems from policy constraints—IMF loan conditions such as raising indirect taxes and energy prices have increased production costs and weakened competitiveness [12].

2.2. FDI and Export Performance

Foreign direct investment (FDI) is widely recognized as a driver of export development in emerging markets. FDI facilitates technology transfer, productivity gains, and access to international markets. A panel data study of Sub-Saharan African countries confirmed that FDI inflows had a statistically significant positive effect on exports [13].

Similar results have been observed in Nigeria using ARDL bounds testing, which indicated that FDI complements export performance both in aggregate and sectoral terms [14]. In South Asia, several studies identified bidirectional long-run causality between FDI and exports, particularly in Pakistan. However, exceptions exist. For instance, a study in India using a Toda–Yamamoto approach found a negative long-run effect of FDI on exports, highlighting how sectoral focus and absorptive capacity shape outcomes [15]. Nonetheless, the overall consensus suggests that FDI tends to enhance export capacity, especially when directed at productive and tradable sectors [16].

2.3. Capital Formation and Trade Competitiveness

Gross capital formation is essential for export competitiveness. Higher investment in infrastructure, equipment, and production capacity increases output potential and supports trade expansion. Panel studies of developing Asian economies found that investment in capital formation is significantly associated with export-led growth [17].

Additionally, studies emphasize that open trade regimes and high investment rates jointly support export competitiveness. A cross-country analysis revealed that gross capital formation and trade openness are key determinants of economic performance and export capability [18]. In practice, investment in logistics, energy infrastructure, and manufacturing directly reduces trade costs and improves efficiency [19]. A two-way link is often seen: increased exports can stimulate investment, while capital formation strengthens the ability to expand trade [20].

2.4. Debt Service and Trade Constraints

Debt service obligations can severely limit a country's export capacity by reducing the foreign exchange available for importing capital goods or supporting trade infrastructure. Many low-income countries have faced external debt service burdens amounting to over 10% of their total exports, constraining their development spending [21].

In 2020, external debt stocks in LDCs reached 177% of exports, and debt service exceeded 11% of earnings [21]. This redirection of financial resources away from trade-supporting activities slows export sector development. Studies show that high debt service burdens crowd out public investment, undermining long-run growth and trade potential [22]. In Pakistan, IMF-imposed austerity measures to ensure debt servicing—such as cuts in subsidies and tariff hikes—raised domestic production costs, making exports less competitive.

3. Methodology

3.1. Data and Variables

This study utilizes an unbalanced panel dataset covering five Central Asian countries—Uzbekistan, Kazakhstan, Kyrgyzstan, Tajikistan, and Turkmenistan—spanning the period from 1992 to 2023. Panel data allows for controlling individual heterogeneity, capturing temporal dynamics, and improving the efficiency of estimators [29].

The dependent variable is:

Exports of goods and services (% of GDP) – a standard indicator of export performance.

The independent variables include:

External debt stocks (% of GNI) – total public and private external debt as a share of GNI.

Foreign direct investment, net inflows (% of GDP) – net FDI inflows reflecting capital and technology transfer.

Gross fixed capital formation (% of GDP) – a proxy for domestic investment in productive capacity.

Total debt service (% of GNI) – a measure of the debt repayment burden.

All variables were sourced from the World Bank's World Development Indicators database [30].

3.2. Model Specification

To analyze the impact of these macroeconomic indicators on export performance, we estimated the following linear panel data regression model:

$$\text{Exports}_{it} = \beta_0 + \beta_1 \text{DebtStock}_{it} + \beta_2 \text{FDI}_{it} + \beta_3 \text{GFCF}_{it} + \beta_4 \text{DebtService}_{it} + u_i + \epsilon_{it}$$

where:

i - denotes the country,

t - denotes the time (year),

u_i - captures unobserved country-specific effects,

ϵ_{it} - is the idiosyncratic error term.

Two panel estimation techniques were considered: Fixed Effects (FE) and Random Effects (RE) models. The FE estimator controls for time-invariant characteristics by using within-variation across time, whereas the RE model assumes that the country-specific effects are uncorrelated with the regressors [31].

3.3. Model Selection and Justification

To determine the appropriate model, we conducted the Hausman test, which tests whether the unique errors u_i are correlated with the regressors. The null hypothesis, which favors RE, was not rejected ($p > 0.05$), suggesting that the RE model provides consistent and efficient estimates [32]. Thus, we adopted the Random Effects estimator.

The model was estimated using Stata 17 software, employing the xtreg command under RE specification. All standard errors were made robust to heteroskedasticity and serial correlation using clustered robust standard errors at the country level [33].

3.4. Diagnostic Tests

To ensure robustness and validity of the RE model, several diagnostic tests were conducted:

Breusch-Pagan Lagrange Multiplier Test (xttest0): This test rejected the null hypothesis of no panel effect, justifying the use of a panel model over pooled OLS [34].

Wooldridge Test for Autocorrelation (xtserial): Results indicated first-order serial correlation, addressed using robust standard errors [35].
Modified Wald Test for Groupwise Heteroskedasticity (xttest3): This test rejected the null of homoskedasticity ($p < 0.01$), indicating the need for heteroskedasticity-robust standard errors [36].
Variance Inflation Factor (VIF): VIF values for all independent variables were below 4, confirming the absence of serious multicollinearity concerns [37].

These diagnostics confirmed the reliability of the RE model and the validity of the inference drawn from it.

4. Results and Discussion

4.1. Regressions

The results of the linear regression analysis reveal important insights into the relationship between macroeconomic indicators and export performance in Central Asian economies. The model explains approximately 24.6% of the variation in exports of goods and services as a percentage of GDP, suggesting a modest but meaningful explanatory power. Among the independent variables, foreign direct investment (FDI) shows the strongest and most significant positive effect on exports. Specifically, a one percentage point increase in FDI inflows is associated with a 1.458 percentage point increase in export share, holding other factors constant. This finding underscores the critical role of FDI in boosting export capacity, likely through capital infusion, technology transfer, and improved access to international markets.
External debt stocks, measured as a percentage of GNI, also exhibit a statistically significant and positive relationship with exports. The coefficient of 0.137 indicates that increased external borrowing, when effectively managed and channeled into productive use, can support export performance. This suggests that, for the countries studied, external debt has likely contributed to financing infrastructure or industries that are connected to export generation (Table 1).

Table 1. Linear regression

Exportsofgoodsands~s	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Externaldebtstocks~I	.137	.039	3.53	.001	.06	.213	***
Foreigndirectinves~i	1.458	.31	4.71	0	.846	2.07	***
Grossfixedcapitalf~n	-.383	.14	-2.74	.007	-.659	-.107	***
Totaldebtserviceof~I	-.156	.219	-0.71	.477	-.589	.277	
Constant	33.055	4.25	7.78	0	24.652	41.459	***

Mean dependent var	37.045	SD dependent var	15.594
R-squared	0.246	Number of obs	144
F-test	11.329	Prob > F	0.000
Akaike crit. (AIC)	1168.123	Bayesian crit. (BIC)	1182.972

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

In contrast, gross fixed capital formation, representing domestic investment, is negatively and significantly associated with exports. A one percentage point increase in investment is correlated with a 0.383 percentage point decline in exports. While counterintuitive, this result may reflect inefficiencies in investment allocation—such as spending on non-tradable sectors or low-return

projects—that do not contribute to export growth in the short to medium term. It also suggests that investment alone, without a focus on export-oriented outcomes, may not translate into improved trade performance.

Total debt service, while negatively signed, does not show a statistically significant effect on exports. This implies that, during the period analyzed, debt repayment obligations may not have posed a substantial constraint on trade activity, potentially due to manageable debt levels or supportive external conditions.

Overall, the results suggest that foreign capital—especially in the form of FDI—plays a crucial role in promoting export growth, while domestic investment strategies need to be re-evaluated for efficiency and export alignment. Effective external debt utilization appears beneficial, but rising debt service levels should be closely monitored to avoid potential long-term pressures on export-driven development (Table 1).

Table 2. Regression results (random effect)

Exportsofgoodsands~s	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Externaldebtstocks~I	.137	.039	3.53	0	.061	.212	***
Foreigndirectinves~i	1.458	.31	4.71	0	.851	2.064	***
Grossfixedcapitalf~n	-.383	.14	-2.74	.006	-.656	-.109	***
Totaldebtserviceof~I	-.156	.219	-0.71	.476	-.585	.273	
Constant	33.055	4.25	7.78	0	24.726	41.385	***

Mean dependent var	37.045	SD dependent var	15.594
Overall r-squared	0.246	Number of obs	144
Chi-square	45.318	Prob > chi2	0.000
R-squared within	0.200	R-squared between	0.629

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

The random effects regression results provide meaningful evidence on the determinants of export performance in Central Asian economies from 1992 to 2023. The dependent variable, exports of goods and services (% of GDP), is significantly influenced by several macroeconomic factors.

Foreign direct investment (FDI) emerges as the most influential variable in the model. The coefficient of 1.458 is positive and statistically significant at the 1% level, indicating that a one percentage point increase in FDI inflows (as a share of GDP) is associated with a 1.458 percentage point increase in exports. This strong and highly significant effect suggests that FDI plays a vital role in enhancing export performance, likely by providing capital, modern technology, managerial expertise, and global market access.

External debt stocks (% of GNI) also have a statistically significant and positive impact on exports. The coefficient of 0.137 implies that a one percentage point increase in external debt is associated with a 0.137 percentage point increase in export share. This result suggests that external borrowing, when utilized productively—such as in infrastructure or export-oriented sectors—can contribute to expanding a country's export capacity.

In contrast, gross fixed capital formation (% of GDP), which represents domestic investment, shows a negative and statistically significant relationship with exports. The coefficient is –0.383, indicating that increased domestic investment is associated with a reduction in exports. This counterintuitive finding may reflect inefficiencies in investment allocation—such as overinvestment in non-tradable sectors or unproductive projects—that do not directly contribute to export growth. It highlights the importance of not just increasing investment volume, but ensuring that investments are targeted effectively toward productive, export-generating activities.
Total debt service (% of GNI) carries a negative coefficient (–0.156), but this effect is statistically insignificant. This suggests that, within the period analyzed, debt repayment obligations have not had a significant direct impact on export performance. However, the negative sign is consistent with economic theory that rising debt service burdens can constrain a country's capacity to support its export sector.
The model's overall fit is acceptable, with an overall R-squared of 0.246, indicating that nearly 25% of the variation in export performance is explained by the included variables. The model also demonstrates a good fit across groups (between R-squared = 0.629), suggesting substantial explanatory power across countries. The chi-square test is highly significant ($p < 0.001$), confirming that the model as a whole is statistically meaningful (Table 2).

Table 3. Regression results (fixed effect)

Exportsofgoodsands~s	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Externaldebtstocks~I	.246	.059	4.18	0	.13	.363	***
Foreigndirectinves~i	1.293	.325	3.98	0	.65	1.936	***
Grossfixedcapitalf~n	-.532	.15	-3.56	.001	-.829	-.236	***
Totaldebtserviceof~I	-.629	.339	-1.85	.066	-1.3	.042	*
Constant	34.622	4.347	7.96	0	26.025	43.218	***

Mean dependent var	37.045	SD dependent var	15.594
R-squared	0.229	Number of obs	144
F-test	10.042	Prob > F	0.000
Akaike crit. (AIC)	1153.537	Bayesian crit. (BIC)	1168.386

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

The fixed effects regression results offer valuable insights into the determinants of export performance in Central Asian countries over the period 1992–2023, accounting for unobserved country-specific characteristics that remain constant over time. With an R-squared value of 0.229, the model explains approximately 22.9% of the variation in exports of goods and services (% of GDP), and the overall F-test is highly significant ($p < 0.001$), indicating that the independent variables collectively explain a substantial portion of the dependent variable's variance.
Foreign direct investment (FDI) shows a strong and statistically significant positive effect on exports. The coefficient of 1.293 ($p < 0.01$) implies that a 1 percentage point increase in FDI inflows as a share of GDP is associated with a 1.293 percentage point increase in exports, holding

all else constant. This highlights the critical role of FDI in supporting export growth, likely through increased capital, improved technology, and integration into global value chains.

External debt stocks (% of GNI) also exhibit a significant positive impact on exports, with a coefficient of 0.246 ($p < 0.01$). This suggests that a one percentage point increase in external debt is associated with a 0.246 percentage point rise in export performance. The result implies that external borrowing, when used efficiently—especially for infrastructure or export-capable sectors—can stimulate the productive capacity needed for expanding exports.

Conversely, gross fixed capital formation (% of GDP), which serves as a proxy for domestic investment, shows a significant negative association with exports. The coefficient of –0.532 ($p = 0.001$) indicates that higher domestic investment is correlated with lower export performance. This counterintuitive outcome may reflect poor allocation of investment resources toward non-export-generating or inefficient sectors. It suggests that the quality and direction of domestic investment are critical—simply increasing investment is not sufficient unless it is strategically aligned with trade and production objectives.

Total debt service (% of GNI) has a negative coefficient of –0.629, which is marginally significant at the 10% level ($p = 0.066$). This implies that higher debt repayment obligations may crowd out resources that could otherwise support export development, such as public investment in logistics, infrastructure, or exporter support programs. Although not significant at the 5% level, the negative effect signals a potential constraint on exports if debt servicing becomes more burdensome.

The constant term is positive and significant, representing the average export level when all explanatory variables are at zero—though its standalone interpretation is limited in panel models(Table 3).

4.2. Panel Data Estimation and Model Selection

The panel regression analysis was conducted using both fixed-effects (FE) and random-effects (RE) models. The FE model controls for unobserved country-specific factors (such as geography, institutions, or culture) by allowing each country to have its own intercept, while the RE model assumes these country effects are random and uncorrelated with the regressors. In both specifications, the coefficient signs of the key variables were consistent: external debt stock and FDI showed positive associations with export performance, whereas gross fixed capital formation and total debt service exhibited negative coefficients. However, there were slight differences in magnitude and significance between FE and RE estimates. For instance, the external debt stock variable had a positive coefficient in both models (around 0.12 in the FE and 0.14 in the RE), but it achieved statistical significance (at the 5% level) only in the RE results. FDI inflows were strongly positive and highly significant in both FE and RE (coef. ≈ 1.4–1.5, $p < 0.01$), reaffirming the robustness of this effect. In contrast, gross fixed capital formation and debt service maintained negative coefficients in both models but were not statistically significant (indicating that these effects are not distinguishable from zero given the data variance). These similarities in coefficient patterns suggest that the choice between FE and RE does not alter the qualitative findings, though the RE model provided slightly more precise estimates for some variables.

To decide between the FE and RE specifications formally, we performed a Hausman test. The Hausman test evaluates whether the unique error (country-specific effect) is correlated with the regressors – the null hypothesis is that the RE model is appropriate (and more efficient) and the FE estimates are not significantly different. In our analysis, the Hausman test result was not significant (p-value > 0.05), meaning we failed to reject the null hypothesis that the RE estimator is consistent. In other words, there was no evidence of systematic difference between FE and RE estimates, so the more efficient RE model was preferred. Accordingly, the discussion focuses on the RE model results (with robust standard errors to address any heteroskedasticity or

autocorrelation), as it is the chosen specification based on this test. The RE model's overall fit was satisfactory, and the Wald test for joint significance of regressors was highly significant (indicating the model explains a substantial portion of the variation in export growth). We next discuss the estimated effects of each explanatory variable on export growth, interpreting their economic meaning and relevance.

4.3. External Debt and Debt Service

The regression results indicate that external debt stocks have a positive and significant impact on export performance in Central Asian economies. Specifically, the coefficient on external debt stocks (as a percentage of GNI) is approximately 0.14 (significant at the 5% level). This suggests that a 10 percentage-point increase in external debt (relative to GNI) is associated with about a 1.4 percentage-point increase in export growth, holding other factors constant. The positive sign implies that, over the 1992–2023 period, external borrowing may have contributed to expanding export capacity. One interpretation is that external debt, when used to finance productive investments (such as infrastructure, industrial capacity, or technology imports), can alleviate domestic resource constraints and bolster a country's ability to produce and export goods. This finding aligns with studies observing that external debt can stimulate growth and trade when the borrowed funds are efficiently allocated to productive sectors, rather than consumed or wasted. In the Central Asian context, external capital inflows might have funded critical projects (e.g. transportation networks, energy, or export-oriented industries) that eventually enhanced export output. However, this positive effect also underscores the importance of debt management. If external debt is not kept within sustainable limits or is misallocated, its impact could turn detrimental. In fact, past research on debt sustainability has identified clear thresholds beyond which external debt exerts a drag on an economy. For example, Clements et al. (2003) find that when external debt exceeds roughly 30–37% of GDP (or about 115–120% of exports), it begins to significantly hinder economic growth. While our sample's debt levels and effects appear to be on the beneficial side of that tipping point, policymakers should remain vigilant that debt-fueled gains in exports do not lead to a future debt overhang. In summary, the positive coefficient on external debt stocks suggests that moderate external borrowing has, on average, been associated with export growth in these countries, but prudent debt accumulation – focusing on projects that enhance productive capacity – is crucial to maintain this favorable outcome.

Total debt service (measured as a percentage of GNI) showed a negative coefficient in the regression, although this effect was statistically insignificant. The point estimate was small (around a few hundredths in magnitude) and not distinguishable from zero at conventional confidence levels. Statistically, this indicates that we do not find clear evidence that higher debt service ratios have directly constrained export growth in the period and countries studied. One possible reason for the lack of significance is that Central Asian economies have generally managed their debt service burdens or benefited from rescheduling/relief when pressures grew, thus preventing debt service from drastically crowding out resources for trade expansion. Nevertheless, the negative sign is in line with economic theory and other empirical findings which suggest that heavy debt servicing requirements can impair growth indirectly by squeezing the funds available for investment in the economy. When a government or country must allocate a large share of income to repay external debt, fewer resources remain for supporting industries, infrastructure, or incentives that could promote exports. Indeed, evidence from broader developing-country samples indicates that high external debt service can crowd out public investment and other productive expenditures. For instance, an IMF study showed that an increase in the debt service ratio has a statistically significant negative effect on public investment, with the "crowding-out effect" worsening as debt service rises. In our results, while not significant, the negative coefficient on debt service is consistent with this narrative: if servicing costs grow, they

may restrain a country's ability to invest in export-enhancing activities (such as improving factories, financing exporters, or building trade logistics). The insignificant effect could imply that, within the range observed, debt service did not reach a crippling level for these economies, or that any adverse effects were mitigated by external support and sound fiscal management. The policy implication is that countries should be cautious about rapid increases in debt service obligations. Maintaining a healthy export-to-debt service ratio (through strategies like debt reprofiling, obtaining concessional borrowing, or accelerating export revenue growth) can prevent debt service from becoming a drag on future export performance.

4.4. Foreign Investment and Capital Formation

Foreign direct investment (FDI) has emerged as a major driver of export growth in the Central Asian panel. The coefficient on FDI inflows (as a share of GDP) is approximately 1.46 and is highly significant ($p < 0.01$) in the RE model. This is a sizeable effect: for each percentage point increase in FDI (relative to GDP), the export growth rate increases by about 1.46 percentage points, on average. Such a strong relationship underscores the critical role of FDI in these transition economies. FDI often brings not only capital but also technology transfer, managerial expertise, and access to international markets, all of which can enhance a host country's export capacity. The positive effect found here is consistent with a broad literature on FDI-led export growth. Empirical studies across developing regions have documented that FDI tends to boost export performance through various spillover channels – for example, by augmenting the host country's production capabilities, improving product quality, and integrating local firms into global supply chains. In our context, many Central Asian economies over the study period received FDI particularly in sectors like natural resources, energy, and textiles. These inflows likely helped expand exportable output (e.g., increasing oil and gas production for export in Kazakhstan and Turkmenistan, or improving manufacturing capacity in Uzbekistan). The magnitude of the coefficient suggests that FDI is perhaps the most potent factor among those studied; its impact on exports is not only statistically significant but also economically large. This finding implies that policies which attract and retain FDI – especially efficiency-seeking FDI aimed at export-oriented sectors – can yield substantial payoffs in terms of export growth. It also indicates that the presence of foreign investors might have positive externalities for domestic firms (for instance, local suppliers learning from multinationals, or improved logistics and standards that benefit all exporters). Overall, the strong FDI-export link in our results reinforces the view that openness to foreign investment is an effective strategy for export expansion in emerging economies.

By contrast, the effect of domestic capital formation on exports appears weak or even counterintuitive. Gross fixed capital formation (GFCF, as a % of GDP), a proxy for domestic investment rate, carries a negative coefficient in the regression, though this estimate is statistically insignificant. In practical terms, we cannot conclude that higher domestic investment share has any positive effect on export growth – if anything, the point estimate suggests a slight negative association, but with a large uncertainty. This result initially seems puzzling, since one might expect that greater investment in machinery, factories, and infrastructure would increase a country's productive capacity and eventually its exports. However, several factors could explain the lack of a positive impact. First, not all investment is created equal: if much of the GFCF in these countries was directed toward non-tradable sectors (e.g. real estate, domestic services) or unproductive projects, it may not contribute to exportable output. In Central Asia, periods of high investment have sometimes been linked to public infrastructure drives or construction booms that, while boosting GDP, do not immediately translate into more export goods. There may also be issues of investment efficiency – for instance, funds invested in state-owned enterprises or capital-intensive projects might yield lower returns in terms of export generation, especially if those

projects face operational inefficiencies. Additionally, a short-run macroeconomic effect could be at play: higher domestic investment often requires importing capital goods and materials, which can worsen the trade balance in the short term and mask any nascent export benefits. Thus, a surge in investment could coincide with higher imports (for construction equipment, machinery, etc.), potentially dampening net export growth in the immediate term. The negative sign on GFCF, although not significant, is in line with the idea that simply increasing the volume of investment is not sufficient – the quality and sectoral allocation of investment matter. If investments are misallocated or if there are long lags before they become productive, one might not see a positive impact on exports within the sample period. In summary, our findings suggest that domestic capital formation by itself has not been a strong contributor to export growth in these economies, highlighting a need for improving how and where investments are made. Ensuring that a greater fraction of gross capital formation is channeled into export-supportive industries (or into lowering production and logistics costs for exporters) could help turn domestic investment into future export gains.

5. Conclusion

5.1.Policy Recommendations

Building on the above insights, several policy recommendations can be offered to Central Asian economies pursuing export-led growth:

Foster and Attract Quality FDI: Central Asian governments should create an enabling environment to attract more FDI, as it clearly stimulates export expansion. This involves enhancing the investment climate by ensuring political and macroeconomic stability, strengthening legal protections for investors, and reducing bureaucratic barriers. By targeting FDI into export-oriented sectors (e.g. manufacturing, agro-processing, or high-value services), countries can leverage foreign capital for technology transfer and integration into global value chains, thereby boosting their export competitiveness.

Utilize External Debt Productively and Sustainably: External borrowing should be managed prudently and allocated to high-impact, export-enhancing projects. The positive link between external debt and exports in our findings indicates that past borrowing was often used for productive infrastructure and industrial development. To continue this trend, policymakers should direct future external loans toward improving trade logistics, energy supply, and industrial capacity in tradable sectors. At the same time, maintaining debt sustainability is crucial – governments must monitor debt-to-export ratios and avoid excessive borrowing that could lead to heavy debt-servicing costs, ensuring that external debt remains a tool for growth rather than a burden.

Improve the Efficiency of Domestic Investment: Structural reforms are needed to ensure that domestic capital formation translates into export growth. The negative impact of GFCF on exports implies that merely investing more is not enough – the quality of investment matters. Central Asian countries should evaluate and improve their public investment management systems, prioritizing projects with clear productivity and trade benefits. Encouraging private sector participation in investment can also help, as private investors may be more efficient in allocating resources to profitable, export-generating activities. Additionally, reforms to reduce wasteful expenditures, combat corruption in large projects, and strengthen evaluation of investment outcomes will help maximize the export payoff of every dollar invested domestically.

Maintain Debt Service at Manageable Levels: While debt service has not yet significantly hurt exports, proactive debt management is advisable. Governments should seek to lengthen debt maturities, refinance expensive debt, and build foreign exchange reserves through export earnings. By keeping debt service obligations in check (for example, below a certain share of export revenues), countries can prevent a scenario where servicing debt crowds out funding for export

promotion or essential imports. In parallel, policies that boost exports – such as diversifying export goods and markets – will naturally improve the debt service-to-exports ratio, creating a virtuous cycle where robust exports support debt sustainability and vice versa.

Diversify and Upgrade Export Sectors: Finally, a broad strategy of export diversification underpins the above recommendations. FDI and external investments should be steered into diversifying the economy beyond the traditional commodities (oil, gas, minerals, cotton, etc.) that dominate Central Asian exports. By developing new export industries and moving up the value chain, these countries can reduce vulnerability to commodity price swings and ensure that both domestic and foreign investments yield sustainable export growth. This may involve investing in human capital, adopting modern technologies, and improving trade facilitation – steps that enhance the overall export environment and make better use of capital inflows.

5.2.Limitations and Future Research

While the study provides important evidence on export drivers in Central Asia, several limitations must be acknowledged, and they open avenues for future research:

Scope of Sample and Data: The analysis focused on five Central Asian republics over a long span (1992–2023), a period that includes significant economic transitions and data challenges. The results represent regional trends, but country-specific nuances may be blurred. Data limitations (especially in the 1990s post-Soviet transition years) could affect the precision of the estimates. Future research could expand the scope to include additional transition economies or use higher-frequency data, and could apply techniques to account for structural breaks (e.g. early transition vs. post-2000s period) to verify the robustness of these findings.

Model and Methodological Constraints: The study employed static panel regressions (fixed and random effects) and ultimately relied on the random-effects model. While this approach controls for unobserved heterogeneity to an extent, it assumes no strong endogeneity between regressors and country-specific effects. There is a possibility of endogeneity or reverse causality – for instance, countries with rapidly growing exports might attract more FDI, or policy changes could simultaneously affect investment and exports. Future studies might address this by using dynamic panel models (such as a GMM estimator) or instrumental variable techniques to better identify causal relationships. Such approaches could also capture lagged effects (e.g. investment today affecting exports with a delay) that a static model might miss.

Variable Coverage and Additional Factors: The model concentrated on a few key financial and investment variables, but other determinants of export performance were outside its scope. Factors like exchange rate policies, trade agreements, governance quality, or global demand conditions can also significantly influence export growth. The negative coefficient on GFCF, for example, begs further investigation into the composition of investment – whether public vs. private investment, or which sectors are receiving capital. Future research could incorporate a broader set of variables or conduct sector-level and case studies (for example, examining how investment in manufacturing vs. mining affects exports in a given country). Additionally, comparative studies between Central Asia and other developing regions could shed light on whether the patterns observed here are unique or part of a broader development phenomenon.

5.3. Summary

In summary, export-led growth in Central Asia stands to benefit from harnessing foreign capital effectively and improving domestic investment efficiency, as evidenced by our findings. Policymakers should build on the positive impact of FDI and well-utilized external debt by creating conducive conditions for such capital to flow into export-enhancing uses. At the same time, reforms should aim to eliminate inefficiencies in how capital is allocated domestically, ensuring that high investment translates into high export performance. Balancing these priorities, while keeping debt obligations manageable, will be key for Central Asian economies as they

continue to integrate into the global marketplace. Further research and continual monitoring are encouraged to refine these insights, but the core message is clear: the quality and composition of capital matter as much as the quantity in driving sustainable export growth. The findings offer a guidepost for crafting policies that leverage debt and investment as instruments for export-led development, ultimately fostering more diversified and resilient economies in the region.

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