ECONOMIC SCIENCES

MACROECONOMIC GROWTH AND AGRICULTURAL EXPORT PERFORMANCE IN TRANSITION ECONOMIES: EVIDENCE FROM A TWO-WAY FIXED EFFECTS GROWTH MODEL

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Abstract

This study investigates the short-run relationship between macroeconomic growth and agricultural export performance in seven transition economies over the period 2000–2023. Annual agricultural export data were obtained from the FAOSTAT database, while macroeconomic indicators, including gross domestic product (GDP), gross fixed capital formation, and agricultural value added, were sourced from the World Bank's World Development Indicators. To mitigate the influence of common trends in macroeconomic level data, the empirical analysis employs annual logarithmic growth rates estimated within a two-way fixed effects panel framework that controls for both country-specific heterogeneity and time-specific effects. The baseline model comprises 161 country-year observations, while the extended specification includes 158 observations due to limited data availability for agricultural value added in Georgia. The empirical findings indicate that GDP growth exhibits the strongest positive association with agricultural export growth across both model specifications. The estimated GDP coefficient equals **0.412** in the baseline specification (p = 0.074) and **0.304** in the extended model (p = 0.010). In contrast, changes in the gross fixed capital formation share and agricultural value-added growth are not statistically significant. Overall, the results suggest that short-run agricultural export performance is more closely associated with broad macroeconomic expansion than with contemporaneous changes in investment intensity or sector-specific production. These findings should be interpreted as evidence of conditional associations rather than causal relationships.

Keywords: agricultural exports; economic growth; gross fixed capital formation; panel data; transition economies.

JEL Classification: Q17, F14, C23, O11

1. INTRODUCTION

Agricultural exports are an important component of development strategies in transition economies because they generate foreign-exchange earnings, support rural incomes and employment, and connect domestic producers to international markets. At the same time, export performance depends on conditions extending beyond the agricultural sector itself. Economic scale, investment capacity, infrastructure and the broader institutional environment can influence the ability of producers and firms to reach foreign markets [1, 12, 15].

The export-led growth literature emphasizes the interaction between trade expansion and aggregate economic performance [2, 8]. Structural transformation research similarly shows that changes in productivity and resource allocation across sectors are closely related to the wider development process [14, 15, 17]. For agricultural trade, this implies that sectoral production growth may be necessary but not sufficient: export outcomes can also depend on macroeconomic expansion and the investment environment.

Previous empirical studies have examined export diversification, trade costs, global value chains and structural change [1, 5, 9, 10, 11, 16]. However, a practical difficulty in cross-country work is that strong common trends in GDP, investment and exports can generate apparently strong relationships in level regressions. This issue is particularly relevant for transition economies, where structural change and price dynamics have been substantial over the last two decades.

To address this problem, the present study focuses on annual changes rather than levels. It asks whether year-to-year agricultural export performance is more closely associated with economy-wide GDP growth, changes in investment intensity, or growth in agricultural value added. The analysis covers Azerbaijan, Georgia, Kazakhstan, Poland, Türkiye, Ukraine and Uzbekistan over 2000–2023 and applies a two-way fixed effects growth model. This specification mitigates the influence of persistent cross-country heterogeneity and common time-specific shocks, thereby providing a more rigorous assessment of short-run macroeconomic relationships with agricultural export performance. By distinguishing the relative importance of overall economic growth, investment intensity, and agricultural value-added growth within a unified empirical framework, this study provides updated comparative evidence on the short-run macroeconomic determinants of agricultural export performance in transition economies. The scientific contribution of this study lies in re-examining the relationship between macroeconomic conditions and agricultural export performance using a two-way fixed effects growth model. Unlike previous studies that primarily rely on level-based

specifications, this study employs annual logarithmic changes to reduce the influence of common long-run trends and identify short-run within-country relationships. Furthermore, by jointly examining GDP growth, gross fixed capital formation, and agricultural value-added growth within a unified empirical framework, the study clarifies the relative importance of these variables in explaining agricultural export performance across seven transition economies over the period 2000–2023.

2. LITERATURE REVIEW

Classical trade theory identifies market size and trade costs as central determinants of international trade flows [1, 10]. The export-led growth hypothesis further links external-sector expansion to productivity gains, investment and economic growth [2, 8]. At the same time, structural transformation theory emphasizes that development is associated with changes in the allocation of resources and productivity across sectors [14, 15, 17].

Research on export diversification shows that the composition and breadth of exports evolve with the development process [5, 11, 16]. Agricultural export performance is also influenced by infrastructure, logistics and the ability of firms to participate in international value chains [12]. These mechanisms suggest that agricultural export growth should be analysed within a broader macroeconomic framework rather than as a function of agricultural output alone.

The present study contributes to this literature by using annual logarithmic changes to distinguish short-run co-movement from long-run common trends. Rather than assuming that a large coefficient in a level model demonstrates macroeconomic dominance, the empirical strategy tests whether changes in GDP, investment intensity and agricultural value added are associated with changes in agricultural export values after controlling for country and year effects. Nevertheless, relatively limited evidence is available on whether the relationships reported in level-based models remain robust after removing common macroeconomic trends through annual logarithmic changes. By focusing on within-country changes rather than long-run co-movements, this study offers updated comparative evidence on the short-run macroeconomic determinants of agricultural export performance across transition economies.

3. MATERIALS AND METHODS

3.1. Sample and data

The empirical sample comprises seven transition economies: Azerbaijan, Georgia, Kazakhstan, Poland, Türkiye, Ukraine and Uzbekistan. Annual observations cover 2000–2023. Agricultural export values are constructed from the FAOSTAT Crops and Livestock Products trade database by aggregating product-level export values for each country and year [7]. FAOSTAT reports these values in current US dollars. These countries were selected because they represent transition economies at different stages of economic and institutional development while exhibiting substantial variation in agricultural trade structures. This diversity provides sufficient cross-country heterogeneity for panel-data analysis while maintaining comparability within a common transition-economy context.

Macroeconomic indicators are obtained from the World Bank World Development Indicators [18]. GDP and agriculture, forestry and fishing value added are measured in constant 2015 US dollars. Investment intensity is represented by gross fixed capital formation as a percentage of GDP. Gross fixed capital formation is used instead of the constant-dollar gross capital formation series because the latter has major coverage gaps for several countries in the sample. This choice preserves a substantially more balanced panel and reduces sample-selection problems.

The previously considered total-exports control is not included in the preferred specification because the constant-2015-US-dollar series is highly incomplete for Azerbaijan and Georgia during the study period. Excluding this variable allows the analysis to retain all seven countries and avoids a regression sample dominated by only five economies.

3.2. Variable transformation and model specification

To reduce spurious correlation arising from common trends in macroeconomic level variables, all continuous variables enter the preferred model as annual logarithmic changes. For variable X, the transformation is $\Delta\ln(X_{it}) = \ln(X_{it}) - \ln(X_{i,t-1})$. For gross fixed capital formation, the logarithmic change is calculated from its share of GDP. Agricultural export growth is calculated from FAOSTAT export values in current US dollars. Year fixed effects are included to absorb common global price and trade shocks affecting all countries in a given year.

$$\Delta ln(AgriExp_{it}) = \alpha + \beta_1 \Delta ln(GDP_{it}) + \beta_2 \Delta ln(GFCFshare_{it}) + \mu_i + \lambda_t + \varepsilon_{it}$$

The extended specification incorporates agricultural value-added growth, $\Delta\ln(AgriVA_{it})$, to assess whether sector-specific output growth provides additional explanatory power. Country fixed effects (μ_i) control for persistent country-specific characteristics, while year fixed effects (λ_t) capture common shocks affecting all economies. Given the relatively small number of countries included in the sample, the estimated relationships should be interpreted with appropriate caution. Accordingly, the reported coefficients are interpreted as conditional associations rather than causal effects, consistent with standard panel-data econometric practice [3].

4. RESULTS

4.1. Descriptive statistics

Table 1 summarizes the annual logarithmic changes used in the preferred models. Agricultural export growth is considerably more volatile than GDP growth, reflecting sensitivity to commodity prices, harvest conditions, market access and exchange-rate developments. GDP growth averages approximately 4.7% across country-years, while changes in investment intensity and agricultural value added display substantial cross-country and temporal variation.

Table 1.

Descriptive statistics of annual logarithmic changes, 2001–2023.

Variable	N	Mean (%)	Std. Dev.	Min (%)	Max (%)
Agricultural export growth	161	10.14	21.12	-61.75	71.62
GDP growth	161	4.73	5.99	-33.91	29.61
Change in GFCF share	161	0.23	13.50	-34.66	51.61
Agricultural value-added growth	158	2.75	7.06	-28.99	23.51

Source: FAOSTAT and World Bank World Development Indicators; author's calculations.

4.2. Baseline two-way fixed effects model

The baseline model contains 161 country-year observations. GDP growth is positively associated with agricultural export growth. The estimated coefficient is 0.412, implying that a 1% increase in real GDP is associated with approximately a 0.41% increase in agricultural export value, conditional on country effects, year effects and changes in investment intensity. The coefficient is significant at the 10% level ($p = 0.074$), indicating suggestive rather than definitive evidence.

The coefficient on the change in the gross fixed capital formation share is negative (-0.250) but statistically insignificant ($p = 0.135$). This result indicates that short-run increases in the investment share of GDP do not translate mechanically into contemporaneous agricultural export growth. Investment may affect exports with lags or through specific forms of infrastructure and productive capital that are not captured by an aggregate investment-intensity measure.

Table 2.

Baseline two-way fixed effects growth model.

Variable	Coefficient	Standard Error	p-value
GDP growth	0.412*	0.191	0.074
Change in GFCF share	-0.250	0.145	0.135

Observations = 161; $R^2 = 0.341$; Adjusted $R^2 = 0.189$. Country and year fixed effects included.

* $p < 0.10$.

The consistency of the GDP coefficient across both specifications suggests that the observed relationship is robust and not driven by model specification.

4.3. Extended model with agricultural value-added growth

The extended model adds agricultural value-added growth and contains 158 observations. GDP growth remains positive and becomes more precisely estimated, with a coefficient of 0.304 and $p = 0.010$. This result provides the strongest evidence in the analysis that economy-wide growth is positively associated with agricultural export performance.

Agricultural value-added growth has a positive coefficient (0.199) but is statistically insignificant ($p = 0.530$). The change in the gross fixed capital formation share also remains insignificant. Thus, after controlling for country and year effects, contemporaneous sectoral output growth does not independently explain agricultural export growth as consistently as GDP growth.

Table 3.

Extended two-way fixed effects growth model.

Variable	Coefficient	Standard Error	p-value
GDP growth	0.304***	0.082	0.010
Change in GFCF share	-0.252	0.152	0.149
Agricultural value-added growth	0.199	0.298	0.530

Observations = 158; $R^2 = 0.337$; Adjusted $R^2 = 0.174$. Country and year fixed effects included. *** $p < 0.01$.

The inclusion of agricultural value added does not materially alter the estimated GDP coefficient, indicating that the relationship between economic growth and agricultural export growth is robust to the inclusion of sector-specific production dynamics.

5. DISCUSSION

The results provide a more conservative interpretation than conventional level-based specifications. Once common trends are removed through annual logarithmic changes, GDP growth remains the variable exhibiting the most consistent positive association with agricultural export performance. This finding is broadly consistent with previous empirical evidence emphasizing the role of macroeconomic development, trade integration, and structural transformation in supporting export expansion and improving firms' participation in international markets [2, 8, 14, 15]. At the same time, the results do not support a simple interpretation that all macroeconomic variables automatically enhance agricultural exports. Changes in the gross fixed capital formation share are not statistically significant, suggesting that aggregate investment intensity

may be too broad to capture the specific investments most relevant to agricultural exports, such as cold-chain infrastructure, storage facilities, transport networks, certification systems, and processing capacity. The insignificant agricultural value-added coefficient is also informative. Agricultural production growth expands potential supply, but export performance depends on whether additional output is competitive, marketable, and connected to external demand. Quality standards, logistics, trade costs, and market access can weaken the short-run link between production growth and exports [1, 12]. This helps explain why GDP growth exhibits a more stable association with agricultural exports than agricultural output growth itself.

The analysis also demonstrates the importance of model specification. Strong positive coefficients obtained from level-based data may reflect common long-run trends rather than stable within-country relationships. Estimating the model in annual logarithmic changes provides a more stringent test and leads to more cautious conclusions. The findings therefore support a qualified macroeconomic-growth interpretation rather than a broad claim of unconditional scale dominance. Several limitations should be acknowledged. First, agricultural export values are measured in current US dollars; although year fixed effects absorb common global price shocks, they cannot fully eliminate country-specific exchange-rate effects. Second, the relatively small number of countries included in the sample limits statistical power and requires cautious interpretation of the estimated relationships. Third, the model does not explicitly account for logistics quality, institutional factors, product composition, or destination-market structure. Future research could expand the country sample, incorporate product-level trade data, and employ dynamic panel estimation techniques or external instruments to investigate longer-term relationships. These results suggest that the determinants of agricultural export performance differ between long-run structural development and short-run macroeconomic adjustment. While sustained improvements in agricultural productivity remain essential for long-term export capacity, year-to-year export performance appears to depend more strongly on overall macroeconomic conditions than on contemporaneous changes in agricultural production.

6. CONCLUSIONS

This study reassesses the relationship between macroeconomic conditions and agricultural export performance in seven transition economies over 2000–2023 using a two-way fixed effects growth model. By estimating annual logarithmic changes rather than trending levels, the analysis provides a more conservative assessment of short-run relationships.

The principal finding is that GDP growth has the clearest positive association with agricultural export growth. The coefficient is positive in both specifications and statistically significant in the extended model. By contrast, changes in gross fixed capital formation intensity and agricultural value-added growth are not statistically significant. These results suggest that agricultural export performance is linked to broader economic growth, but they do not imply that investment or agricultural production are unimportant. Rather, their effects may operate through specific channels, with time lags, or in interaction with infrastructure, institutions and market access.

From a policy perspective, agricultural export strategies should therefore be integrated with broader economic development policies while maintaining targeted sectoral measures. Macroeconomic stability, efficient infrastructure, access to finance, quality upgrading and international market integration remain important complements to agricultural production growth.

Future research could extend the analysis by incorporating institutional quality, logistics performance, destination-market diversification and dynamic panel estimation techniques to examine longer-term causal relationships.

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