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The Impact of Trade Globalization on Non-tradable and Tradable Sector Output in South Africa

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Abstract. The study examines whether the *de jure* and *de facto* dimensions of trade globalization affect tradable and non-tradable sector output differently in South Africa. Using secondary time series data from 1980 to 2022, the KOF trade globalization sub-indices, and an autoregressive distributed lag (ARDL) framework, long- and short-run elasticities were estimated for each sector. Results show that trade globalization exhibits an asymmetric effect where in the long run *de jure* integration increases performance in tradable sectors, however it reduces non-tradable output. Short-run estimates reveal a structural divergence between the sectors, raising concerns for transformation in an era where conventional industrialization pathways are losing significance. Findings suggest that trade liberalization practices should be complemented by an aligned industrial investment policy landscape that seeks to diversify the economic base. The study contributes to the literature by providing disaggregated evidence on the *de jure* and *de facto* dimensions of trade globalization at a sectoral level, offering new insights into how trade globalization impacts structural dynamics in emerging and African economic contexts.

Keywords: trade, inter-sectoral output, autoregressive distributed lag (ARDL) model, South Africa, time series

JEL Classification: F14; F43; O14; O55

1. Introduction

Globalization has been one of the most influential sources shaping socio-economic circumstances across the globe. Whilst it has afforded many benefits, these have not been universal to all (Alkharafi and Alsabah, 2025). The complexity in which the impact of the process has been associated with has been matched by its understanding. For many scholars, a universally agreed-upon definition has been something highly contested, though what has remained central across disciplines has been the idea of integration. For economists, this has been linked to aspects such as the free flow of trade and capital, alongside greater access to foreign resources and labour markets (Helpman, 2025). Nevertheless, other disciplines have conceptualized the process as the spread of ideas, knowledge, information, goods, and services around the world (Hashemi-Pour, 2023). Whilst these differences underscore the complexity in which it has evolved, modern understandings have acknowledged that the process extends across three dimensions (Gygli et al., 2019; Moeng and de Jongh, 2023). In this respect, economic globalization is understood in relation to the integration of financial capital, the flow of investment, trade, specialization, and labour division (Gygli et al., 2019). Social globalization revolves around the spread and sharing of cultures, values, ideas, and information (Marcel and Mkojera, 2021), while political globalization refers to the interaction of governments, international institutions, and global governance structures. Through these channels, empirical evidence surrounding globalization and how it relates to several macroeconomic outcomes, including levels of government debt, inequality, and most importantly the growth prospects in both developing and developed countries, have become well established (Bataka, 2019).

This dominant body of literature has been clear in that trade globalization has, in particular, afforded greater allocative efficiency, technology transfers, and, with it, enhanced productivity (Usman and Landry, 2021). More specifically, it allows countries to expand export-oriented sectors by capturing additional foreign investment and strengthening long-run growth prospects (World Trade Organization (WTO), 2021). Most frequently, developed countries at the centre of this process maximize these advantages. Countries such as the United Kingdom and Germany have been well known for leveraging foreign direct investment (FDI), service-sector trade, and trade partnership agreements to sustain their financial dominance, while imports have excelled their manufacturing (Diallo, 2024). For Germany in particular, their industrial specialization in the automotive and machinery sectors stems from EU trade integration (Schneider, 2023). For developing countries – albeit in more peripheral positions in the globalization arena – economic integration, too, has afforded these advantages. However, scholars have acknowledged that access to these gains has been even more selective and uneven in these economies (Lang and Tavares, 2018). It is understood to be dependent more on their productive

capacity, infrastructure, and institutional quality. Whilst aspects such as trade openness can generate job creation in export sectors, most often it simultaneously displaces labour in import-competing industries (Chipeta, 2022). Frequently, gains from globalization differs across income groups, regions, and industries, all of which have contributed to heightened inequality. Together, these complexities and intrinsic heterogeneity have prevented a holistic understanding of the impact of trade globalization in emerging countries, especially where sectoral structures have been fragmented and uneven.

Nowhere else has this been more evident when considering the sub-Saharan African context. Trade integration has been constrained by infrastructure deficits and limited domestic value addition (Abubakar, 2024). Yet selective successes exist. Nigeria's oil exports generate the majority of foreign exchange earnings (MEMAN, 2023), while Ethiopia's apparel sector and Kenya's digital services exports demonstrate the gains possible through targeted industrial and technological strategies (World Bank, 2022). However, many resource-rich countries capture only a small share of final product value, reflecting persistent structural vulnerabilities (Braunstein and Chuchko, 2025). For South Africa, the case has been much similar. On the one hand, trade globalization has induced service sector expansion and selectively reduced low-skill unemployment (Chipeta, 2022). However, on the other hand, these improvements have coincided with manufacturing decline, signalling a premature deindustrialization (Tregenna et al., 2021). Taking this into account, various scholars have sought to understand the impact of globalization on growth, yet the majority have adopted macro-level analyses that have failed to account for possible sub-sector differences, especially between non-tradable (including construction, personal and social services, wholesale and retail, general government) and tradable sectors (mining, agriculture, manufacturing (Radło and Tomeczek, 2022)). This is noteworthy, as it provides only limited insight into how these subsectors react to globalization-induced shocks, as well as into how potential gains in non-tradable sectors can compensate for potential losses in internationally competing tradable industries.

Considering the above, the study seeks to add to the body of knowledge by investigating the impact of trade globalization on both tradable and non-tradable sector output in South Africa. In this context, its significance lies in addressing a notable gap in the body of knowledge – that is, shedding light on the ambiguity surrounding the trade globalization experience of African and emerging economies, specifically at a sectoral level. Further, it offers answers relating to whether the effects of trade globalization affect the structural composition within domestic economies, particularly in ways that might constrain long-term growth and productivity during a time when transitions and alternative industrialization strategies alone are at the front of policymakers' agendas. By moving away from a focus on aggregate growth, it contributes to a more nuanced understanding,

offering a valuable point of reference that might inform policy recalibration amid volatile global trade dynamics.

In the remainder of this paper, Section 2 theoretically examines the relevant literature to offer a better understanding of the relationship between trade globalization and sectoral performance. Section 3 incorporates the methodology of the study. Section 4 outlines the results, and Section 5 presents the discussion that provides insights into the contributions on both a theoretical and a practical level. Lastly, Section 6 concludes the research study and discusses policy implications and recommendations. There is also a list of abbreviations following Section 6.

2. Literature Review

2.1. Theoretical Relationship between Trade Globalization and Sectoral Output

Globalization is complex and multi-faceted, reflecting both the benefits and drawbacks of integration into the global economy (Opara et al., 2025). Whilst multidimensional, so often literature has equated the process with its trade component. Trade globalization in this regard is viewed in close relation to trade openness. Whilst it also captures changes in export and import volumes, it extends by offering a broader structural perspective. Siddiqui (2017) notes that it explores the fragmentation of the global production system, where specific stages are designated to different countries and understanding their role in the production and trade of specific commodities or services. Furthermore, it also focuses on liberalization practices that facilitate cross-border integration, and closely linked to this is the creation of an evolving international division of labour with the purpose of ensuring the most efficient production within the global market (Rapoport, 2016). Also closely tied to this is the proliferation of trade agreements, which is set to enhance greater market stability, reduce transaction costs, and create preferential conditions that streamline cross-border interactions (Anukoonwattaka and Heal, 2014).

Given these understandings, the relationship between trade globalization and output levels has been well documented. The earliest advocates, such as Smith (1776), Ohlin (1933), and Stolper and Samuelson (1941), proposed that integration based on trade is set to accelerate wealth accumulation by inducing specialization and expanding market access. As time has passed, these understandings have been supported by additional insight, with scholars highlighting greater factor accumulation, knowledge transfers, and consequently substantial productivity gains (Kaczmarczyk and Flassbeck, 2023). Though it has been associated with improvements in economic trajectories, much of the recent dismay surrounding

global trade has been based on the increasing understanding that these benefits have not been shared equally (Gulcemal, 2020). This pertains not only to the national level but also to the heterogeneity inherent in its impact on sector performance. Drawing on the work of dependency scholars, trade globalization in this respect is understood to unfold along core–periphery lines, reflected in the prevailing North–South divide, thereby producing the so-called winners and losers of the process (Gunter and Wilcher, 2020). Regarding the latter, most developing countries have experienced mixed effects. Whilst Asian countries reflect the success story of the globalization era, trade-induced sustainable growth has been largely lacking in the South American and sub-Saharan African regions. This comes on the back of an overreliance on commodity exports, lack of diversification, and aggressive import competition with limited manufacturing capacity (Wintgens, 2022). This has been compounded by the more modern relevance of global value chains (GVCs) where most occupy downstream, low-value-added positions (Atkin et al., 2020). Furthermore, compared to their developed counterparts, these countries have export sectors with weak backward and forward linkages with broader domestic supply chains.

It is the latter that has particularly made the relationship between trade globalization and sectoral performance intriguing, especially when distinguishing between tradable and non-tradable sectors. Tradable sectors in this respect represent industries that compete directly with international competitors in the exporting and importing of goods and services (Inklaar et al., 2023). These include activities in manufacturing, agriculture, and mining industries for example. By contrast, non-tradable sectors refer to the goods and services produced that are consumed in the domestic economy, including construction, wholesale and retail, personal and social services, general government services as well as energy sectors (Donnat, 2023). Whilst conventionally operationalized as a sectoral binary, over time, the fall in communication costs, digitalization of professional services, and the fragmentation of production into GVCs have meant that activities once unambiguously categorized as domestic can now be classified as tradable. Simultaneously, parts that were once considered tradable have now been geared entirely towards local demand.

As a response, the measurement literature has increasingly treated tradability on a continuum with three approaches remaining central to the insight it offers. The first classifies sectors on the basis of their revealed openness using ratio of exports to value added as proxies for tradability thresholds (Mano and Castillo, 2015). Others have opted to view tradability on the basis of the spatial distribution of production in relation to where products are demanded (Gervais and Jensen, 2019). Tradable activity in this sense is classified based on geographic concentration. Finally, the third approach makes use of input-output tables to allow for categorization, tracing the destination of sectoral output through domestic and foreign final demand

(Lombardo and Ravenna, 2012). Likewise, Blignaut et al. (2008) in their analysis of South Africa, make use of this approach, largely confirming the broad contours of the conventional classification whilst also identifying several sectors that occupy an intermediate position on the continuum rather than being clearly identifiable.

Based on these views, the relationship between trade globalization and these sectoral performances is one that is complex and dynamic. Goldberg and Ruta (2025) explain that trade globalization directly impacts tradable sectors by offering market expansion, technological upgrading, and scale economies. However, it can also be detrimental if industries are uncompetitive, having potential consequences of import penetration, premature deindustrialization, and job losses. In contrast with this, the effects of trade globalization on non-tradable sectors are more indirect and intrinsic. Devarajan (2019) here reiterates that effects on these industries are felt through income effects, exchange rate movements, and capital flows. In this respect, the dynamics relating to tradable sector activities become paramount. Mora and Olabisi (2023) explain that during times of export booms, currency appreciation can potentially shift resources towards the demand for domestic services. The caveat, though, is that consequences of this restructuring depend on diversification and expansion. For many developing countries, this relates strongly to the well-known Dutch Disease. Reliance on commodity cycles that do not generate upgrading and import competition that reduces tradable industry productivity would see the expansion of low productivity activities when resources are shifted towards the non-tradable sector, reinforcing structural dualism (Khemraj and Pasha, 2024). Conversely, when tradable sector growth is accompanied by diversification and stronger domestic supply chain linkages, income and demand effects can propel productivity-enhanced development in non-tradable sectors.

2.2. Trade Globalization and Sectoral Performance in South Africa

In relation to these theoretical understandings, the South African case provides an ambiguous picture. Since the democratic transition in 1994, South Africa's economic policy framework has been fundamentally shaped by trade liberalization and global economic integration (Edwards et al., 2024). This trajectory, initiated in the early 1990s as part of broader structural adjustment reforms, has had profound and heterogeneous effects across key economic sectors, including manufacturing, agriculture, services, and mining (Mateko et al., 2026). In the early phases during the 1990s and early 2000s, the country's trade profile remained predominantly resource-based, with exports heavily concentrated in commodities and primary products (Ngepah et al., 2021). This persistence underscored the enduring structural reliance on mining and agriculture despite policy shifts intended to promote diversification and deeper integration into the global economy (IDC, 2025). This commodity-driven trade structure rendered South Africa's export earnings highly

sensitive to global price volatility, particularly evident during the commodities supercycle (2003–2011) (Akcay et al., 2022). Nonetheless, this period marked a vital expansion in trade, as the trade-to-GDP ratio rose from approximately 50% in the mid-1990s to over 70% by the mid-2000s, underscoring the rising significance of international trade in the domestic economy (Lee, 2024). The mining sector alone accounted for around 8% of GDP and 30% of export revenues (Gedefie et al., 2025). Furthermore, improved market access through South Africa's accession to the World Trade Organization (WTO) and the negotiation of preferential trade agreements facilitated a gradual diversification of export destinations beyond traditional western markets (Guan et al., 2021).

However, the reliance on primary commodities also exposed the economy to significant risks (Guan et al., 2021). The 2008 global financial crisis triggered a sharp decline in commodity demand and prices, leading to a current account deficit by 2009 and highlighting the vulnerabilities of an undiversified export base (Naidoo, 2025). Furthermore, the dominance of mining contributed to a crowding out of investment in manufacturing and hindering industrial diversification (Robinson, 2016). Despite strong growth in sectors like automotive and agri-processing, manufactured exports have remained a relatively small share of total trade, limiting South Africa's ability to position itself upstream in GVCs (Miao, 2023). This form of integration has left the country struggling to attain notable productivity gains, further exacerbating long-term structural challenges in a context where growth has been subdued for the past decade and unemployment and poverty levels remain stubbornly high. Simultaneously, manufacturing, once a cornerstone of the economy, has seen its share of GDP decline from approximately 20% to just 13% by 2025 (World Bank, 2026), signalling premature deindustrialization (Andreoni and Tregenna, 2021). Notable improvements in this respect have been hindered by the inability of domestic firms to compete globally due to high input costs, energy instability, and lagging productivity. In stark contrast, the mining sector has retained its export dominance, buoyed by global demand for platinum, gold, and coal, particularly over the course of the last year (IDC, 2025).

Due to these circumstances, downstream sectors, including the automotive and construction industries, have been particularly subjected to demand shocks during commodity price downturns, resulting in reduced industrial activity and economic uncertainty (Makoni and Chikobvu, 2023). Similarly, the agricultural sector, though smaller in export share, has been vulnerable to similar instability, with recurring droughts and fluctuating global prices for key exports like maize and citrus disrupting production (Vink et al., 2025). In relation to these characteristics, South Africa's non-tradable sector demonstrates a strong dependence on commodity cycles, benefiting from export-driven booms through increased demand in retail, banking, and infrastructure, but notably contracting during downturns (Mertens

et al., 2022). Volatility in the rand has further amplified inflationary pressures and interest rate fluctuations, undermining cost structures for non-tradable industries (Edwards and Jenkins, 2015). Rather than offsetting weaknesses in the tradable sector, non-tradable economic activity has seemed to mirror the cyclicality inherent in tradable sectors, reinforcing a broader low-growth trajectory.

2.3. Empirical Literature

In relation to the dynamics within the South African context, research on the effects of post-1990 trade liberalization in the various parts of the world show just how complex and context-specific the relationship between trade globalization and sectoral performance is. Pertaining to the aggregate effects, results on the relationship between trade globalization and output have been quite extensive and unanimous, especially in the developing world. Studies such as by Sarkar (2008), Jošić (2023), and Yeboah et al. (2025) make use of time series and panel data sets for high-income countries, OECD economies, and nine selected European countries, respectively, to confirm the trade-induced benefits in these countries' growth trajectories. By making use of conventional autoregressive distributed lag (ARDL) models, panel dynamic generalized methods of moments (GMM) as well as pooled mean group ARDL models, these studies point to the productivity gains that the process offers. They attribute these gains to the economy's institutional capacities as well as infrastructure quality, which facilitate them. For developing countries, these aggregate effects have been somewhat mixed. In East Asian and transitioning European economies, evidence provided by Ceyhan and Erkisi (2019) and Intisar et al. (2020) using longitudinal and panel econometric models (Westerlund cointegration, FMOLS, DOLS) confirm the catch-up and growth-inducing effects of trade liberalization at least over the last 20 years. However, studies such as Fankem and Oumarou's (2020), which have focused on SSA countries using GMM estimations for the period from 1989 to 2012, point to a lack of these effects specifically when sufficient policies, investment in human and physical capital as well as price stability are absent.

Studies that have moved away from these aggregate effects and shifted their focus towards a sectoral disaggregation have likewise produced mixed findings. For example, Di Giovanni and Levchenko (2012) found that trade globalization induces greater volatility in the output of manufacturing sectors of 55 developed and developing counties. The study cites the additional competitive pressures and need for heightened specialization as key factors in this nexus. Landesmann et al. (2001) similarly showed the effect of import penetration from the South on employment in the manufacturing industries of OECD countries, signalling the displacement effects of these exchanges. Their analysis made use of least squares

dummy variable (LSDV) modelling techniques for the period from 1980 to 1996. Supporting these findings, Khobai and Moyo (2021), using a pooled mean group (PMG) estimator for Southern African Development Community (SADC) countries, likewise point to trade liberalization and its detrimental impact on tradable sector (manufacturing) output. The study refers to the need for greater upskilling and additional infrastructure investment to improve the sector's competitiveness. In contrast to these findings, others have shown positive effects. For instance, Tahir et al. (2019) in their study examined 73 developing countries, focusing on the impact of trade openness on three different sectoral levels, namely the industrial, agriculture, and services sectors. By covering the period from 1993 to 2014 and utilizing fixed and random effects panel estimators, the study points to a resource curse in these economies, with trade expanding industrial and agricultural activity yet reducing service-sector performance.

Taking these findings into account, evidence on the linkages between tradable and non-tradable sectors and the role of trade globalization within these dynamics has been scarce. Chipeta (2022) provides evidence of the impact of trade-induced effects in South Africa's non-tradable sector. Using ARDL estimation for the period from 1995 to 2021, the study shows heterogenous effects on employment for various industries. The study alludes to the danger of trade liberalization given the shifting of resources to non-productive sectoral activity. Additionally, Wu et al. (2025) provide relative and strong evidence to the body of knowledge. However, focusing on resource expansion induced by trade globalization elements, the study shows how dependence in six crude oil exporting sub-Saharan African countries redirects resources on an intra-tradable sector level, consequently affecting structural transformation. The study adopted a linear and non-linear panel ARDL approach covering the period from 1983 to 2020.

3. Research Methodology

The main objective of the study was to examine the impact of trade globalization on tradable and non-tradable sector growth in South Africa. To achieve this, a quantitative research design was adopted whilst a functionalist paradigm served as the philosophical base of the study.

3.1. Data Description and Sample Period

Secondary time series data from 1980 to 2022 were utilized. The selected time period was determined by the availability of data. A total of 43 observations were included. The variables under consideration include South African tradable

and non-tradable sector output as dependent variables. Sectoral aggregates for these were constructed from the SARB (2026) gross value added (GVA) at basic constant prices (2015 = base year). Following insights from Blignaut et al. (2008), tradable sector output comprised GVA from the agricultural, forestry and fishing, mining and quarrying as well as manufacturing sectors. Non-tradable activity was aggregated from electricity, gas and water, construction, wholesale and retail trade, catering and accommodation, general government services, and personal and community services. In this sense, sectors classified as intermediate on the continuum – namely transport, storage and communication as well as finance, insurance, real estate, and business services – were excluded. Moreover, given the study period, the classification is held constant and fixed across the sample to simplify the interpretation.

The key explanatory variables comprised both *de facto* and *de jure* trade globalization indices. The data were collected from World Bank Development Indicators and KOF Swiss Economic Institute as well as the South African Reserve Bank (SARB). The variables under consideration are shown in *Table 1* below, which provides insight into their metrics and the database from which they were sourced. The main dependent variables were derived on the basis of the total aggregation of gross value added at basic prices. For the tradable sector metric, this included GVA values from the mining, manufacturing, and agricultural sectors. The non-tradable sector aggregation included GVA levels (measured at constant prices in rand) from sectors including energy, construction, wholesale, retail, general government, and social and personal services.

Table 1. *Variable description and data sources*

Variable	Description	Measurement units	Database
Tradable sector output	Total aggregated GVA at basic constant prices from the manufacturing, agriculture, and mining sectors.	Total GVA at basic constant prices (2015 = base) measured in millions of rands.	SARB (2026)
Non-tradable sector output	Sectors include energy, construction, wholesale and retail, general government and social and personal services.		
Trade globalization (*de facto*)	Measure for the level of tangible trade integration. Comprised of 3 trade-related features, including trade in services, goods, and trade partner diversity.	Index-based value between 0 and 100. Higher scores reflect higher integration levels.	KOF Swiss Economic Institute (2026)
Trade globalization (*de jure*)	Policy-based metrics that allow for tangible flows to be captured, including the level of trade regulations, taxes, tariffs, and number of trade agreements.		

Variable	Description	Measurement units	Database
Gross fixed capital formation	Gross fixed capital formation in real rands in millions. Two aggregations used, namely tradable-sector (GFCFto)-specific investment and non-tradable sector investment (GFCFno).	Real rands in millions with total aggregation across tradable and non-tradable sector specifications.	SARB (2026)
Employment	Total employment disaggregated between tradable (EMPto) and non-tradable sectors (EMPno). Served as proxy for labour input.	Total amount of labour employed aggregated from tradable and non-tradable sectors.	
Inflation	Consumer price index annual percentage change.	Changes in percentage (%).	

Source: authors' own construction

To capture the levels of the key explanatory variable, i.e. trade globalization, the study used the trade globalization sub-index developed by the KOF Swiss Economic Institute. Specifically, the analysis uses disaggregated measures (*de jure* and *de facto*) to address a gap in the existing body of knowledge. Gross fixed capital formation (GFCF) and employment (EMP) served as important variables within the chosen theoretical framework in which the study is based. Here two separate and sector-specific (tradable vs non-tradable) measures were utilized, namely GFCFto and GFCFno as well as EMPto and EMPno. Finally, the consumer price index (measured in percentage changes) (INF) served as an important control for macroeconomic stability.

3.2. Econometric Methods of Analysis

Several statistical approaches and econometric models were employed. These approaches were used to determine the long- and short-run as well as the causal relationships between trade globalization and sectoral growth (both for the tradable and the non-tradable sector) in South Africa. The first step involved the use of descriptive statistics and trends analysis. This was followed by using different types of unit root tests that assisted in the determination of the order of integration and the stationarity level of variables. As a means of estimating the long-run and short-run elasticities, an ARDL model was adopted. This was done for two reasons. Firstly, these modelling techniques are considered more appropriate when sample sizes are smaller. Secondly, ARDL specification is not as restricted compared to similar techniques considering the stationarity properties of the data. It can provide robust results when variables are either I(0), I(1) or a mixture of I (0)

and I(1). Finally, the Toda–Yamamoto Granger causality test was utilized to help identify any possible causal relationships between the variables. However, prior to any inferential techniques being employed, all variables were transformed into their natural logarithm.

3.3. Theoretical Framework and Model Specification

To achieve the main empirical objectives, the study employed two broad models. The models are firmly grounded in a Cobb–Douglas production function. This theoretical framework is chosen based on its parsimonious and tractable structure. It has been used widely in trade and growth studies, which enhances this study's comparability with previous empirical findings. As shown in equation (1) below:

$$Y_t = AL^{\partial}K^{\sigma} \tag{1}$$

Here Y_t represents real output, K represents capital input, and L the labour input. A denotes the total factor productivity of the inputs. The parameters ∂ and σ denote output elasticities with respect to capital and labour. This specification assumes positive but diminishing marginal products of each factor and provides a parsimonious representation of sectoral production behaviour. Given the premise of this study, in which it is believed that trade globalization affects sectoral performance directly through productivity, this equation is augmented where productivity is modelled as a function of trade integration. Consequently, four broad models are specified. The first and second models aim to capture the dynamics between tradable sector output and features of *de facto* and *de jure* trade globalization. Subsequently, the third and fourth models examine the possible effects of trade-related elements (*de facto* and *de jure*) on non-tradable sector output:

$$\begin{aligned}\Delta LTO = {} & \varphi_0 + \sum_{j=1}^{k} \eta_j \, \Delta LTO_{t-j} + \sum_{j=1}^{k} \alpha_j \, \Delta TGdf_{t-j} + \sum_{j=1}^{k} \gamma_j \, \Delta LEMPto_{t-j} + \sum_{j=1}^{k} \delta_j \, \Delta LGFCFto_{t-j} \\ & + \sum_{j=1}^{k} \vartheta_j \, \Delta INF_{t-j} + \omega_1 \Delta LTO_{t-1} + \omega_2 \Delta TGdf_{t-1} + \omega_3 \Delta LEMPto_{t-1} \\ & + \omega_4 \Delta LGFCFto_{t-1} + \omega_5 \Delta INF_{t-1} + \mu_t \end{aligned} \tag{2}$$

$$\begin{aligned}\Delta LTO = {} & \varphi_0 + \sum_{j=1}^{k} \eta_j \, \Delta LTO_{t-j} + \sum_{j=1}^{k} \alpha_j \, \Delta TGdj_{t-j} + \sum_{j=1}^{k} \gamma_j \, \Delta LEMPto_{t-j} + \sum_{j=1}^{k} \delta_j \, \Delta LGFCFto_{t-j} \\ & + \sum_{j=1}^{k} \delta_j \, \Delta INF_{t-j} + \omega_1 \Delta LTO_{t-1} + \omega_2 \Delta TGdj_{t-1} + \omega_3 \Delta LEMPto_{t-1} \\ & + \omega_4 \Delta LGFCFto_{t-1} + \omega_5 \Delta INF_{t-1} + \mu_t \end{aligned} \tag{3}$$

$$\Delta LNO = \varphi_0 + \sum_{j=1}^{k} \eta_j \Delta LNO_{t-j} + \sum_{j=1}^{k} \alpha_j \Delta TGdf_{t-j} + \sum_{j=1}^{k} \gamma_j \Delta LEMPno_{t-j} + \sum_{j=1}^{k} \delta_j \Delta LGFCFno_{t-j} + \sum_{j=1}^{k} \delta_j \Delta INF_{t-j} + \omega_1 \Delta LNO_{t-1} + \omega_2 \Delta TGdf_{t-1} + \omega_3 \Delta LEMPno_{t-1} + \omega_4 \Delta LGFCFno_{t-1} + \omega_5 \Delta INF_{t-1} + \mu_t \quad (4)$$

$$\Delta LNO = \varphi_0 + \sum_{j=1}^{k} \eta_j \Delta LNO_{t-j} + \sum_{j=1}^{k} \alpha_j \Delta TGdj_{t-j} + \sum_{j=1}^{k} \gamma_j \Delta LEMPno_{t-j} + \sum_{j=1}^{k} \delta_j \Delta LGFCFno_{t-j} + \sum_{j=1}^{k} \delta_j \Delta INF_{t-j} + \omega_1 \Delta LNO_{t-1} + \omega_2 \Delta TGdj_{t-1} + \omega_3 \Delta LEMPno_{t-1} + \omega_4 \Delta LGFCFno_{t-1} + \omega_5 \Delta INF_{t-1} + \mu_t \quad (5)$$

Adopting this framework into the log-linear form allows for the direct estimation of output elasticities and facilitates the interpretation of coefficients as elasticities, which is particularly useful in sector-level analyses. Here TO represents the natural logarithm of tradable sector output, TGdf the levels of *de facto* trade globalization, and TGdj the levels of *de jure* trade globalization. Employment is included in level formation rather than as a rate or share, in line with the Cobb–Douglas framework requirements. Using rates or share expressions would ultimately change the interpretation of the elasticity, turning it into a composition effect. LEMPto shows the natural logarithm of total employment in the tradable sector, whilst LEMPno reflects the natural logarithm of total employment in the non-tradable sector (accounting for the labour input). LGFCFto stands for the natural logarithm of the tradable sector gross fixed capital formation. LGFCFno reflects the natural logarithm of the non-tradable sector gross fixed capital formation, which also represents capital input. INF denotes the annual change in the consumer price index, which serves as important control for macroeconomic stability. Reflected in these equations, the long-run coefficients are expressed by η_j, α_j,γ_j,δ_j, and ϑ_j,whilst the short-run coefficients are represented by ω_1, ω_2, ω_3 ….ω_n. Based on equations 2, 3, 4, and 5, the following hypotheses could be tested:

Null hypothesis (H_0): No co-integration between the variables

Alternative hypothesis (H_1): Presence of co-integration between the variables

The analysis then employed a bounds test to evaluate these hypotheses. Here an f-statistic is calculated and evaluated against upper and lower bound critical values derived from Pesaran et al. (2001). Cointegration is confirmed when the calculated statistics exceeds both the upper and lower bounds. Alternatively, when these values are lower than the bounds ranges, then the null hypothesis cannot be rejected. Subsequently, given the simultaneous estimation of short-run elasticities, the analysis estimated an error correction model (ECM). This also enabled an assessment of the adjustment towards equilibrium following shocks induced by trade globalization. In this respect, equations (2)–(5) above are formulated and augmented as follows:

$$\Delta LTO = \varphi_0 + \sum_{j=1}^{k} \eta_j \Delta LTO_{t-j} + \sum_{j=1}^{k} \alpha_j \Delta TGdf_{t-j} + \sum_{j=1}^{k} \beta_j \Delta LEMPto_{t-j} + \sum_{j=1}^{k} \delta_j \Delta LGFCFto_{t-j} + \sum_{j=1}^{k} \delta_j \Delta INF_{t-j} + \theta ECT_{t-1} + \mu_t \quad (6)$$

$$\Delta LTO = \varphi_0 + \sum_{j=1}^{k} \eta_j \Delta LTO_{t-j} + \sum_{j=1}^{k} \alpha_j \Delta TGdj_{t-j} + \sum_{j=1}^{k} \beta_j \Delta LEMPto_{t-j} + \sum_{j=1}^{k} \delta_j \Delta GFCFto_{t-j} + \sum_{j=1}^{k} \delta_j \Delta INF_{t-j} + \theta ECT_{t-1} + \mu_t \quad (7)$$

$$\Delta LNO = \varphi_0 + \sum_{j=1}^{k} \eta_j \Delta LNO_{t-j} + \sum_{j=1}^{k} \alpha_j \Delta TGdf_{t-j} + \sum_{j=1}^{k} \beta_j \Delta LEMPno_{t-j} + \sum_{j=1}^{k} \delta_j \Delta LGFCFno_{t-j} + \sum_{j=1}^{k} \delta_j \Delta INF_{t-j} + \theta ECT_{t-1} + \mu_t \quad (8)$$

$$\Delta LNO = \varphi_0 + \sum_{j=1}^{k} \eta_j \Delta LNO_{t-j} + \sum_{j=1}^{k} \alpha_j \Delta TGdj_{t-j} + \sum_{j=1}^{k} \beta_j \Delta LEMPno_{t-j} + \sum_{j=1}^{k} \delta_j \Delta LGFCFno_{t-j} + \sum_{j=1}^{k} \delta_j \Delta INF_{t-j} + \theta ECT_{t-1} + \mu_t \quad (9)$$

Here ECT_{t-1} reflects the error correction term, indicative of the speed of adjustment back to equilibrium. As part of the final stage of the analysis, the study employed a Toda–Yamamoto Granger non-causality test. The model checks for causality by determining if the lagged values of the coefficients of the variables included equal zero. If these values are found to be non-zero, however, it is indicative of the absence of causality.

4. Results

4.1. Descriptive Statistics

As an initial step in the analysis, the study provides a summary of the characteristics of each variable considered. These descriptive insights are outlined in *Table 2*. Results here show relatively higher mean scores for TO when compared to NO. Even though based on value added, non-tradable sectors account for more than 60% of GDP on a production basis, the tradable sector over the study period is almost three times as large given the basis of measurement in gross output. In stark contrast, employment patterns suggest that employment has increasingly become non-tradable, pointing to capital–labour asymmetries across sectors. Trends shown in *Figure 1* support this, with notable declines in tradable sector

output. This points to a large-scale deindustrialization taking place over the study period (de Jongh et al., 2025). Trends in *Figure 1* and statistics in *Table 2* relating to GFCF levels show that the tradable sector has been much more capital intensive. However, it is concerning that investment levels in both of these sectors have remained somewhat stagnant since the early 2000s.

Table 2. *Descriptive statistics*

	TO	NO	TGdf	TGdj	EMPto	EMPno	GFCFto	GFCFno	INF
Mean	2252238	778567	40.746	61.082	3780778	9705730	161539.7	387671.7	8.501
Median	2400459	830780	40.106	64.848	3605020	8644777	187337.9	436748.3	7.039
Maximum	3393335	898958	52.502	75.442	5549837	13274904	247026.5	606999.1	18.654
Minimum	1071372	580750.6	28.846	44.967	2901735	7362904	23931.47	110638.7	-0.692
Std. dev.	716857.4	103371.5	7.012	9.594	652326.8	2235652	62666.45	154778.7	4.608
Probability	0.076	0.160	0.324	0.179	0.129	0.068	0.153	0.140	0.295
Observations	43	43	43	43	43	43	43	43	43

Source: authors' own compilation

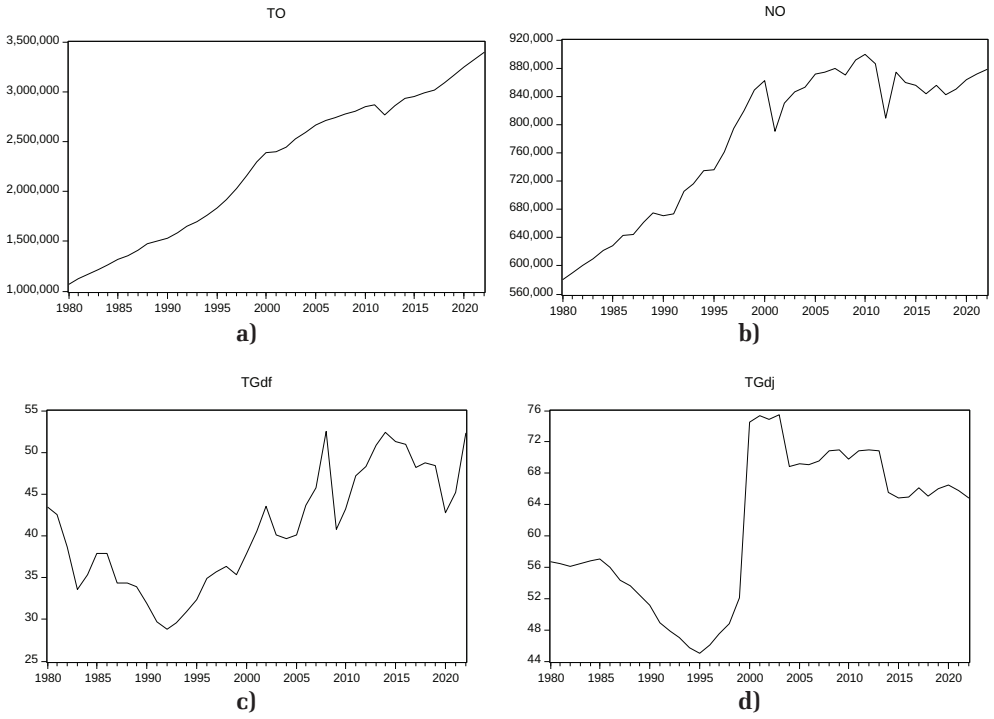


Figure 1(a–d). *Trends in the selected variables (1980–2022)*

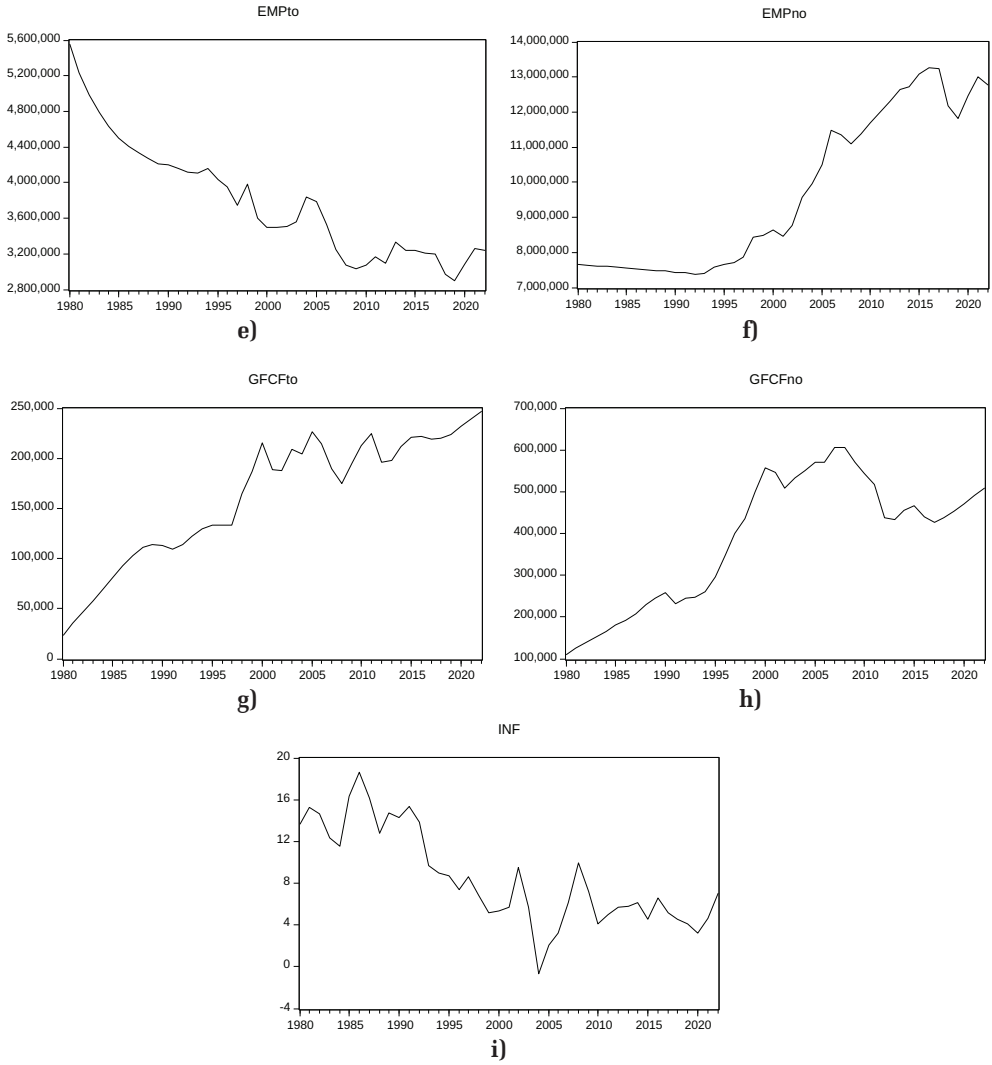


Figure 1(e–i). *Trends in the selected variables (1980–2022)*

In terms of global integration, based on mean values, *de jure* levels have exceeded *de facto* levels, which implies that formal liberalization has not been fully followed by real trade intensity. In fact, trends shown in *Figure 1* produce interesting dynamics. Whilst integration after the end of the apartheid regime excelled notably on both fronts, levels have stagnated considerably after the 2007 period. This relates to the risks associated with trade integration, as global financial shocks can substantially reshape the landscape of globalization (de Jongh, 2023). Whilst the decline for *de jure* features has been gradual, *de facto* indicators have shown much

greater volatility, particularly since the global financial crisis. Volatility measures reported in *Table 2* in fact also reveal several important complexities. Standard deviation scores for tradable sector output relative to non-tradable metrics show just how exposed these sectors are to external demand and global shocks. As for inflation used as a proxy for macroeconomic stability, levels have notably declined since heightened levels in the early 1990s.

4.2. Correlation Analysis

Following the completion of the descriptive analysis, the study advanced to investigate the relationships among the variables under examination. This analysis not only enhances the understanding of how variations in one variable correlate with changes in another but also provides valuable insights into the potential presence of collinearity among the independent variables. Based on the correlation matrix (shown in *Table 3*), several variables in the study exhibit very strong positive relationships. The dependent variables, LTO and LNO, are strongly correlated with each other (0.7695), suggesting their movements are closely linked. More importantly, both LTO and LNO indicate very strong positive correlations with both *de facto* and *de jure* trade globalization indices. Inflation changes seem to exhibit negative correlations with all other variables included in the study.

4.3. Unit Root Analysis

Whilst some variables display high correlations, the possibility of multicollinearity concerns were assessed using VIF values for all included regressors, and no serious concern was identified (*Appendix A*, *Table A1*). After the completion of the correlation analysis, the study then assessed the stationary properties of the data. Here the ADF unit root test (with null of a unit root) was used to ascertain the order of integration of the variables. It also served to determine whether any variables were integrated at the second order of integration. The outcomes of these tests are shown in *Table 4* below. The presented results reveal that all variables, apart from GFCFt, exhibit first-order integration.

To further substantiate the findings from the ADF test, the study also employed the KPSS unit root tests (with null of stationarity), for which the results are presented in *Table 5*. Results largely reflect those reported for the ADF test. With most variables stationary at first difference, only TGdj is assumed to be integrated at levels diverging from the ADF results. Whilst this divergence is noteworthy, both tests confirmed that no variables were integrated at the 2nd order, and thus the analysis could proceed with bounds testing and ARDL specification.

Table 3. *Correlation analysis*

	LTO	LNO	TGdf	TGdj	LEMPto	LEMPno	LGFCFto	LGFCFno	INF
LTO	1.000 ---- ----								
LNO	0.769*** [25.336] (0.000)	1.000 ---- ----							
TGdf	0.679*** [5.923] (0.000)	0.574*** [4.495] (0.000)	1.000 ---- ----						
TGdj	0.659*** [5.621] (0.000)	0.626*** [5.149] (0.000)	0.719*** [6.635] (0.000)	1.000 ---- ----					
LEMPto	0.690*** [12.509] (0.000)	0.801*** [8.581] (0.000)	0.870*** [11.319] (0.000)	0.708*** [6.425] (0.000)	1.000 ---- ----				
LEMPno	-0.757*** [-21.271] (0.000)	-0.919*** [-15.026] (0.000)	-0.646*** [-5.431] 0.000	-0.637*** [-5.297] (0.000)	-0.549*** [-10.303] (0.000)	1.000 ---- ----			
LGFCFto	0.731*** [16.439] (0.000)	0.675*** [28.099] (0.000)	0.498*** [3.684] (0.000)	0.642*** [5.374] (0.000)	0.713*** [6.511] (0.000)	-0.693*** [-12.768] (0.000)	1.000 ---- ----		
LGFCFno	0.728*** [15.978] (0.000)	0.931*** [16.360] (0.000)	0.435*** [3.095] (0.003)	0.535*** [4.056] (0.000)	0.716*** [6.580] (0.000)	-0.711*** [-14.185] (0.000)	0.738*** [17.375] (0.000)	1.000 ---- ----	
INF	-0.554*** [-10.533] (0.000)	-0.671*** [-11.371] (0.000)	-0.493*** [-3.629] (0.000)	-0.575*** [-4.502] (0.000)	-0.728*** [-6.818] (0.000)	0.740*** [7.064] (0.000)	-0.635*** [-9.724] (0.000)	-0.776*** [-7.886] (0.000)	1.000 ---- ----

Source: authors' own compilation

Table 4. *Augmented Dickey–Fuller (ADF) unit root test results*

Variables	Levels				First difference				I(0)/I(1)
	Intercept		Trend and intercept		Intercept		Trend and intercept		
LTO	-2.224	0.192	-1.041	0.926	-3.415**	0.016	-4.078***	0.013	I (1)
LNO	-1.723	0.412	-1.580	0.783	-8.385***	0.000	-8.120***	0.000	I (1)
TGdf	-1.102	0.706	-3.133	0.112	-6.288***	0.000	-6.401***	0.000	I (1)
TGdj	-1.302	0.619	-1.631	0.763	-5.222***	0.000	-5.154***	0.000	I (1)
LEMPto	-2.596	0.101	-2.565	0.297	-5.525***	0.000	-5.730***	0.000	I (1)
LEMPno	0.077	0.960	-2.156	0.500	-4.399***	0.001	-4.344***	0.006	I (1)
LGFCFto	-6.995***	0.000	-5.919***	0.000	-4.509***	0.000	-4.121	0.012	I (0)
LGFCFno	-2.181	0.216	-1.557	0.792	-3.403**	0.016	-3.741**	0.030	I (1)
INF	-0.930	0.767	-0.946	0.939	-5.551***	0.000	-5.512***	0.000	I (1)

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% level of significance respectively.

Source: authors' compilation

Table 5. *KPSS unit root test results*

Variables	Levels		First difference		I(0)/ I(1)
	Constant	Trend and intercept	Constant	Trend and intercept	
LTO	0.802**	0.201**	0.538	0.093	I(1)
LNO	0.725**	0.196**	0.323	0.125	I(1)
TGdf	0.595**	0.156**	0.300	0.128	I(1)
TGdj	0.451	0.092	0.088	0.087	I(0)
LEMPto	0.798**	0.168**	0.277	0.087	I(1)
LEMPno	0.750**	0.133**	0.224	0.132	I(1)
LGFCFto	0.604**	0.735**	0.288	0.181	I(1)
LGFCFno	0.655**	0.200**	0.451	0.074	I(1)
INF	0.654**	0.168**	0.456	0.382	I(1)

Notes: KPSS asymptotic 5% critical values for constant at 0.463; for trend and intercept at 0.146; ***, **, and * indicate significance at the 1%, 5%, and 10% level of significance respectively.

Source: authors' own compilation

4.4. Bounds Testing for Co-integration and Long-Run Analysis

After determining the stationarity properties of the data, the study aimed to assess the impact of trade globalization on sectoral output (tradable and non-tradable sector) in South Africa, adoptping four distinct models. In the first two models, LTO was used as the dependent variable, while the third and fourth model utilized LNO as dependent variable. In doing so, the study not only distinguished between sectors but also examined the differential impact effects of the *de facto* and *de jure* dimensions of trade globalization. Results shown in *Table 6* indicate that calculated f-statistics for all models exceeded the upper bound critical values (1% sig. level). Thus, co-integration for the models concerned could be confirmed.

Table 6. *Bounds test results for the four ARDL models*

Model	Estimated F-value	Presence of co-integration
Model 1 DV: LTO	12.171***	Co-integration confirmed at 1% sig. level
Model 2 DV: LTO	7.835***	Co-integration confirmed at 1% sig. level
Model 3: DV: LNO	6.746***	Co-integration confirmed at 1% sig. level
Model 4: DV: LNO	11.499***	Co-integration confirmed at 1% sig. level

Notes: Upper bound critical values at 1% sig level = 5.256; lower bound critical values at 1% sig. level = 3.657.

Source: authors' own compilation

Given the confirmed co-integrated relationships, the analysis proceeded to estimate the long-run elasticities between the variables. *Table 7* reports these coefficients. Here, in relation to the main objective of the study, results seem to indicate that *de facto* features of the trade globalization process do not seem to statistically significantly affect either tradable or non-tradable sector performance. On the other hand, for *de jure* trade integration, notable relationships are observed. Coefficients and t-statistics in relation to the tradable sector output suggest that a 1 unit increase in *de jure* index levels is associated with a 0.015% increase in these sectors' output levels. In stark contrast, higher unit levels of trade liberalization seem to offset performance in the non-tradable sector by approximately 0.005%. In the case of both these associations, the relationships are significant at the 1% significance level. These findings contrast with those reported by Adjei and Grega (2023) in ECOWAS countries.

Table 7. *Long-run elasticities*

Variables	(1) DV: LTO (df)		(2) DV: LTO (dj)		(3) DV: LNO (df)		(4) DV: LNO (dj)	
	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)
TGdf	-0.005	[-0.572] (0.570)			-0.009	[-1.455] (0.155)		
TGdj			0.015***	[2.751] (0.009)			-0.005***	[-4.314] (0.000)
LEMPto	-0.143	[-0.372] (0.711)	-0.783*	[-1.778] (0.084)				
LEMPno					0.317	[1.188] (0.243)	0.100***	[2.926] (0.006)
LGFCFto	0.087	[0.390] (0.698)	0.514***	[3.381] (0.152)				
LGFCFno					0.140**	[2.672] (0.011)	0.209***	[19.654] (0.000)
INF	-0.017**	[-2.732] (0.010)	-0.004	[-1.342] (0.188)	0.006	[0.680] (0.501)	-0.004*	[-1.903] (0.065)
C	45.885	[0.280] (0.780)	16.714**	[2.104] (0.043)	6.807*	[1.911] (0.064)	9.173***	[16.195] (0.000)

Notes: [ ] shows the t-stats; ( ) shows p-values; ***, **, and * indicate significance at the 1%, 5%, and 10% level of significance respectively.

Source: authors' own compilation

Further results in relation to GFCF for both tradable and non-tradable investment show just how important capital formation is for output performance. Here investment in both sectors is statistically significant (at least at the 5% significance level) and positively associated with sectoral performance related to tradable and non-tradable activities. Other results from *Table 7* show somewhat mixed results for employment in the respective sectors. Relating to tradable sector output, employment coefficients in both the *de facto* and *de jure* models have a negative sign. However, only when accounting for *de jure* impulses does it seem to exhibit a statistically significant impact. In contrast, employment seems to enhance non-tradable sector output. Finally, based on the proxy for macroeconomic stability, for two out of the four models, inflation appears to have a consistently negative effect on sectoral output, as expected (Fedderke, 2021).

4.5. ECM Results and Short-Run Analysis

In relation to the long-run findings, ECM models were examined with the aim of confirming cointegrated relationships as well as to estimate short-run elasticities. *Table 8* summarizes these results. Firstly, pertaining to the error correction terms, coefficients for all models ranged from -0.11 to -0.60 and were statistically significant at the 1% significance level. Based on this estimation, it appears that trade-globalization-induced shocks – be it *de facto* or *de jure* – are corrected for much more quickly in non-tradable sectors when compared to tradable sectors. Pertaining to the short-run relationships, tradable sector activity is shown to be strongly affected by the lag effects of both *de facto* and *de jure* trade globalization. Regarding these dimensions, shocks appear to affect output consistent with the findings of Bataka (2019). The results pertaining to levels of GFCF in the sector reveal some interesting findings. Here immediate changes in capital inputs are inducive; however, more lagged effects seem to exhibit diminishing effects. This might point to what Yeboah and Adamec (2025) refer to as adjustment costs associated with capital allocation inefficiencies. In comparison to the results, estimates from *Table 8* pertaining to the non-tradable sector performance show negative and statistically significant coefficients for both *de facto* and *de jure* trade globalization indices. These seem to arise from the lagged values. By contrast, for both employment and GFCF levels, coefficients were positive. This shows a relationship with the employment-intensive nature of these sectors. Finally, as expected a priori, the proxy for macroeconomic stability indicates an inverse relationship between short-run inflation and output in both the tradable and non-tradable sectors.

Table 8. *ECM results and short-run coefficients*

Variables	ARDL (4,4,1,4,3) (5) DV: LTO (df)		ARDL (3,4,2,4,4) (6) DV: LTO (dj)		ARDL (4,2,4,4,2) (7) DV: LNO (df)		ARDL (3,3,4,4,3) (8) DV: LNO (dj)	
	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)
LTO(-1)	0.038	[0.440] (0.663)	-0.754***	[-4.380] (0.000)				
LTO(-2)	0.103	[1.192] (0.245)	-0.593***	[-4.156] (0.000)				
LTO(-3)	0.409***	[5.196] (0.000)						
LNO(-1)					-0.427***	[-4.926] (0.000)	0.180	[1.703] (0.104)
LNO(-2)					-0.097	[-0.919] (0.369)	0.355***	[3.787] (0.001)
LNO(-3)					-0.306***	[-3.172] (0.005)		
TGdf	0.001***	[4.482] (0.000)			-0.006***	[-2.960] (0.008)		
TGdf(-1)	0.005***	[3.422] (0.002)			0.003***	[3.303] (0.003)		
TGdf(-2)	0.002***	[6.014] (0.000)						
TGdf(-3)	0.003***	[7.907] (0.000)						
TGdj			0.003	[0.388] (0.702)			0.001	[0.256] (0.800)
TGdj(-1)			0.003***	[4.725] (0.000)			-0.002***	[-3.912] (0.000)
TGdj(-2)			0.021**	[2.709] (0.014)			-0.025***	[-4.623] (0.000)

Variables	ARDL (4,4,1,4,3) (5) DV: LTO (df)		ARDL (3,4,2,4,4) (6) DV: LTO (dj)		ARDL (4,2,4,4,2) (7) DV: LNO (df)		ARDL (3,3,4,4,3) (8) DV: LNO (dj)	
	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)
TGdj(-3)			0.011**	[2.5131] (0.0217)				
LEMPto	-0.015	[-0.305] (0.763)	-0.010	[-0.238] (0.814)				
LEMPto(-1)			-0.095*	[-1.976] (0.063)				
LEMPto(-2)								
LEMPto(-3)								
LEMPno					0.774***	[11.976] (0.000)	0.782***	[10.915] (0.000)
LEMPno(-1)					-0.158**	[-2.289] (0.033)	0.081	[1.129] (0.271)
LEMPno(-2)					0.393***	[4.540] (0.000)	0.233**	[2.590] (0.017)
LEMPno(-3)					0.341***	[3.171] (0.005)	0.439***	[5.034] (0.000)
LGFCFto	0.073***	[5.082] (0.000)	0.074***	[2.882] (0.009)				
LGFCFto(-1)	-0.070***	[-4.124] (0.000)	0.038	[1.086] (0.291)				
LGFCFto(-2)	-0.063***	[-3.481] (0.002)	-0.057	[-1.611] (0.124)				
LGFCFto(-3)	-0.046**	[-2.681] (0.013)	-0.099***	[-3.198] (0.005)				

Variables	ARDL (4,4,1,4,3) (5) DV: LTO (df)		ARDL (3,4,2,4,4) (6) DV: LTO (dj)		ARDL (4,2,4,4,2) (7) DV: LNO (df)		ARDL (3,3,4,4,3) (8) DV: LNO (dj)	
	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)
LGFCFno					0.337***	[10.998] (0.000)	0.404***	[13.901] (0.000)
LGFCFno(-1)					-0.078*	[-1.733] (0.099)	-0.197***	[-5.031] (0.000)
LGFCFno(-2)					0.018	[0.3612] (0.721)	-0.202***	[-4.292] (0.000)
LGFCFno(-3)					0.227***	[5.745] (0.000)	0.108***	[3.505] (0.002)
INF	-0.014***	[-6.457] (0.000)	-0.007***	[-2.992] (0.007)	0.015**	[2.251] (0.036)	0.010***	[3.193] (0.004)
INF(-1)	0.007	[0.271] (0.788)	-0.019***	[-5.359] (0.000)	-0.012*	[-1.766] 0.093	-0.006	[-1.533] (0.140)
INF(-2)	-0.005**	[-2.364] (0.027)	-0.009**	[-2.511] (0.021)	0.046***	[8.167] (0.000)	0.033***	[8.963] (0.000)
INF(-3)			-0.008***	[-3.126] (0.005)	-0.012***	[-3.848] (0.001)		
CointEq(-1)*	-0.115***	[-10.823] (0.000)	-0.201***	[-9.0702] (0.000)	-0.603***	[-8.307] (0.000)	-0.540***	[-10.723] (0.000)

Notes: Centred VIF values for model 1 between 1.844 and 4.734; for model 2 between 3.311 and 7.304; for model 3 between 2.176 and 8.100; for model 4 between 2.348 and 9.660. ***, **, and * indicate significance at the 1%, 5%, and 10% level of significance respectively.

Source: authors' compilation

4.6. Diagnostic and stability test

As the final stage of the analysis, the study conducted several diagnostic tests to assess the robustness of the short-run estimates. These tests included assessments for normality, heteroscedasticity, and autocorrelation, with the results presented in *Table 9*. According to these findings, the residuals for all models were normally distributed, exhibited homoscedasticity, and showed no signs of serial correlation. This indicates that the models are well specified and that the assumptions underlying the regression analyses are satisfied.

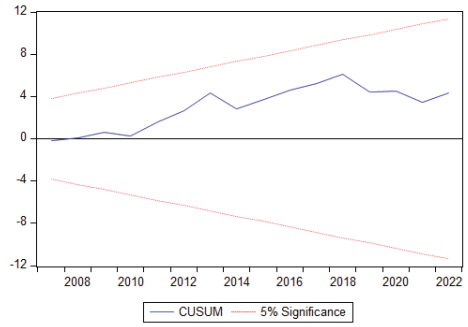
Table 9. *Residual diagnostic and model stability results*

Item	Test	Sig. values			
		ARDL (4,4,1,4,3) DV: LTO (df)	**ARDL (3,4,2,4,4) DV: LTO (dj)**	**ARDL (4,2,4,4,2) DV: LNO (df)**	**ARDL (3,3,4,4,3) DV: LNO (dj)**
Normality	Jarque–Bera	0.309	0.425	0.700	0.905
Homoscedasticity	Breusch–Pagan–Godfrey	0.235	0.387	0.602	0.954
Serial correlation	Breusch–Godfrey	0.589	0.137	0.141	0.338

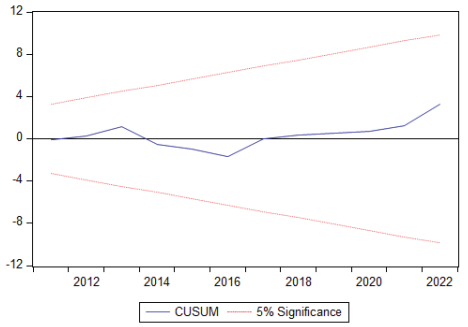
Notes: null hypothesis for Jarque–Bera = normal distribution of residuals; Breusch–Pagan–Godfrey = residuals are homoscedastic; Breusch–Godfrey = no serial correlation.

Source: authors' compilation

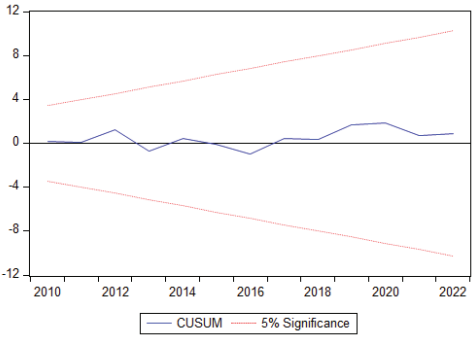
In addition to these tests, both cumulative sum (CUSUM) and CUSUM of squares tests were utilized to assess the stability of the models over the study period. Results are shown in both *Figure 2(a–d)* and *Figure 3(a–d)*. Lines for all four models remain within the critical bounds, reflecting that the model's parameters are stable over the sample period, thereby lending confidence to the validity of the results presented. In addition to this, to determine consistency over key periods, specifically considering the impact of COVID-19, the study estimated all four models using a pre-COVID sample (see *Appendix A*). Coefficients reported in *Table A2* align with those shown in the main estimation (*Table 8*). In this respect, this supports the CUSUM findings, suggesting that the period under investigation could be treated as uniform.



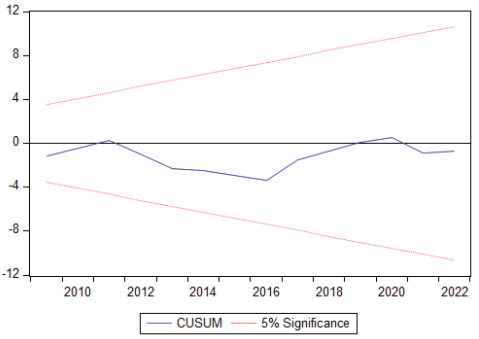
Model 1.



Model 2.

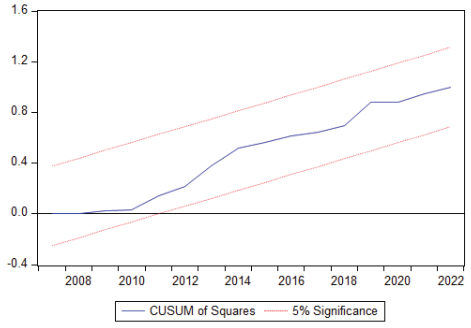


Model 3.

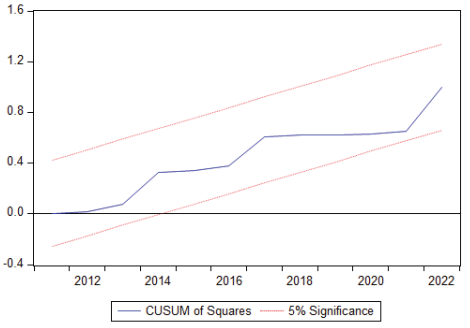


Model 4.

Figure 2. *CUSUM stability results (models 1–4)*

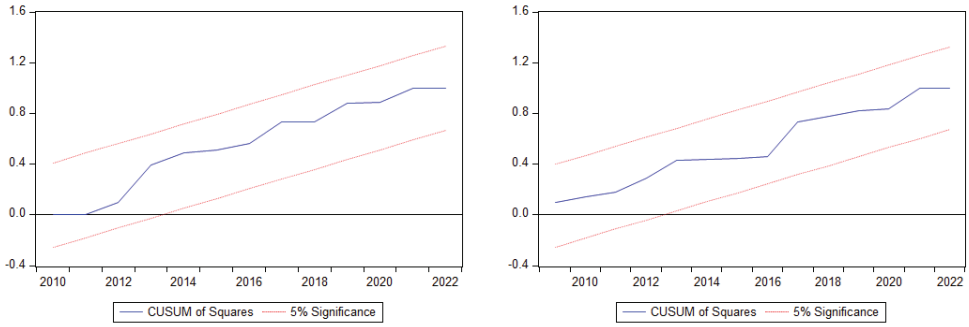


Model 1.



Model 2.

Figure 3. *CUSUMSQ stability results (models 1–2)*



Model 3. **Model 4.**

Figure 3. *CUSUMSQ stability results (models 3–4)*

5. Discussion of Results

Overall, the results reveal an asymmetric effect induced by trade globalization on sectoral performance – for both the long and the short run. Considering the former, specifically *de jure* trade globalization seems to affect tradable sector performance as opposed to the *de facto* features. This distinction is noteworthy because it suggests that institutional and policy-driven integration into global markets may play a more decisive role in shaping sectoral performance than the mere volume of trade flows for the country. In retrospect, this reflects the importance and ease of engaging in quality trade exchanges where aspects such as liberalization, tariff reductions, and regulatory harmony contribute to enhanced security for exporters (Rbehat and Marafi, 2024). On the other hand, it appears that *de jure* trade globalization affects domestic, non-tradable sectors differently. In terms of the findings regarding tradable sector performance, the negative relationship can be explained by strong factor reallocation diverting resources from domestic-oriented activity towards externally exposed sectors, as also supported by Piton (2017). Given the country's comparative advantage in commodity-driven exports, results here tend to point to *de jure* impulses that reinforce existing production structures as opposed to facilitating broad-based structural transformation (also supported by the short-run findings). These findings are complemented by the robustness results presented in *Table A3*. When sectors have been disaggregated into mining, manufacturing, and agricultural activity, both *de facto* and *de jure* trade globalization seems to spur mining output. For manufacturing and agriculture, these relationships are shown as statistically insignificant.

In close relation to these differences, the results also reveal an important structural divergence between the tradable and non-tradable sectors. Employment coefficients

associated with the tradable sector appear negative and mostly insignificant in the long run and the short run as well. For the non-tradable sector performance, however, this exerts a positive and statistically significant influence. In the light of the results on fixed investment levels, this finding can be explained based on the increasingly capital- and productivity-intensive nature of tradable production activities. Firms operating in globally competitive sectors often rely on technological upgrading, capital deepening, and efficiency improvements to maintain competitiveness, which, as a result, limits labour absorption capacity (Alexander, 2021). These results also support previous findings (Steenkamp et al., 2025) that have indicated the prominence of the service sector expansion in driving labour absorption growth in a new era of services-led industrialization. However, the short-run negative lagged coefficients for investment also suggest some considerations in the substitution decisions. Particularly, these negative effects point to the presence of inefficiencies in capital allocation pertaining to investment adjustment costs and delayed productivity gains.

The short-run results further illuminated various important dynamics. Firstly, here the differences noted in the dynamic adjustment process between the two sectors suggest that non-tradable sectors adjust more rapidly to shocks compared to tradable sectors. The more rapid pace of adjustment speaks to the nature of these sectors. As they are exposed mostly to domestic conditions, trade-induced shocks occur more indirectly (Alagidede and Ibrahim, 2016), allowing greater space to fully readjust. For tradable sectors, though, the impact is more direct. Having to deal with global demand conditions, exchange rate fluctuations as well as competing in global value chains infer greater volatility (Borin et al., 2021). This is also shown by the lagged and statistically significant elasticities for the respective globalization metrics. Here both measures (*de facto* and *de jure*) seem to effect tradable sector output positively. Firms engaged in trade here are exposed to dynamic readjustment processes, depending largely on both formal regulatory support and actual flows for benefit.

Finally, among the control variables, macroeconomic stability (proxied by inflation changes) appears to play a notable role both in the long and the short run. For tradable sectors, especially in the short run, the negative relationship can be explained by the potential impact of increasing production costs and the associated uncertainty it brings about (Ambrosino et al., 2026). Usually, firms in these sectors are largely dependent on predictable pricing conditions when competing globally. For non-tradable sectors that depend heavily on domestic demand, inflation shocks are most frequently transmitted through reduced demand resulting from a decline in households' purchasing power.

6. Conclusions and Recommendations

The main aim of the study was to analyse the impact of trade globalization on tradable and non-tradable sector performance in South Africa by accounting for possible differences in the *de facto* and *de jure* dimensions of this process. The results revealed intriguing insights, most prominently the asymmetric nature of trade globalization, not only across sectors but also in the time frames considered. In the long run, *de jure* elements seem to play a decisive role, whilst enhancing tradable sector performance diminishes the output in non-tradable sectors. In this light, the institutional framework in which trade integration unfolds, including the nature of the country's trade agreements, regulatory harmonization, and tariff construction, plays a pivotal role in shaping sectoral performance outcomes, even more so than actual trade volumes themselves. Moreover, when considered alongside the findings on the key control variables, these results suggest a structural divergence between the tradable and non-tradable sectors. In this respect, as trade globalization advances in South Africa, resources are increasingly directed towards export-oriented industries and away from non-tradable domestic activity, albeit this entails substituting labour for capital, as these industries seek to compete in aggressive productivity-rewarding markets. Short-run dynamics reveal further asymmetries in the adjustment processes. Whilst tradable sectors appear to be more volatile and slower to adjust to trade shocks, non-tradable activity regulates these shocks with greater ease, given their dependence on domestic economic conditions.

Considering these findings, several important policy implications, specifically associated with broader structural transformation and sectoral development, can be drawn. The first one relates to the fact that policy-induced trade integration reinforces existing production structures within the South African context. Reliance on commodity-based exports limits the scope for participation in more diversified, value-added activities. Secondly, the results highlight the growing role of service-based sectors in facilitating the absorption of labour, in a framework where conventional industrialization based on manufacturing is losing ground. This divergence between employment-intensive domestic sectors and capital-intensive tradable sectors raises notable considerations for both inclusive growth and employment creation in an economy where inequality and unemployment levels are dangerously high. Finally, the study once again emphasizes the importance of a sound and stable macroeconomic environment. Specifically, stable inflation outlooks as well as efficiency in investment allocation play important roles in shaping the dynamics within the trade globalization and sectoral performance nexus.

From a policy perspective, the findings suggest that trade policy alone is not sufficient to ensure a structural transformation of the economy. Whilst the study provides evidence that trade agreements, tariff construction, and regulatory coordination are imperative, the current asymmetric nature in the way trade

integration has affected sectoral performance calls for a more holistic development approach. This includes the need for a complementary and targeted industrial and investment policy landscape that aims to diversify economic structures. Focus here should be directed towards improving participation in forward-positioned value-added GVCs, support for emerging industries, and enhancing productive capabilities. Forward and backward linkages between export-oriented industries and domestic firms should be prioritized. In achieving this, measures such as supplier development programmes as well as investing in technological upgrading and skills development will help enhance the spillovers effects of trade integration. Future research can build on these findings by providing more disaggregated evidence, specifically on sector- or industry-specific levels. Comparative studies involving countries with different export structures will also help broaden the body of knowledge, lending insight into how policy frameworks can help shape the development outcomes of global economic integration. It must also be acknowledged that this study adopted a simplified approach to classifying tradable and non-tradable sectors to ensure consistency over the sample period. Future studies can thus apply time-varying classifications to further broaden the relevant body of knowledge.

List of Abbreviations

ARDL:	Autoregressive Distributed Lag
CPI:	Consumer Price Index
CUSUM:	Cumulative Sum
DOLS:	Dynamic Ordinary Least Square
ECM:	Error Correction Models
FDI:	Foreign Direct Investment
FMOLS:	Fully Modified Ordinary Least Square
GFCF:	Gross Fixed Capital Formation
GMM:	Generalized Method of Moments
GVC:	Global Value Chains
KOF:	Swiss Economic Institute
LSDV:	Least Squares Dummy Variable
PMG:	Pooled Mean Group
SADC:	Southern African Development Community
SARB:	South African Reserve Bank
SIC:	Schwarz Information Criterion
WTO:	World Trade Organization

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Appendix A

Table A1. *VIF values for estimated ARDL models*

Variables	Model 1 ARDL (4,4,1,4,3)	Model 2 ARDL (3,4,2,4,4)	Model 3 ARDL (4,2,4,4,2)	Model 4 ARDL (3,3,4,4,3)
D(TO(-1))	2.845	5.030		
D(TO(-2))	2.894	3.372		
D(TO(-3))	4.091			
D(NO(-1))			6.910	11.660
D(NO(-2))			6.747	4.956
D(NO(-3))			4.593	
D(TGDF)	3.215			
D(TGDF(-1))	2.975		4.768	
D(TGDF(-2))	3.649		4.543	
D(TGDF(-3))	3.144			

Variables	Model 1 ARDL (4,4,1,4,3)	Model 2 ARDL (3,4,2,4,4)	Model 3 ARDL (4,2,4,4,2)	Model 4 ARDL (3,3,4,4,3)
D(TGDJ)		6.347		2.348
D(TGDJ(-1))		5.722		6.198
D(TGDJ(-2))		3.642		5.291
D(TGDJ(-3))		3.936		
D(EMPLOYMENT_TO)	1.845	3.312		
D(EMPLOYMENT_TO(-1))		4.204		
D(EMPLOYMENT_TO(-2))				
D(EMPLOYMENT_TO(-3))				
D(EMPLOYMENT_NO)			3.043	5.610
D(EMPLOYMENT_NO(-1))			2.349	4.862
D(EMPLOYMENT_NO(-2))			3.728	4.879
D(EMPLOYMENT_NO(-3))			3.541	3.729
D(GFCF_TO)	2.999	6.261		
D(GFCF_TO(-1))	4.053	6.256		
D(GFCF_TO(-2))	4.288	7.224		
D(GFCF_TO(-3))	4.607	7.039		
D(GFCF_NO)			2.983	4.401
D(GFCF_NO(-1))			6.038	8.200
D(GFCF_NO(-2))			7.876	7.194
D(GFCF_NO(-3))			5.696	8.075
D(INF)	3.998	3.319	6.112	4.540
D(INF(-1))	4.734	7.304	4.392	4.385
D(INF(-2))	4.228	3.666		5.071
D(INF(-3))		4.159		

Table A2. *Long-run robustness results for the pre-COVID-19 subsample*

Variables	DV: LTO (df)		DV: LTO (dj)		DV: LNO (df)		DV: LNO (dj)	
	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)
TGdf	-0.007*	[-2.003] (0.0039)			-0.019	[-1.656] (0.0120)		
TGdj			0.011**	[2.601] (0.004)			-0.003***	[-9.635] (0.000)
LEMPto	-1.054***	[-3.4149] (0.3085)	-0.005	[-0.013] (0.395)				
LEMPno					0.862	[2.008] (0.053)	0.144***	[6.125] (0.024)
LGFCFto	-0.076	[-0.393] (0.193)	0.447***	[4.149] (0.108)				
LGFCFno					0.132	[2.564] (0.015)	0.214***	[19.381] (0.011)
INF	-0.028***	[-5.339] (0.005)	-0.041***	[-5.342] (0.007)	-0.002	[-0.418] (0.678)	-0.005***	[-3.277] (0.001)
C	31.365	[4.676] (6.707)	10.522	[1.549] (0.131)	-1.139	[-0.182] (6.250)	8.732***	[19.512] (0.448)
ECT	-0.241***		-0.215***		-0.516***		-0.578***	
Bounds test	9.391***		19.476***		3.704**		7.574***	
Jarque–Bera	0.791		0.341		0.281		0.541	
Breusch–Pagan–Godfrey	0.551		0.526		0.208		0.258	
Breusch–Godfrey	0.872		0.998		0.243		0.800	

Table A3. *Robustness results – disaggregated tradable sector specifications*

Variables	DV: LAGRI (df)		DV: LAGRI (dj)		DV: LMIN (df)		DV: LMIN (dj)		DV: LMAN (df)		DV: LMAN (dj)	
	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)	Coeff.	[t-stat.] (Std err.)
TGdf	0.0251	1.3099 0.0191			0.0041**	2.2137 0.0018			-0.0706	-0.0326 2.1646		
TGdj			-0.0035	-0.3002 0.0115			0.0014***	4.3881 0.0003			0.0029*	1.7790 0.0016
LEMPagri	0.4149	0.2856 1.4529	-0.8151	-0.6023 1.3534								
LEMPmin					0.4390**	2.6822 0.1636	0.3299***	7.2242 0.0456				
LEMPman									-25.7149	-0.0417 615.8728	-1.0722***	-5.4510 0.1967
LGFCFagri	1.5066	1.6356 0.9211	1.7163	1.38617 1.2381								
LGFCFmin					-0.0040	-0.0806 0.0500	0.0694***	3.2522 0.0213				
LGFCFman									-5.5129	-0.0411 133.8782	0.0939	0.8808 0.1066
INF	0.08148	1.4790 0.0550	0.09705	1.2672 0.07658	-0.0032	-1.1553 0.0027	0.0093	0.73752 0.0127	0.2900	0.0404 7.1748	-0.0070	-1.1648 0.0060
C	-14.6205	-0.4644 31.4826	2.5937	0.0822 31.5203	5.5971*	1.9350 2.89249	6.3966***	7.2203 0.8859	467.993	0.04276 10935.53	27.9173***	7.1908 3.8823
ECT		-0.2244***		-0.1890***		-0.8960***		-0.8661***		-0.3788**		-0.8211***
Bounds test		3.5728*		2.9918		3.8546*		8.4913***		0.9691		3.4055*
Jarque–Bera		0.2555		0.5496		0.9626		0.6864		0.7862		0.3413
Breusch–Pagan–Godfrey		0.8726		0.9240		0.2770		0.1934		0.7397		0.7834
Breusch–Godfrey		0.2502		0.6659		0.5949		0.5676		0.9074		0.8996