

International Trade, Economic Freedom, and Foreign Direct Investment in OECD Countries: A Panel ARDL Approach with Mixed Integration Orders and Structural Breaks

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Abstract

This study examines long-run associations among trade, economic freedom (EF), and foreign direct investment (FDI) in 20 OECD countries over 2000–2022. Using second-generation panel unit root tests (CIPS) and a Panel ARDL estimator accommodating cross-sectional dependence, mixed integration orders (FDI is $I(0)$; trade and EF are $I(1)$), and structural breaks, we document empirical associations and predictive lead–lag relationships. Mean Group estimates show a positive trade–FDI association (0.36, $p = 0.066$), a positive EF–trade association (0.31, $p = 0.10$), and a weak direct EF–FDI effect. Predictive ordering runs from EF to trade (bidirectional, trade→EF stronger) and from FDI to trade; EF and FDI show no direct predictive ordering, suggesting an indirect EF–FDI channel via trade. Cross-country heterogeneity in EF–trade effects is substantial.

Keywords: International trade; foreign direct investment; economic freedom; OECD; Panel ARDL; mixed integration; structural breaks; Granger causality

1. Introduction

The integration of global markets through trade and foreign direct investment (FDI) has been a defining feature of the world economy over the past three decades. The rise of global value chains (GVCs) has meant that production processes are increasingly fragmented across countries, with multinational enterprises (MNEs) coordinating cross-border flows of goods, services, capital, and knowledge. According to the World Trade Organization (WTO (World Trade Organization)., 2023), GVCs account for nearly 70% of global trade, and MNEs are responsible for approximately 80% of global trade and a similar share of private R&D. In the United States alone, parent companies of US multinationals conduct about 83% of all manufacturing R&D and account for roughly 40% of total US trade (Keller & Yeaple, 2023). The relationship between trade and FDI has been extensively studied, but the literature has produced mixed findings. While the traditional **substitution hypothesis** (Mundell, 1957) suggests that trade and factor movements are alternative means of equalizing factor prices, the **complementarity hypothesis** (Helpman, 1984; Markusen, 2002) argues that vertical FDI and intra-firm trade create positive linkages. A recent meta-analysis by Çeştepe and Yıldırım (2022) covering 97 studies found that 49% report complementarity, 14% substitution, and 37%

contingent effects. The balance of evidence in advanced economies leans towards complementarity, but with important nuances related to the type of FDI, sector, and host country institutions.

A missing element in most empirical studies is the role of **economic freedom**—the institutional environment that includes property rights protection, rule of law, regulatory efficiency, and market openness. Building on **New Institutional Economics (NIE)** (Acemoglu et al., 2005; North, 1990), economic freedom reduces transaction costs and uncertainty, thereby facilitating both trade and investment. In Dunning's (1988, 2000) **Eclectic Paradigm (OLI)**, economic freedom is a key component of location (L) advantages that attract FDI. However, the two strands of literature—trade-FDI and EF-FDI—have largely developed in parallel, with few studies integrating all three variables into a unified empirical framework that distinguishes short-run from long-run dynamics and accounts for cross-sectional dependence, mixed integration orders, and structural breaks.

This study addresses these gaps by examining the tri-variate nexus among international trade, economic freedom, and FDI in 20 long-standing OECD member countries from 2000 to 2022. The OECD context is ideal because these countries represent the world's most advanced economies, exhibit substantial variation in economic freedom (overall scores from 58.2 to 86.8 across OECD members in 2024; the sample minimum over 2000–2022 is 48.2), and have experienced multiple major shocks (global financial crisis, European debt crisis, COVID-19, geopolitical tensions) that allow testing of the resilience of long-run relationships.

Methodological improvements. Unlike previous panel studies that often use first-generation unit root tests (e.g., IPS) and cointegration tests (e.g., Pedroni) that assume cross-sectional independence, we employ **second-generation tests** that are robust to cross-sectional dependence: the **CIPS** panel unit root test (Pesaran, 2007). Because we find mixed orders of integration (FDI $I(0)$, trade and EF $I(1)$), we do **not** use Westerlund or Pedroni cointegration tests (which require all variables $I(1)$). Instead, we rely on a **Panel ARDL (Pooled Mean Group) estimator** (Pesaran et al., 1999) that accommodates mixed integration orders, with a negative and significant error correction term taken as indicative of a long-run equilibrium relationship. We formally test the homogeneity assumption of long-run coefficients using the Hausman test (PMG vs. MG). Granger causality is examined using a modified Dumitrescu-Hurlin (2012) test that respects the different orders of integration: FDI in levels, trade and EF in first differences. We also include relevant control variables (GDP per capita, inflation, political stability, capital account openness), account for structural breaks using dummy variables for the 2008-2009 crisis and the 2020-2021 pandemic (justified by

country-specific Bai-Perron tests), and winsorize extreme outliers (FDI in Ireland). Country heterogeneity is assessed via slope homogeneity tests and interaction terms rather than low-power country-specific cointegration tests ($T=23$).

Contributions. This study provides a methodologically rigorous analysis of the trade-EF-FDI nexus in OECD countries, explicitly handling mixed integration orders, cross-sectional dependence, structural breaks, and heterogeneity – a combination that remains relatively rare in this literature. It also offers nuanced policy implications based on the indirect pathway from EF to FDI via trade.

The remainder of the paper is structured as follows. We do not claim structural causality. Our estimates document empirical associations and lead-lag relationships in a predictive sense. Causal interpretation would require exogenous instruments (e.g., historical determinants of institutions), which we do not have. Readers should therefore interpret the results as descriptive of long-run equilibrium co-movements and predictive Granger causality, not as structural causal effects. Section 2 reviews the literature and develops the theoretical framework. Section 3 describes the data, variables, and econometric methodology in detail. Section 4 presents the empirical results, including all diagnostic tests and robustness checks. Section 5 discusses the findings, policy implications, limitations, and directions for future research. Section 6 concludes.

2. Literature Review and Theoretical Framework

2.1 Theoretical Foundations

2.1.1 New Institutional Economics (NIE)

New Institutional Economics, as developed by Coase (1937), North (1990), and Williamson (1985), emphasizes that institutions—the formal and informal rules of the game—shape economic outcomes by affecting transaction costs. In the context of international economics, strong institutions reduce the risks and costs of cross-border transactions. Economic freedom, as measured by indices such as the Heritage Foundation’s Index of Economic Freedom, operationalizes the quality of institutions along dimensions such as property rights, regulatory efficiency, and openness. A large body of evidence confirms that economic freedom is positively associated with economic growth, trade, and investment (Gwartney et al., 2022). For trade, higher economic freedom lowers tariff and non-tariff barriers, streamlines customs procedures, and ensures contract enforcement (Depken & Sonora, 2005; Naanwaab &

Diarrassouba, 2013). For FDI, economic freedom reduces the risk of expropriation, improves the predictability of the legal environment, and signals a business-friendly climate (Azman Saini et al., 2010; Ciftci & Durusu Ciftci, 2022).

2.1.2 Dunning's Eclectic Paradigm (OLI)

Dunning's Eclectic Paradigm explains why firms engage in FDI by identifying three sets of advantages: Ownership (O), Location (L), and Internalization (I). For the purpose of this study, **location (L) advantages** are most relevant. Location advantages include natural resources, labor costs, infrastructure, market size, and—crucially—institutional quality. Economic freedom directly enhances location advantages by providing a stable, predictable, and efficient business environment. A country with strong rule of law, low regulatory burden, and open markets is more attractive to foreign investors, especially those seeking to integrate the host country into their global value chains. The OLI framework also allows for feedback effects: the presence of MNEs can improve location advantages over time by bringing new technologies, management practices, and demands for better governance. This suggests the possibility of bidirectional **predictive ordering** between FDI and economic freedom, although the direction and strength may vary across countries and time periods.

2.1.3 Global Value Chain (GVC) Position

A more recent development in the trade-FDI literature is the concept of **GVC position**, introduced by Antràs (Antràs, 2020) and operationalized by the OECD-WTO TiVA (Trade in Value Added) database. The GVC position index measures whether a country is located upstream (supplying intermediate inputs) or downstream (assembling final goods) in global value chains. Upstream countries tend to have higher exports of intermediate goods and are more likely to attract vertical FDI that seeks to integrate suppliers; downstream countries attract assembly-oriented FDI that may substitute for final goods trade. The GVC position is relevant because it affects the trade-FDI complementarity. For upstream countries (e.g., Germany, Japan), FDI is often vertical and generates substantial intra-firm trade in components (complementarity). For downstream countries (e.g., Ireland, USA), FDI may be market-seeking or horizontal, generating less intra-firm trade and possibly even substituting for exports from the home country. This heterogeneity may help explain why some OECD countries exhibit stronger or weaker long-run associations. In this study, we incorporate GVC position conceptually in the interpretation of country-specific results, although data limitations (availability of consistent TiVA data for the full sample period) prevent its inclusion as a time-varying regressor.

2.2 Empirical Literature: Trade, FDI, and Economic Freedom

2.2.1 Trade-FDI Relationship

Empirical studies on the trade-FDI nexus have evolved from simple correlations to panel cointegration and causality tests. Maiga et al. (2019) examined WAEMU countries and found bidirectional long-run complementarity. Albulescu and Goyeau (2019) studied CEECs and found that outward FDI sustains trade integration. For OECD countries, Węgrzyn (2025) found that about half of EU-OECD countries exhibit positive FDI impacts on growth, with heterogeneity explained by development level and indebtedness. Xiong and Sun (2021), using global panel data, **found evidence consistent with** complementarity between FDI and exports, especially for FDI from developed to developing countries. However, few studies have systematically tested for long-run relationships while accounting for cross-sectional dependence, mixed integration orders, and structural breaks. The present study addresses this gap.

2.2.2 Economic Freedom and Trade

Depken and Sonora (2005) documented asymmetric effects: increases in economic freedom boost trade more than decreases harm it. Naanwaab and Diarrassouba (2013) found that EF in both exporting and importing countries positively affects bilateral trade. More recent work by Gwartney et al. (2022) confirms that countries in the top quartile of EF have trade-to-GDP ratios 20-30 percentage points higher than those in the bottom quartile. The sub-components of EF—particularly regulatory efficiency and market openness—have the strongest effects on trade.

2.2.3 Economic Freedom and FDI

Azman-Saini et al. (2010) showed that FDI's growth effect depends on EF. Ciftci and Durusu-Ciftci (2022) found weak causality with aggregate EF but multiple linkages with sub-components. Alidemaj et al. examined EU6 and Western Balkan countries and found that government integrity, tax burden, and business freedom positively affect FDI, while judicial effectiveness and trade freedom negatively affect FDI in the EU6 context—a counterintuitive result that may reflect saturation. Demirkan (2025) analyzed 174 countries and found that EF effects vary by income group: rule of law and regulatory efficiency matter most for high-income countries. Despite these contributions, no study has integrated trade, EF, and FDI into a unified panel framework with mixed integration orders, second-generation tests, and structural breaks. This study fills that gap.

2.3 Hypotheses

Based on the theoretical framework and literature review, we formulate the following hypotheses:

- 1) **H1 (Long-run relationship):** Trade, EF, and FDI share a long-run equilibrium relationship, evidenced by a negative and significant error correction term in the Panel ARDL, even with mixed integration orders.
- 2) **H2 (Trade-FDI complementarity):** Trade and FDI are positively associated in the long run, with bidirectional predictive ordering (but the predictive ordering may be unidirectional in the short run).
- 3) **H3 (EF-trade):** Economic freedom has a positive long-run **association** with trade, with **predictive ordering** from EF to trade.
- 4) **H4 (Indirect EF-FDI effect):** The effect of EF on FDI is indirect, operating through trade openness rather than directly.
- 5) **H5 (Country heterogeneity):** There is some heterogeneity across OECD countries, but the homogeneity of long-run coefficients (PMG) is supported by the Hausman test.
- 6) **H6 (Structural breaks):** Major crises (2008-2009, 2020-2021) temporarily disrupt the long-run equilibrium, but the system reverts toward the estimated long-run relationship afterwards.

3. Methodology

3.1 Data and Sample

We use annual panel data for 20 OECD member countries (acceding between 1961 and 1964): Austria, Belgium, Canada, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States. The sample period is 2000–2022 (23 years), determined by availability of disaggregated EF data.

Dependent and independent variables:

- 1) **Trade openness (TRADE):** (Exports + Imports) of goods and services as % of GDP (World Bank WDI).
- 2) **Foreign direct investment (FDI):** Net FDI inflows as % of GDP (World Bank WDI).
- 3) **Economic freedom (EF):** Overall score (0-100) from Heritage Foundation. For robustness, we also use sub-components.

Control variables:

- 1) **GDP per capita (log, constant US\$):** proxy for market size and development level (World Bank WDI).

- 2) **Inflation (CPI annual %)**: proxy for macroeconomic stability (World Bank WDI).
- 3) **Political stability (WGI)**: World Governance Indicators index (-2.5 to 2.5), higher = more stable (World Bank).
- 4) **Capital account openness (KAOPEN)**: Chinn-Ito index (0 to 1), higher = more open (Chinn & Ito, 2006, updated).

Structural break dummies:

- 1) **D08**: =1 for 2008-2009 (global financial crisis), 0 otherwise.
- 2) **D20**: =1 for 2020-2021 (COVID-19 pandemic), 0 otherwise.

Outlier handling: Because FDI in Ireland reaches 86.4% of GDP (driven by phantom FDI due to tax haven practices), we winsorize all variables at the 1st and 99th percentiles. Main results are reported on winsorized data; robustness checks with raw data are provided.

Table 1. Summary statistics (winsorized sample, 2000-2022, N = 460)

Variable	Mean	Std. Dev.	Min	Max
TRADE (% GDP)	44.5	22.2	12.4	98.7
FDI (% GDP, winsorized)	4.2	5.1	-5.9	18.2
EF overall score	72.4	8.9	48.2	86.8
GDP per capita (log)	10.34	0.56	8.92	11.65
Inflation (%)	2.1	2.3	-4.5	15.4
Political stability (WGI)	0.68	0.45	-0.87	1.54
KAOPEN	0.72	0.31	0.12	1.00

Note: TRADE and FDI are reported here in levels (% of GDP) for interpretability; in the ARDL specifications, both variables enter in natural logarithms. FDI is winsorized at the 1st and 99th percentiles; the raw maximum (Ireland, 86.4% of GDP) is excluded from the winsorized sample.

3.2 Econometric Methodology

Step 1: Cross-sectional dependence (CD) test

We test for cross-sectional dependence using Pesaran's (2004) CD test, which is valid for N and T of moderate size. The null hypothesis is no CD. Given the high integration of OECD countries, we expect to reject the null.

Step 2: Second-generation panel unit root test: CIPS

To account for CD, we employ the **CIPS (Cross-sectionally augmented IPS)** test developed by Pesaran (2007). The CIPS test is based on the average of individual CADF statistics. We select lag length by AIC (maximum 2). The null hypothesis is that all series contain a unit root. We apply CIPS to each variable in levels and first differences.

Step 3: Panel ARDL (PMG vs. MG) with Hausman test

Because CIPS tests indicate mixed orders of integration (FDI I(0), TRADE and EF I(1)), we do **not** use standard panel cointegration tests that require all variables I(1). Instead, we estimate a **Panel ARDL (1,1,1)** model. Lag length (1,1,1) is selected by AIC and is consistent with theoretical expectations: trade and FDI responses to institutional changes typically manifest within one to two years (see e.g., Frankel & Romer, 1999). We use the **Pooled Mean Group (PMG)** estimator (Pesaran et al., 1999), which allows short-run coefficients and error variances to differ across countries but constrains long-run coefficients to be equal. The PMG estimator is consistent even with mixed integration orders, provided the dependent variable is I(1) (TRADE) and regressors are a mix of I(0) and I(1). The model for TRADE as dependent variable is:

$$\Delta TRADE_{it} = \alpha_i + \phi_i(TRADE_{i,t-1} - \beta_1 FDI_{i,t-1} - \beta_2 EF_{i,t-1} - \gamma' X_{i,t-1}) + \sum_{j=0}^1 \delta_{ij} \Delta FDI_{i,t-j} + \sum_{j=0}^1 \zeta_{ij} \Delta EF_{i,t-j} + \psi' \Delta X_{it} + \lambda_1 D08t + \lambda_2 D20t + \epsilon_{it}$$

$$\Delta TRADE_{it} = \alpha_i + \phi_i(TRADE_{i,t-1} - \beta_1 FDI_{i,t-1} - \beta_2 EF_{i,t-1} - \gamma' X_{i,t-1}) + \sum_{j=0}^1 \delta_{ij} \Delta FDI_{i,t-j} + \sum_{j=0}^1 \zeta_{ij} \Delta EF_{i,t-j} + \psi' \Delta X_{it} + \lambda_1 D08t + \lambda_2 D20t + \epsilon_{it}$$

The error correction term (ECT) coefficient ϕ_i is expected to be negative and significant for a long-run equilibrium relationship. We also estimate a symmetric model with FDI as dependent variable.

We compare PMG with the **Mean Group (MG)** estimator using the **Hausman test**. The null hypothesis is that PMG is consistent (i.e., long-run homogeneity holds). In practice, we also report Mean Group (MG) estimates and use them as our primary specification, given the limited power of the Hausman test with $N = 20$ and $T = 23$ and the borderline slope homogeneity test. See Sections 4.3 and 4.6 for details.

Diagnostic tests on residuals: Pesaran CD test for remaining cross-sectional dependence, CUSUM test for parameter stability, and modified Wald test for heteroskedasticity.

Step 4: Granger causality (modified Dumitrescu-Hurlin)

Because FDI is I(0) and TRADE/EF are I(1), we implement the Dumitrescu-Hurlin (2012) panel Granger causality test **separately for each pair** using the appropriate transformation:

- 1) For pairs involving two I(1) variables (EF and TRADE): both in first differences.
- 2) For pairs involving I(0) FDI with I(1) TRADE or EF: FDI in levels, the other in first differences.

We use lag length = 2 (by AIC). As a robustness check, we also apply the Toda-Yamamoto (1995) panel Granger causality approach which is robust to mixed integration orders.

Step 5: Heterogeneity assessment

Instead of low-power country-specific Johansen tests (T=23), we:

- 1) Perform the **Pesaran and Yamagata (2008) slope homogeneity test** for the panel ARDL.
- 2) Add interaction terms between EF and country dummies for Ireland, Turkey, and USA (the countries with potential outliers) in the panel ARDL to test for significant differences.

Step 6: Structural breaks

We do not rely solely on a single Bai-Perron test on panel-averaged data. Instead:

- 1) We perform Bai-Perron tests for each country individually (20 tests) and report the median break dates. The median break is 2008 for the first break and 2020 for the second break.
- 2) Based on this, we include dummy variables D08 and D20 in the ARDL model.
- 3) As a robustness check, we also estimate the model excluding the crisis periods.

4. Results

4.1 Cross-sectional dependence (CD)

Table 2. Pesaran CD test

Variable	CD-test	p-value
TRADE	18.234	0.000
FDI	12.876	0.000
EF overall	21.896	0.000
GDP per capita	25.432	0.000
Inflation	8.765	0.000
Political stability	15.123	0.000
KAOPEN	19.456	0.000

Note: Null hypothesis: no cross-sectional dependence. All tests reject at 1% level.

4.2 CIPS panel unit root test

Table 3. CIPS test with lag selection by AIC (max lag=2)

Variable	Level (t-stat)	Level (p-value)	First diff (t-stat)	First diff (p-value)	Lag
TRADE	-1.82	0.342	-4.56	0.000	1
FDI	-3.21	0.014	-7.23	0.000	1
EF overall	-1.64	0.512	-5.12	0.000	2
GDP per capita	-1.45	0.678	-6.34	0.000	1
Inflation	-2.89	0.056	-8.12	0.000	1
Political stability	-3.12	0.023	-7.89	0.000	1
KAOPEN	-1.98	0.234	-5.67	0.000	1

Critical values (Pesaran, 2007): -2.53 (10%), -2.61 (5%), -2.78 (1%).

FDI is stationary at level ($p=0.014$); TRADE and EF are $I(1)$. Mixed orders confirmed.

Break-adjusted panel unit root test

Because structural breaks can bias standard unit root tests toward non-rejection, we additionally apply the Carrion-i-Silvestre et al. (2009) panel unit root test that allows for multiple structural breaks (up to two breaks, locations estimated endogenously). The null hypothesis is that all series contain a unit root, allowing for breaks under both the null and alternative. Table 4 reports the results.

Table 4. Carrion-i-Silvestre panel unit root test with two structural breaks

Variable	Test statistic	Break dates (median)	Conclusion (5%)
TRADE	-2.14	2008, 2020	$I(1)$ with breaks
FDI	-4.87	2009, 2020	$I(0)$ with breaks
EF	-1.98	2008, 2020	$I(1)$ with breaks

Critical value at 5%: -3.42. The test rejects the unit root null for FDI even when allowing for breaks, confirming its stationarity. Trade and EF remain integrated of order one after accounting for structural breaks. This reinforces our mixed integration classification.

4.3 Hausman test for PMG vs. MG

Table 5. Hausman test (dependent: Δ TRADE)

Model	Log likelihood	Chi-square	d.f.	p-value	Decision
PMG	456.23	—	—	—	—

MG	462.89	8.34	7	0.27	Cannot reject homogeneity (low power)
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The Hausman test fails to reject the null that PMG is consistent ($p=0.27$). However, with $N=20$ and $T=23$, the Hausman test has low power against heterogeneous alternatives. Moreover, the slope homogeneity test (Section 4.6) yields a borderline p -value ($p=0.104$), and the MG results (Table 6) show a wide range of country-specific long-run coefficients (e.g., $EF \rightarrow TRADE$ from -0.09 to 0.61). Given these indications of meaningful cross-country heterogeneity, we treat the **Mean Group (MG) estimator as our primary specification** (Table 6) and use PMG as a robustness check (Appendix Table A1). This conservative approach avoids imposing homogeneity where it may be economically unrealistic.

4.4 Panel ARDL (MG) estimates – winsorized sample

Table 6. Mean Group (MG) estimates (primary specification)

Variable	Model 1: $\Delta TRADE$ (MG)	Model 2: ΔFDI (MG)
Error correction term		
ECT (-1)	-0.312** (0.142)	-0.178 (0.118)
Long-run coefficients (country means)		
TRADE (log)	---	0.364* (0.198)
FDI (log, winsorized)	0.392** (0.176)	---
EF overall	0.308* (0.162)	0.134 (0.108)
GDP per capita (log)	0.185 (0.142)	0.162 (0.134)
Inflation	-0.068 (0.058)	-0.042 (0.048)
Political stability	0.121 (0.092)	0.183** (0.086)
KAOPEN	0.145 (0.102)	0.198** (0.092)
Range of country-specific $EF \rightarrow TRADE$ coefficients	-0.087 to 0.612	---
Number of countries with positive $EF \rightarrow TRADE$	17 / 20	---
Short-run coefficients (average)		
$\Delta FDI(-1)$	0.038 (0.042)	---
$\Delta EF(-1)$	0.025 (0.034)	0.016 (0.024)

$\Delta\text{TRADE}(-1)$	---	0.058 (0.048)
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Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors in parentheses. $N=20$, $T=23$. Lag (1,1,1) by AIC. Mean Group (MG) estimates are the primary specification. PMG estimates are reported in Appendix Table A1.

Diagnostic tests (Model 1):

- 1) Pesaran CD on residuals: $CD = 1.234$, $p = 0.217 \rightarrow$ no remaining CD.
- 2) CUSUM: within 5% bounds for all countries $\rightarrow$ parameter stability.
- 3) Modified Wald heteroskedasticity: $\chi^2(20)=28.34$, $p=0.102 \rightarrow$ no heteroskedasticity.

The ECT is negative in both models, but it is statistically significant only in the trade equation ($p < 0.05$), providing partial support for a long-run equilibrium relationship (H1). Trade and FDI show a positive but imprecisely estimated association in the MG specification: a 1% increase in trade openness is associated with a 0.36% increase in FDI inflows ($p = 0.066$). Similarly, the EF-trade association is positive at 0.31 ($p = 0.10$). The direct EF-FDI effect is small and not significant (0.13, $p = 0.21$). For comparison, the homogeneous-coefficient PMG estimates (Appendix Table A1) yield coefficients of 0.38 ($p < 0.01$) for trade $\rightarrow$ FDI and 0.33 ($p < 0.01$) for EF $\rightarrow$ trade, but these averages mask substantial cross-country variation (see Table A3). The crisis dummies are negative and significant for trade (both crises) and for FDI (only 2008-2009), consistent with temporary disruptions.

4.5 Modified Granger causality (Dumitrescu-Hurlin)

Table 7. Modified Dumitrescu-Hurlin test – predictive ordering (respecting mixed orders)

Null hypothesis	Transformation	Z-bar	p-value	Predictive ordering
$EF \neq \text{TRADE}$	Both first diff	3.012	0.003	$EF \rightarrow \text{TRADE}$
$\text{TRADE} \neq EF$	Both first diff	4.321	0.000	$\text{TRADE} \rightarrow EF$
$FDI \neq \text{TRADE}$	FDI level, TRADE diff	2.567	0.010	$FDI \rightarrow \text{TRADE}$
$\text{TRADE} \neq FDI$	TRADE diff, FDI level	1.678	0.093	No predictive ordering
$EF \neq FDI$	EF diff, FDI level	1.023	0.306	No predictive ordering
$FDI \neq EF$	FDI level, EF diff	0.987	0.324	No predictive ordering

Notes: Lag length = 2 (AIC). The test is implemented separately for each pair. Toda-Yamamoto panel test confirms these results.

The Dumitrescu-Hurlin test shows bidirectional predictive ordering between EF and trade (with trade $\rightarrow$ EF stronger). When FDI is $I(0)$ and trade is $I(1)$, the test for FDI $\rightarrow$ TRADE asks whether the *level* of FDI helps predict *changes* in trade – i.e., a one-unit increase in the level of FDI (which is mean-reverting, not permanent) predicts future acceleration of trade openness. This

pattern is consistent with the view that multinationals investing in a country may subsequently expand intra-firm trade, though our analysis cannot establish this mechanism. The absence of predictive ordering from EF to FDI (and vice versa) suggests that the link between economic freedom and FDI operates indirectly through trade, consistent with H4. We use the term "predictive ordering" rather than "Granger causality" to emphasize that these are lead-lag relationships conditional on the information set, not structural causal effects.

4.6 Slope heterogeneity test

Table 8. Pesaran & Yamagata (2008) slope homogeneity test

Statistic	Δ	Δ_{adj}	p-value
Value	2.34	2.56	0.104

The null of slope homogeneity is not rejected at conventional levels ($p=0.104$), but the p-value is borderline. Given the low power of this test in small T panels, we interpret this as suggestive evidence of heterogeneity. The MG estimates (Table 6) **are consistent with** economically meaningful cross-country variation (coefficient range -0.09 to 0.61). Accordingly, we base our main inferences on the MG estimator, which allows all coefficients to vary across countries, and relegate the homogeneous-coefficient PMG estimates to Appendix Table A1 as a robustness check.

4.7 Interaction terms for country heterogeneity

Table 9. Interaction terms (augmented Panel ARDL – significant only)

Interaction term	Coefficient	p-value
EF $\times$ D_Ireland	-0.087	0.342
EF $\times$ D_Turkey	-0.045	0.512
EF $\times$ D_USA	0.032	0.678

None are significant, indicating that after winsorizing, the long-run effect of EF on trade does not differ significantly across these countries. The earlier country-specific tests were likely false negatives due to low power ($T = 23$).

4.8 Robustness checks

- 1) **Non-winsorized sample:** Long-run coefficients: TRADE $\rightarrow$ FDI = 0.42, EF $\rightarrow$ TRADE = 0.36; ECT significant. Results qualitatively similar but slightly larger due to outliers.
- 2) **Alternative EF measure (Fraser Institute EFW, 2000-2020):** EF $\rightarrow$ TRADE = 0.29 ($p=0.01$), TRADE $\rightarrow$ FDI = 0.35 ($p=0.01$). Consistent.

- 3) **Excluding crisis periods (2008-2009, 2020-2021):** ECT = -0.31 (trade), -0.19 (FDI); long-run coefficients similar.
- 4) **Alternative lag length (2,2):** No substantive change.
- 5) **MG estimator:** Mean long-run coefficients: TRADE→FDI = 0.36 (p=0.08), EF→TRADE = 0.31 (p=0.10). The point estimates are similar in magnitude to the PMG averages, suggesting that the homogeneous PMG estimates are not severely biased by aggregation. However, the wide range of country-specific coefficients (Table A3) indicates meaningful heterogeneity that PMG obscures.
- 6) **System GMM estimation (Blundell & Bond, 1998):** To address potential endogeneity from reverse causality and omitted variables, we re-estimate the dynamic panel model using system GMM, which instruments differenced variables with lagged levels and levels with lagged differences. We treat EF and trade as potentially endogenous (using lags 2–4 as instruments) and all control variables as exogenous. The Hansen test for overidentifying restrictions yields $p = 0.213$, and the Arellano-Bond test for AR(2) yields $p = 0.184$, supporting the validity of instruments. The long-run coefficients from system GMM (Appendix Table A2) are: TRADE→FDI = 0.35 ($p = 0.02$), EF→TRADE = 0.29 ($p = 0.04$). While standard errors are larger than those from PMG, the point estimates are similar, suggesting that endogeneity does not fundamentally alter our main conclusions. Nevertheless, these estimates remain associational and should not be interpreted as structural causal parameters.
- 7) **Country-specific break dummies:** We re-estimated the MG model using country-specific crisis dummies (D08_i and D20_i) where the break year for each country is taken from its individual Bai-Perron test (e.g., 2008 for most countries, 2009 for Greece/Portugal/Spain, 2013 for Italy). The long-run coefficients were EF→TRADE = 0.31 ($p = 0.02$) and TRADE→FDI = 0.35 ($p = 0.03$), very close to the baseline MG estimates. This suggests that using common crisis dummies based on median break dates does not materially bias the results.

5. Discussion

5.1 Interpretation of key findings

The positive long-run association between trade and FDI (H2) is consistent with the Mean Group (MG) estimate: a 1% increase in trade openness is associated with a 0.36% increase in FDI inflows ($p = 0.066$). For comparison, the homogeneous-coefficient PMG estimate (Appendix Table A1) is slightly higher at 0.38 ($p < 0.01$), suggesting that pooling across

countries masks heterogeneity but does not reverse the sign. The positive **association** between EF and trade (H3) is estimated at 0.31 ($p = 0.10$) in the MG specification; a one-point increase in the EF overall score (0–100 scale) is associated with a 0.31 percentage point increase in trade openness (% GDP). The PMG counterpart is 0.33 ($p < 0.01$). The weak direct EF-FDI effect (0.13, $p = 0.21$ in MG; 0.11, $p = 0.09$ in PMG) is consistent with the indirect pathway hypothesis (H4): EF enhances trade, and trade attracts FDI, rather than EF directly attracting FDI. This is a notable finding with potential policy relevance. The long-run complementarity between trade and FDI (H2) is consistent with the meta-analysis by Çeştepe and Yıldırım (2022) and with studies on advanced economies (Albulescu, C. T., & Goyeau, 2019). a 1% increase in trade openness is associated with a 0.38% increase in FDI (log-log elasticity) inflows – a substantial effect.

The positive association between EF and trade (0.33, H3) is consistent with Depken and Sonora (2005) and Naanwaab and Diarrassouba (2013). A one-point increase in the EF overall score (on a 0-100 scale) is associated with a 0.33 percentage point increase in trade openness (% GDP). The weak direct EF–FDI effect (0.11, $p=0.09$) is consistent with the indirect pathway hypothesis (H4): EF enhances trade, and trade attracts FDI, rather than EF directly attracting FDI. This is a notable finding with potential policy relevance.

The modified Granger causality results reveal bidirectional predictive ordering between EF and trade, with the trade→EF effect being stronger ($Z\text{-bar}=4.32$ vs. 3.01). The predictive ordering from trade to EF ($Z\text{-bar} = 4.32$) is consistent with the hypothesis that trade openness precedes improvements in economic freedom, a pattern sometimes referred to as "trade-led institutional development." However, because our analysis does not address endogeneity from omitted variables or reverse causality, this should be interpreted as a predictive lead-lag relationship, not as causal evidence. The unidirectional predictive ordering from FDI to trade is consistent with a lead–lag pattern in which FDI levels help predict subsequent changes in trade openness, but it does not establish that FDI structurally causes trade integration. The absence of a direct predictive ordering between EF and FDI is consistent with an indirect link operating through trade.

The significant negative coefficients for D08 and D20 are consistent with temporary reductions in trade and FDI during the 2008–2009 global financial crisis and the 2020–2021 pandemic. The negative ECT is consistent with reversion toward the estimated long-run relationship. This pattern is characteristic of advanced economies with strong institutions, although our analysis cannot isolate institutional effects.

The country-specific heterogeneity, once outliers are winsorized, is not statistically significant for the long-run EF-trade relationship. The earlier false negatives from low-power country-specific long-run tests ($T=23$) underscore the importance of using appropriate methods (interaction terms, slope homogeneity tests) for panels with moderate time dimension.

The MG estimates reveal meaningful heterogeneity that the PMG averages mask. While 17 of 20 countries show positive EF→TRADE coefficients, three countries (Greece, Turkey, Italy) exhibit negative or near-zero coefficients (-0.087, -0.045, and -0.012, respectively). This likely reflects institutional quality thresholds: countries with weaker rule of law or frequent policy reversals may not reap the same trade benefits from EF improvements as countries with strong initial institutions (e.g., Switzerland, Denmark). The coefficient range (-0.09 to 0.61) suggests that a one-size-fits-all policy may be suboptimal; countries with low initial EF might need complementary reforms (e.g., anti-corruption measures) before trade openness responds strongly.

5.2 Policy implications

- 1) **Prioritize regulatory efficiency and rule of law.** The long-run association between EF and trade (0.31 in the MG estimate, though imprecisely estimated with $p = 0.10$) suggests that improving regulatory efficiency (business freedom, labor freedom) and rule of law (property rights, judicial effectiveness) should be top priorities. These reforms reduce transaction costs and make countries more attractive trading partners.
- 2) **Leverage trade as a driver of institutional reform.** The predictive ordering from trade to EF suggests that trade liberalization and participation in deep trade agreements (e.g., EU single market, CPTPP) may be associated with subsequent institutional improvements. Countries seeking to upgrade their institutions should consider joining such agreements as a commitment device.
- 3) **Coordinate trade and FDI policies.** The positive long-run association between trade and FDI (0.36 in the MG estimate, $p = 0.066$) and the predictive ordering from FDI to trade suggest that investment promotion may usefully be considered alongside trade policy. For example, free trade agreements should include strong investment chapters, and investment promotion agencies should highlight trade openness as a key selling point.
- 4) **Build crisis resilience.** The significant negative association between crises and trade/FDI, and the subsequent reversion toward the estimated long-run relationship, are consistent with the importance of maintaining institutional quality during crises. Policies that preserve contract enforcement, avoid protectionism, and maintain regulatory stability during shocks will help the economy recover faster.

- 5) **Adopt country-specific strategies only where necessary.** Since interaction terms were not significant after winsorizing, a broadly uniform approach to improving EF may be appropriate for most OECD countries. However, outliers like Ireland should address tax-haven distortions to ensure that measured FDI reflects real activity.

5.3 Limitations and caveats

The analysis presented above documents empirical associations and predictive lead-lag relationships, not structural causality. Several sources of endogeneity remain unaddressed. First, reverse causality: economic freedom may attract FDI, but FDI may also improve institutions over time. Second, omitted variables: tax policy, sectoral composition, and multinational enterprises' global strategies could confound the estimated relationships. Third, common shocks (e.g., global financial crisis, pandemic) affect all variables simultaneously. While the panel ARDL's lag structure, the inclusion of crisis dummies, and the system GMM robustness check mitigate some concerns, causal claims would require exogenous instruments (e.g., historical determinants of institutions) or quasi-experimental variation. We therefore caution against over-interpreting the coefficients as structural elasticities.

Beyond identification, other limitations should be acknowledged.

Sample and generalizability. Our sample is restricted to 20 long-standing OECD countries; results may not generalize to non-OECD or emerging economies, where institutional contexts differ substantially.

Measurement of economic freedom. We used the Heritage Foundation's overall EF index. The Fraser Institute's EFW index (tested partially as a robustness check) yields similar point estimates, but different sub-components might produce nuanced results.

Time-varying GVC position. Data limitations prevented us from including a time-varying GVC position index. Future research could use OECD-WTO TiVA data to examine how upstream vs. downstream positions moderate the trade-FDI relationship.

Moderate time dimension. With $T=23$, the power of some tests (e.g., Hausman, slope homogeneity) is limited. Longer panels would be desirable for stronger inference.

Homogeneity assumption. The MG estimates (our primary specification) reveal meaningful cross-country heterogeneity (EF→TRADE coefficients ranging from -0.09 in Greece to 0.61 in Switzerland). While the Hausman test does not reject homogeneous long-run coefficients, the test has low power. The PMG estimates in Appendix A1 should therefore be interpreted as average effects for the typical OECD country, not as universal parameters.

Structural breaks. Our main specification uses common crisis dummies (2008-2009, 2020-2021) based on median Bai-Perron break dates. Although robustness checks with country-specific break dummies yielded similar long-run coefficients, future research with longer panels could employ time-varying coefficient models or interactive fixed effects to more flexibly account for heterogeneous break patterns.

Directions for future research. Building on these limitations, future studies could: (i) extend the analysis to non-OECD countries to test whether the indirect EF→FDI channel holds in weaker institutional environments; (ii) incorporate time-varying GVC position indices; (iii) use historical instruments (e.g., legal origins, colonial past) or quasi-experimental reforms (e.g., WTO accessions, EU enlargement) to strengthen causal identification; (iv) explore non-linear threshold effects (e.g., whether EF affects trade only above a certain institutional quality level); and (v) apply panel local projections or other methods that do not require differencing of $I(0)$ variables for impulse response analysis.

6. Conclusion

This study re-examined the relationships among international trade, economic freedom, and FDI in 20 OECD countries (2000-2022) using a methodology that accommodates mixed orders of integration, cross-sectional dependence, structural breaks, and country heterogeneity. Key conclusions are:

- 1) CIPS tests show that FDI is $I(0)$ while trade and EF are $I(1)$ – a mixed order that precludes standard cointegration tests but is accommodated by Panel ARDL.
- 2) The Panel ARDL error correction term is negative and significant in the trade equation, providing partial support for a long-run equilibrium relationship; the FDI equation yields a negative but statistically insignificant ECT.
- 3) The Hausman test has low power and does not reject homogeneity ($p=0.27$), but MG estimates reveal economically meaningful heterogeneity: EF→TRADE coefficients range from -0.09 (Greece) to 0.61 (Switzerland), with 17 of 20 countries showing positive associations.
- 4) Long-run effects (Mean Group estimates): trade and FDI show a positive association (0.36 , $p=0.066$); EF and trade show a positive association (0.31 , $p=0.10$); the direct EF-FDI association is weak and not statistically significant (0.13 , $p=0.21$). Homogeneous-coefficient PMG estimates (Appendix) are more precise (0.38 and 0.33 , $p<0.01$) but mask substantial heterogeneity.

- 5) Modified Granger causality shows predictive ordering: EF and trade have bidirectional predictive ordering (with trade→EF stronger); FDI predicts trade (unidirectional); no direct predictive ordering between EF and FDI.
- 6) Structural break dummies (2008–2009, 2020–2021) are significant, and the system reverts toward the estimated long-run relationship.
- 7) Country-specific heterogeneity, after winsorizing outliers, is not statistically significant for the long-run EF-trade relationship.

The study contributes a methodologically rigorous analysis of the trade-EF-FDI nexus in OECD countries, explicitly handling mixed integration orders, cross-sectional dependence, structural breaks, and heterogeneity – a combination that remains relatively rare in this literature. Policy implications emphasize improving regulatory efficiency and rule of law, leveraging trade as a driver of institutional reform, coordinating trade and investment policies, and building crisis resilience.

Future research should extend the analysis to non-OECD countries, incorporate GVC position indices, use instrumental variables to address endogeneity, and explore non-linear threshold effects.

7. References

- Acemoglu, D., Johnson, S., & Robinson, J. A. (2005). Institutions as a fundamental cause of long run growth. *Handbook of Economic Growth, 1* (In P. Aghion & S. Durlauf (Eds.)), 385–472. [https://doi.org/10.1016/S1574-0684\(05\)01006-3](https://doi.org/10.1016/S1574-0684(05)01006-3)
- Albulescu, C. T., & Goyeau, D. (2019). The interaction between trade and FDI: The CEECs experience. *International Economics and Economic Policy*, 16(3), 489–509. <https://doi.org/10.1007/s10368-019-00438-1>
- Antràs, P. (2020). *Global production: Firms, contracts, and trade structure*. Princeton University Press.
- Azman Saini, W. N. W., Baharumshah, A. Z., & Law, S. H. (2010). Foreign direct investment, economic freedom and economic growth: International evidence. *Economic Modelling*, 27(5), 1079–1089. <https://doi.org/10.1016/j.econmod.2010.04.001>
- Bai, J., & Perron, P. (1998). Estimating and testing linear models with multiple structural changes. *Econometrica*, 66(1), 47–78.
- Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), 115–143.
- Carrion-i-Silvestre, J. L., del Barrio-Castro, T., & López-Bazo, E. (2009). Breaking the panels: An application to the GDP per capita. *The Econometrics Journal*, 8(2), 159–175. <https://doi.org/10.1111/j.1368-423X.2005.00157.x>

- Çeştepe, H., & Yıldırım, D. (2022). How has outward foreign direct investment influenced international trade over the past seventy six years? A systematic literature review. *Journal of Economic Surveys*, 36(4), 987–1025. <https://doi.org/10.1111/joes.12456>
- Chinn, M. D., & Ito, H. (2006). What matters for financial development? Capital controls, institutions, and interactions. *Journal of Development Economics*, 81(1), 163–192.
- Ciftci, C., & Durusu Ciftci, D. (2022). Economic freedom, foreign direct investment, and economic growth: The role of sub components of freedom. *The Journal of International Trade & Economic Development*, 31(2), 233–254. <https://doi.org/10.1080/09638199.2021.1962392>
- Coase, R. H. (1937). The nature of the firm. *Economica*, 4(16), 386–405. <https://doi.org/10.1111/j.1468-0335.1937.tb00002.x>
- Depken, C. A., & Sonora, R. J. (2005). Asymmetric effects of economic freedom on international trade flows. *International Journal of Business and Economics*, 4(2), 141–155.
- Dumitrescu, E. I., & Hurlin, C. (2012). Testing for Granger non causality in heterogeneous panels. *Economic Modelling*, 29(4), 1450–1460. <https://doi.org/10.1016/j.econmod.2012.02.014>
- Dunning, J. H. (1988). The eclectic paradigm of international production: A restatement and some possible extensions. *Journal of International Business Studies*, 19(1), 1–31. <https://doi.org/10.1057/palgrave.jibs.8490372>
- Dunning, J. H. (2000). The eclectic paradigm as an envelope for economic and business theories of MNE activity. *International Business Review*, 9(2), 163–190. [https://doi.org/10.1016/S0969-5931\(99\)00035-9](https://doi.org/10.1016/S0969-5931(99)00035-9)
- Frankel, J. A., & Romer, D. (1999). Does trade cause growth? *American Economic Review*, 89(3), 379–399. <https://doi.org/10.1257/aer.89.3.379>
- Gwartney, J., Lawson, R., Hall, J., & Murphy, R. (2022). Economic freedom of the world: 2022 annual report. In *Fraser Institute*.
- Helpman, E. (1984). A simple theory of international trade with multinational corporations. *Journal of Political Economy*, 92(3), 451–471.
- Keller, W., & Yeaple, S. R. (2023). Multinational enterprises and international trade. *The Cambridge Economic History of the Modern World*, 2, 321–350.
- Maiga, O. A., Oumarou, I., & Coulibaly, S. K. (2019). Foreign direct investment and international trade in WAEMU – Panel causality and long term relationship analysis. *Review of Economics*, 70(2), 193–212. <https://doi.org/10.1515/roe-2019-0011>
- Markusen, J. R. (2002). *Multinational firms and the theory of international trade*. MIT Press.
- Mundell, R. A. (1957). International trade and factor mobility. *American Economic Review*, 47(3), 321–335.
- Naanwaab, C., & Diarrassouba, M. (2013). The impact of economic freedom on bilateral trade: A cross country analysis. *International Journal of Business, Management and Economic Research*, 4(1), 668–672.
- North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge University Press.
- Pesaran, M. H. (2004). *General diagnostic tests for cross section dependence in panels*.
- Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross section dependence. *Journal of Applied Econometrics*, 22(2), 265–312. <https://doi.org/10.1002/jae.951>
- Pesaran, M. H., & Yamagata, T. (2008). Testing slope homogeneity in large panels. *Journal of Econometrics*, 142(1), 50–93.
- Pesaran, M. H., Shin, Y., & Mith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association*, 94(446), 621–634. <https://doi.org/10.1080/01621459.1999.10474156>

- Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. *Journal of Econometrics*, 66(1–2), 225–250. [https://doi.org/10.1016/0304-4076\(94\)01616-8](https://doi.org/10.1016/0304-4076(94)01616-8)
- Węgrzyn, P. (2025). The link between foreign direct investments and economic growth: Empirical study from selected EU countries. *Torun International Studies*, 18(1), 1–22. <https://doi.org/10.12775/TIS.2025.001>
- Williamson, O. E. (1985). *The economic institutions of capitalism*. Free Press.
- Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics*, 126(1), 25–51.
- WTO (World Trade Organization). (2023). *World trade report 2023: Re globalization for a secure, inclusive and sustainable future*. WTO Publications.
- Xiong, T., & Sun, H. (2021). Structure and dynamics of global capital and international trade: Analysis of the relationship between exports and foreign direct investment (FDI) from 2001 to 2006. *International Journal of Finance & Economics*, 26(1), 542–559. <https://doi.org/10.1002/ijfe.1803>

Appendix

Table A1. Panel ARDL (PMG) estimates (alternative specification, for comparison with MG)

Note: This table reports the Pooled Mean Group estimates referenced in the main text. The Mean Group estimates in Table 6 are our primary specification.

Variable	Model 1: Δ TRADE	Model 2: Δ FDI
Error correction term		
ECT (-1)	-0.284*** (0.089)	-0.153** (0.072)
Long-run coefficients		
TRADE (log)	---	0.379*** (0.114)
FDI (log, winsorized)	0.381*** (0.108)	---
EF overall	0.327*** (0.102)	0.112* (0.065)
GDP per capita (log)	0.208** (0.085)	0.179** (0.072)
Inflation	-0.072* (0.042)	-0.049 (0.032)
Political stability	0.138** (0.066)	0.198*** (0.063)
KAOPEN	0.162** (0.072)	0.218*** (0.062)
Short-run coefficients (average)		
Δ FDI(-1)	0.042 (0.030)	---
Δ EF(-1)	0.029 (0.026)	0.018 (0.018)
Δ TRADE(-1)	---	0.062* (0.035)
Structural break dummies		
D08 (2008-2009)	-0.118** (0.045)	-0.083** (0.039)
D20 (2020-2021)	-0.092** (0.046)	-0.038 (0.033)
Constant	0.221** (0.098)	0.175* (0.094)

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors in parentheses. $N=20$, $T=23$, total obs=460 (winsorized). Lag (1,1,1) by AIC.

Table A2. System GMM robustness check (full results)

Note: Dynamic panel estimation using system GMM (Blundell & Bond, 1998). EF and trade treated as potentially endogenous (instruments: lags 2–4). Control variables treated as exogenous. Windmeijer-corrected standard errors.

Variable	Model 1: Δ TRADE	Model 2: Δ FDI
Long-run coefficients		
TRADE (log)	---	0.351** (0.142)
FDI (log, winsorized)	0.338** (0.156)	---
EF overall	0.291** (0.138)	0.108 (0.092)
GDP per capita (log)	0.175 (0.124)	0.154 (0.118)
Inflation	-0.061 (0.048)	-0.041 (0.038)
Political stability	0.112 (0.078)	0.176** (0.072)
KAOPEN	0.138* (0.082)	0.192** (0.088)
Diagnostics		
Hansen J (p-value)	0.213	0.287
AR(1) (p-value)	0.008	0.012
AR(2) (p-value)	0.184	0.201
Number of instruments	28	28

Notes: ** $p < 0.05$, * $p < 0.10$. The Hansen test does not reject instrument validity ($p > 0.10$). AR(2) indicates no second-order serial correlation. Point estimates are broadly similar to the Panel ARDL results, though standard errors are larger.*

Table A3. Country-specific long-run EF→TRADE coefficients (Mean Group estimation)

Country	Coefficient	Std. Error	95% CI	p-value
Switzerland	0.612**	0.201	(0.218, 1.006)	0.012
Denmark	0.487**	0.185	(0.124, 0.850)	0.021
Sweden	0.453**	0.192	(0.077, 0.829)	0.028
Netherlands	0.421**	0.178	(0.072, 0.770)	0.018
United States	0.398*	0.212	(-0.018, 0.814)	0.061
Canada	0.387*	0.204	(-0.013, 0.787)	0.058
United Kingdom	0.376*	0.198	(-0.012, 0.764)	0.057
Germany	0.362*	0.186	(-0.003, 0.727)	0.052
Austria	0.348*	0.182	(-0.009, 0.705)	0.056
Norway	0.334	0.214	(-0.086, 0.754)	0.118
Belgium	0.321	0.208	(-0.087, 0.729)	0.124
France	0.298	0.196	(-0.086, 0.682)	0.128
Spain	0.276	0.188	(-0.092, 0.644)	0.142
Portugal	0.242	0.202	(-0.154, 0.638)	0.231
Japan	0.218	0.194	(-0.162, 0.598)	0.262
Iceland	0.165	0.176	(-0.180, 0.510)	0.348
Ireland	0.112	0.168	(-0.217, 0.441)	0.504
Italy	-0.012	0.142	(-0.290, 0.266)	0.932
Turkey	-0.045	0.138	(-0.315, 0.225)	0.743
Greece	-0.087	0.112	(-0.307, 0.133)	0.438

Notes: ** $p < 0.05$, * $p < 0.10$. The coefficient is the long-run elasticity of trade openness with respect to a 1-point increase in EF score. The wide range (-0.09 to 0.61) indicates substantial cross-country heterogeneity, but the average (0.31) is close to the PMG estimate (0.33).