Methodology Note

for

APEC Policy Support Unit (PSU) Policy Brief No. 73
How Trade Winds Have Shifted:
Structural Changes in Trade Dynamism
in the APEC Region
September 2026

This methodology note accompanies, and is meant to complement, APEC Policy Support Unit (PSU) Policy Brief No. 73. It provides a technical overview of the econometric methodology used for the analysis and provides the complete analytical results.

Data

The policy brief uses a panel of bilateral trade flows between APEC member economies obtained from the *Base pour l'Analyse du Commerce International* (BACI) database developed and maintained by the Centre d'Études Prospectives et d'Informations Internationales (CEPII). The dataset covers 420 intra-APEC bilateral pairs over 30 years (1995–2024). Trade and gross domestic product (GDP) values used in the analysis are in current US dollars.

Finding structural breakpoints

Consider a panel dataset with *I* groups and *T* time periods and a linear regression model of the form

$$y_{it} = c + bx_{it} + \varepsilon_{it}, i = 1 \ldots I, t = 1 \ldots T$$

where *c* is the constant, *y* is the dependent variable, *x* is the independent variable and ε is the error term. The coefficients *c* (constant) and *b* (slope) are the parameters for estimation. Let us define a time point $t = t_b$, $1 < b < T$ as a point dividing the observed time periods into two periods, with period I covering $t_1 \ldots t_b$ and period II covering $t_{b+1} \ldots$T. Time point t_b is considered a *structural breakpoint* if the estimated parameters for periods I and II are statistically different from each other, that is, if $c_I^* \neq c_{II}^*$ or $b_I^* \neq b_{II}^*$ or both.

In the case where the likely t_b is known and there is only one breakpoint under consideration, the Chow[1] breakpoint test can be utilised to test whether t_b is indeed a structural breakpoint, that is, the estimated parameters are significantly different for periods I and II. However, for this analysis, we neither assume the number of breakpoints – t_b could be one or more time periods – nor the years these breakpoints occur. Hence, to allow the data to find and test these breakpoints, we use the methodology developed by Bai and Perron[2] and

[1] G. C. Chow, "Tests of Equality between Sets of Coefficients in Two Linear Regressions," *Econometrica* 28, no. 3 (1960): 591–605.
[2] J. Bai and P. Perron, "Computation and Analysis of Multiple Structural Change Models," *Journal of Applied Econometrics* 18 (2003): 1–22.

operationalised by Ditzen, Karavias and Westerlund.[3] To find the breakpoints in our data, we run the Bai-Perron model testing the relationship between trade and GDP

$$\log(X_{ijt}) = \log(Y_{it}) + \log(Y_{jt}) + t, i \neq j$$

as well as the relationship between trade and per capita GDP

$$\log(X_{ijt}) = \log(Y_{it}/P_{it}) + \log(Y_{jt}/P_{jt}) + t, i \neq j$$

where X_{ijt} are exports of economy i to j during year t, Y is GDP, and P is population, so Y_{it}/P_{it} is economy i per capita GDP during year t.

Running the Bai-Perron test on both models without specifying the number of breakpoints and the breakpoint years yields the same structural breakpoints:

Table 1. Bai-Perron test results

Number of observations	10,852	SSR	2281.1 (GDP) 2280.6 (GDP per capita)
Number of groups	420	Trimming	0.15

Breakpoint No.	Index	Date	95% Confidence Interval	
1	5	1999	1998	2000
2	13	2007	2006	2008
3	23	2017	2016	2018

SSR= sum of squared residuals.
Source: CEPII-BACI data and APEC Policy Support Unit (PSU) staff estimates.

Measuring income elasticity of trade by period

After finding the structural breakpoints, the same model is utilised to estimate the income elasticity of trade according to the four periods. In particular, the following reduced form equation is estimated:

$$\log(X_{ijt}) = \sum_{S=\mathrm{I}}^{\mathrm{IV}} \left[\log\left(\frac{Y_{it}}{P_{it}}\right) + \log\left(\frac{Y_{jt}}{P_{jt}}\right) + t\right]_{t \in S} + \mathbf{0}_{t \notin S}, i \neq j, S = \mathrm{I, II, III, IV}$$

where S identifies the structural periods I… IV as defined by the Bai-Perron test, $t \in S$ is the years within period S, $\mathbf{0}$ is a null vector, and other variables are as previously defined. This model is estimated using bilateral panel fixed effects Ordinary Least Squares with Huber-White robust standard errors. Estimation results are presented in Table 2.

[3] J. Ditzen et al., "Testing and Estimating Structural Breaks in Time Series and Panel Data in Stata," *The Stata Journal* 25 no. 3 (2025): 526–60.

Table 2. Income elasticity of trade in APEC, 1995–2024

Dependent variable: Log of bilateral trade	
Log of exporter's per capita GDP, Period I	0.712***
	(0.0688)
Log of exporter's per capita GDP, Period II	0.551***
	(0.0714)
Log of exporter's per capita GDP, Period III	0.492***
	(0.0817)
Log of exporter's per capita GDP, Period IV	0.358***
	(0.0900)
Log of importer's per capita GDP, Period I	0.902***
	(0.0756)
Log of importer's per capita GDP, Period II	0.822***
	(0.0698)
Log of importer's per capita GDP, Period III	0.738***
	(0.0851)
Log of importer's per capita GDP, Period IV	0.816***
	(0.0916)
Period I years	0.00459
	(0.00556)
Period II years	0.00489
	(0.00556)
Period III years	0.00505
	(0.00558)
Period IV years	0.00511
	(0.00559)
Constant	0.750
	(11.00)
Observations	10,852
Number of bilateral pairs	420
R-squared	0.522

Note: Robust standard errors in parentheses. Significance levels are indicated by *** p<0.01, ** p<0.05, and * p<0.1
Source: CEPII-BACI data and APEC PSU staff estimates.

Estimating year fixed-effects

In the context of this study, year fixed-effects are a vector of binary variables (i.e., one scalar binary variable for each year) included in the bilateral trade gravity model to control for macroeconomic trends and shocks affecting all economies. The estimated coefficients for these binary variables act as year-specific intercepts accounting for all the events, shocks and unobserved changes affecting all the panel observations – in this case, bilateral trading partners – in a given year.

To derive the year fixed-effects coefficients while controlling for variations in income, we estimate a simplified gravity model with the following reduced form:

$$\log(X_{ijt}) = c + \beta_1 \log(Y_{it}) + \beta_2 \log(Y_{jt}) + \beta_3 R_{ijt} + \boldsymbol{\gamma}\mathbf{t} + \boldsymbol{\alpha}_{\mathbf{ij}} + u_{ijt} \quad (1)$$

where c, X and Y are as previously defined, R is a binomial variable equal to 1 if trade partners i and j are in a regional or bilateral free trade area agreement and zero otherwise, t is a vector of year binomial variables, α_{ij} is the vector of bilateral pair fixed effects and u_{ijt} is the error term. To test for robustness, we also estimate the following gravity models:

$$\log(X_{ijt}) = c + \beta_1 \log(Y_{it}/P_{it}) + \beta_2 \log(Y_{jt}/P_{jt}) + \beta_3 R_{ijt} + \boldsymbol{\gamma}\mathbf{t} + \boldsymbol{\alpha}_{\mathbf{ij}} + u_{ijt} \quad (2)$$

and

$$\log(X_{ijt}) = c + \beta_1 \log(Y_{it}) + \beta_2 \log(Y_{jt}) + \beta_3 \log(P_{it}) + \beta_4 \log(P_{jt}) + \beta_3 R_{ijt} + \boldsymbol{\gamma}\mathbf{t} + \boldsymbol{\alpha}_{\mathbf{ij}} + u_{ijt} \quad (3)$$

where P is as previously defined. Note that the year fixed-effects estimates are not to be interpreted as determinants of bilateral trade flows or to imply causality; rather they are only measurements of the conduciveness of the trading environment for that year relative to the base year of 1995. Econometric results for models (1) to (3) are presented in Table 3.

Table 3. Econometric results for models (1) to (3)

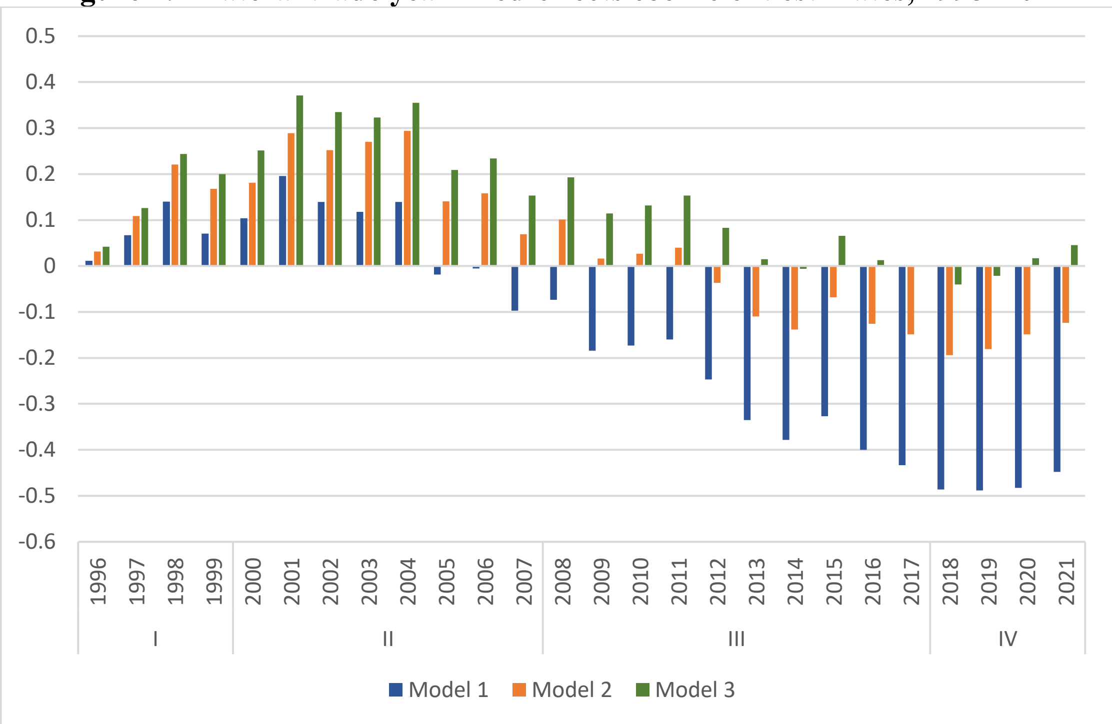
Dependent variable: Log of bilateral trade	(1)	(2)	(3)
Log of exporter's GDP	0.765***		0.789***
	(0.0750)		(0.0778)
Log of importer's GDP	0.851***		0.936***
	(0.0776)		(0.0798)
Bilateral pair is in an RTA/FTA	0.0466	0.0407	0.0439
	(0.0526)	(0.0507)	(0.0506)
Log of exporter's per capita GDP		0.805***	
		(0.0784)	
Log of importer's per capita GDP		0.932***	
		(0.0806)	
Log of exporter's population			-0.517
			(0.388)
Log of importer's population			-1.776***
			(0.365)
Year fixed effects, base = 1995			
1996	0.011	0.032	0.042
1997	0.067	0.109***	0.126***
1998	0.140***	0.221***	0.244***
1999	0.070	0.168***	0.200***
2000	0.104**	0.181***	0.251***
2001	0.196***	0.289***	0.371***
2002	0.139**	0.252***	0.335***
2003	0.118*	0.270***	0.323***
2004	0.139**	0.294***	0.355***
2005	-0.018	0.141**	0.209***
2006	-0.005	0.158**	0.234**
2007	-0.097	0.069	0.153
2008	-0.073	0.101	0.193*
2009	-0.184**	0.016	0.114
2010	-0.173	0.027	0.132
2011	-0.160	0.040	0.153
2012	-0.247**	-0.037	0.083
2013	-0.335***	-0.110	0.015

	2014	-0.378***	-0.138	-0.006
	2015	-0.327**	-0.068	0.065
	2016	-0.400***	-0.126	0.013
	2017	-0.433***	-0.149	-0.001
	2018	-0.486***	-0.194	-0.040
	2019	-0.488***	-0.181	-0.021
	2020	-0.483***	-0.149	0.017
	2021	-0.448***	-0.124	0.045
Constant		-18.04***	9.614***	3.601
		(2.033)	(0.208)	(5.243)
Observations		10,852	10,852	10,852
R-squared		0.503	0.509	0.510
Number of bilateral pairs		420	420	420

FTA= free trade agreement; RTA= regional trade agreement.
Note: Robust standard errors in parentheses. Standard errors for year fixed-effects are suppressed for brevity. Significance levels are indicated by *** p<0.01, ** p<0.05, and * p<0.1
Source: CEPII-BACI data and APEC PSU staff estimates.

A graphical illustration of the year fixed-effect coefficient estimates is provided in Figure 1.

Figure 1. Bilateral trade year fixed-effects coefficient estimates, 1995–2021



Source: CEPII-BACI data and APEC PSU staff estimates.

To derive the year fixed-effects in percentage terms (FE%) as presented in the policy brief, we apply the following adjustment formula:

$$\text{FE\%} = (\exp(B) - 1) \times 100\%$$

where B = estimated year fixed-effect coefficient.