



Artificial Intelligence-Driven Semiconductor Demand and Malaysia's Export Response Dynamics

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ABSTRACT

This study examines whether Malaysia's export response to the global semiconductor cycle changed during the post-2023 AI-related demand expansion. Using monthly data from January 2019 to January 2026, Malaysia's SITC Section 7 export growth is modelled against worldwide semiconductor-sales growth across contemporaneous and distributed-lag specifications. The results show a positive association between global semiconductor demand and Malaysia's broad export growth. The post-2023 contemporaneous interaction is small and statistically imprecise. Although the lag-specific post-AI interactions are jointly significant, their cumulative contrast over lags 0–6 is not, indicating that differences across individual lags do not translate into a precise change in net cumulative responsiveness. Recursive-endpoint estimates further show that the negative post-AI cumulative contrast becomes progressively less negative as the sample expands. Cross-source validation of narrower semiconductor-related trade measures also reveals material measurement sensitivity, particularly for integrated-circuit trade in 2025. Overall, Malaysia remains exposed to the global semiconductor cycle, but the evidence does not establish a stronger post-2023 export response. Semiconductor upgrading is therefore better assessed through a combination of trade responsiveness and domestic capability indicators than through aggregate export growth alone.

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1. INTRODUCTION

The global semiconductor cycle has changed markedly with the rapid expansion of generative artificial intelligence. Recent demand has become increasingly concentrated in advanced logic, high-bandwidth memory, data-centre infrastructure, high-performance computing and advanced packaging, where capital and technological requirements are high (Bain & Company, 2024; Deloitte, 2024). This shift has increased the strategic importance of semiconductor production networks while making the distribution of demand across countries and production stages less straightforward.

Malaysia provides a useful setting for examining this relationship. Its electronics and semiconductor industries have long been integrated into international production networks through assembly, testing, packaging and electronics manufacturing services (Athukorala, 2014; Ernst, 2002). More recent assessments continue to identify Malaysia as an important semiconductor-linked production location, while also

highlighting constraints in technological deepening and higher-value activities (Said & Tan, 2024). Its position is therefore substantial but uneven across different semiconductor functions, particularly as industry restructuring places greater emphasis on technological capability and value-chain position (Prabheesh & Vidya, 2025; Wong et al., 2024).

These characteristics make the trade response to global semiconductor demand an empirical question rather than an automatic consequence of supply-chain participation. Modern production networks divide manufacturing across multiple countries and stages, increasing the role of intermediate inputs and vertical specialisation in recorded trade flows (Hummels et al., 2001). Governance within these networks also affects where particular functions and capabilities are located (Gereffi et al., 2005). Consequently, gross exports do not necessarily provide a direct measure of the domestic economic value associated with a change in external demand (Johnson & Noguera, 2012; Koopman et al., 2014). Adjustment may also occur with delay because production, processing and shipment are sequenced

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across locations (Baldwin & Venables, 2013). Both the magnitude and timing of Malaysia's export response therefore require empirical assessment.

The issue has gained further relevance as Malaysia seeks to deepen its semiconductor capabilities. The National Semiconductor Strategy places greater emphasis on integrated-circuit design, advanced packaging, semiconductor manufacturing equipment and higher-value domestic capabilities (Ministry of Investment, Trade and Industry [MITI], 2024). Existing research has examined Malaysia's integration into production networks, industrial upgrading and technological constraints, but less is known about whether its high-frequency export responsiveness to the global semiconductor cycle changed during the post-2023 AI-related expansion.

This study examines that question using monthly data from January 2019 to January 2026. Global semiconductor demand is measured by worldwide semiconductor billings from World Semiconductor Trade Statistics (WSTS, 2026b), while Malaysia's export outcome is based on SITC Section 7 data from the Department of Statistics Malaysia (DOSM, 2026). Because SITC Section 7 covers a broader set of machinery and transport products, it is treated as a broad export measure rather than a semiconductor-specific outcome. Contemporaneous interaction and distributed-lag models are used to examine whether the relationship differs after January 2023 and whether any differences emerge across the lag structure.

The analysis addresses three research questions:

RQ1. To what extent is Malaysia's SITC Section 7 export growth responsive to the global semiconductor cycle?

RQ2. Does the contemporaneous relationship between global semiconductor-sales growth and Malaysia's Section 7 export growth differ after January 2023?

RQ3. Does the post-2023 period alter the lag-specific and cumulative relationship between global semiconductor demand and Malaysia's Section 7 export growth?

Taken together, these questions distinguish baseline semiconductor-cycle exposure from potential post-2023 changes in contemporaneous and cumulative export responsiveness. The following analysis evaluates these relationships without presuming either the direction or magnitude of any post-AI change.

2. LITERATURE REVIEW

2.1 Fragmentation, Export Responsiveness, and Timing in Semiconductor Global Value Chains

Semiconductor production is organised through highly fragmented global value chains in which design, fabrication, equipment, assembly, testing, packaging and final electronics production are distributed across firms and economies. Vertical specialisation increases the cross-border movement of intermediate inputs and makes recorded exports dependent on internationally dispersed production processes (Hummels et al., 2001). Gross trade flows may therefore contain substantial foreign value added and repeated border crossings, limiting their correspondence with domestically generated value (Johnson & Noguera, 2012; Timmer et al., 2014). This measurement boundary is particularly important in highly

fragmented industries, where trade values can reflect multiple stages of production rather than a single domestic contribution (Koopman et al., 2014). Evidence from electronics value chains further shows that participation in production and the capture of economic value can be distributed unevenly across firms and functions (Dedrick et al., 2010). At finer product levels, inference also becomes more sensitive to how traded products are classified and aggregated, making measurement choices especially important when semiconductor-specific outcomes are constructed.

Functional position and production sequencing introduce two distinct questions for export responsiveness. The first is whether external demand changes are reflected in exports at all, given that lead-firm governance and functional specialisation shape where technology and higher-value activities are located (Gereffi et al., 2005; Sturgeon & Kawakami, 2011). Semiconductor trade is especially heterogeneous because materials, equipment, integrated circuits and packaging activities have different technological and geographical structures (Ou et al., 2024). The second question concerns **when** external demand appears in trade outcomes. Sequential organisation across production stages also makes the position and timing of activities within the value chain economically relevant (Antràs & Chor, 2013). Fragmented production creates sequencing between demand, processing, production and shipment, so export responses may emerge with delay rather than entirely within the contemporaneous period (Baldwin & Venables, 2013). Magnitude and timing should therefore be treated as related but analytically distinct dimensions of semiconductor export responsiveness.

2.2 Malaysia's Semiconductor Position and Upgrading

Malaysia's electronics industry developed through sustained integration into multinational production networks. Foreign investment and production sharing established Penang as a major regional electronics manufacturing and export platform (Athukorala, 2014). This integration created durable production capabilities, although the allocation of functions within multinational networks continued to shape opportunities for domestic upgrading (Ernst, 2002). Malaysian firms subsequently accumulated substantial production and engineering capabilities, but progress into more knowledge-intensive semiconductor functions remained uneven (Rasiah, 2010). Technological catching-up therefore depends not only on participation and foreign investment but also on domestic learning and local capability formation (Wang & Lim, 2023).

Malaysia's position is nevertheless evolving. New demand associated with AI, electric vehicles and renewable energy has expanded opportunities for its semiconductor ecosystem while increasing requirements for talent and technological capability (Said & Tan, 2024). Regional trade evidence confirms Malaysia's continuing importance within ASEAN semiconductor networks, although specialisation differs across economies and product categories (Prabheesh & Vidya, 2025). More recently, Malaysia has sought to combine its established assembly, testing and packaging strengths with technological diversification and industrial upgrading as U.S.–China semiconductor competition reshapes supply chains (Lu & Moorthy, 2026). Its position is therefore better characterised as deeply integrated but functionally evolving than as a fixed downstream role. This evolving position also provides a reason to treat export responsiveness as potentially time-varying rather than as a fixed relationship.

2.3 AI-Era Semiconductor Demand and the Empirical Gap

The recent semiconductor cycle has become increasingly associated with AI and other data-intensive technologies. AI, 5G and the Internet of Things have contributed to broader semiconductor demand across electronics industries (Hafiz et al., 2025). Within the post-2023 cycle, demand has been especially strong in advanced logic, high-bandwidth memory, high-performance computing, data-centre infrastructure and advanced packaging (Bain & Company, 2024; Deloitte, 2024). At the same time, semiconductor production is being reorganised under intensifying geopolitical competition. Higher- and lower-value functions remain unevenly distributed even as firms diversify production geographically (Wong et al., 2024). For Malaysia, these pressures interact with an established back-end manufacturing base and current efforts to deepen technological capability (Lu & Moorthy, 2026).

These developments leave the direction and timing of Malaysia's export response theoretically uncertain. Stronger global semiconductor demand may raise exports through established production linkages, but the size and timing of that response depend on which semiconductor segments expand and where additional production is allocated. Malaysia's position is also shaped by broader technological and regulatory dependencies, adding another layer to its evolving role in global semiconductor networks (Anuar, 2026). Existing studies provide substantial evidence on industrial upgrading, regional semiconductor trade and geopolitical repositioning, but less evidence on whether the relationship between global semiconductor demand and Malaysia's monthly export growth changed during the post-2023 AI-related expansion. The empirical gap therefore concerns whether contemporaneous responsiveness changed, whether differences emerged across the lag structure, and whether those differences altered the cumulative response, rather than assuming their direction or magnitude in advance.

3. DATA AND METHODOLOGY

3.1 Data and Variable Construction

The analysis uses monthly data from January 2019 to January 2026, with January 2023 defining the main post-AI regime. Malaysia's export outcome is constructed from monthly trade data published by the Department of Statistics Malaysia through OpenDOSM (DOSM, 2026).

The export measure is SITC Section 7, *Machinery and transport equipment*, reported in RM million. As this category is broader than electrical and electronics or semiconductor trade, it is treated as a broad export measure rather than a semiconductor-specific outcome. The dependent variable is its year-on-year percentage growth.

The global semiconductor cycle is measured by year-on-year growth in worldwide monthly semiconductor sales reported by World Semiconductor Trade Statistics (WSTS, 2026b). Controls include monthly changes in the USD/MYR exchange rate and WTI crude-oil prices, with the extended specification additionally including changes in the PHLX Semiconductor Sector Index and BDRY. Financial-market series are obtained from Yahoo Finance (2026). The contemporaneous specifications contain 85 observations, while the distributed-lag specification contains 79 after constructing

six monthly lags. Variable definitions and descriptive statistics are reported in Tables 1 and 2.

Table 1. Variable definitions and data sources

Variable	Definition / measurement	Source
Malaysia SITC Section 7 exports	Monthly SITC Section 7, <i>Machinery and transport equipment</i> exports (RM million)	DOSM (2026), OpenDOSM
Section 7 export growth	Year-on-year percentage growth in Section 7 exports	Author calculation from DOSM (2026)
Global semiconductor sales	Worldwide monthly semiconductor sales (USD billion)	WSTS (2026b), Historical Billings Report
Global semiconductor-sales growth	Year-on-year percentage growth in worldwide semiconductor sales	Author calculation from WSTS (2026b)
Post-AI regime	Indicator equal to 1 from January 2023 onward and 0 otherwise	Author construction
Semiconductor-sales growth $\times$ Post-AI regime	Interaction between semiconductor-sales growth and the post-AI regime	Author construction
USD/MYR monthly change	Monthly percentage change in USD/MYR	Yahoo Finance (2026)
WTI monthly change	Monthly percentage change in WTI crude-oil price	Yahoo Finance (2026)
SOX monthly change	Monthly percentage change in the PHLX Semiconductor Sector Index	Yahoo Finance (2026)
Shipping-cost proxy monthly change	Monthly percentage change in BDRY	Yahoo Finance (2026)

Table 2. Descriptive statistics

Variable	Obs.	Mean	SD	Min	Median	Max
Malaysia SITC Section 7 export growth	85	10.443	15.974	-23.149	7.411	48.628
Global semiconductor sales growth	85	9.622	17.623	-24.139	11.987	58.336
USD/MYR monthly change	85	-0.045	2.070	-6.732	-0.012	6.247
WTI oil-price monthly change	85	1.389	14.322	-54.245	1.467	88.376
SOX index monthly change	85	2.643	8.323	-17.505	2.947	18.580
Shipping-cost proxy monthly change	85	1.571	21.516	-36.876	-2.768	86.228

Note. Sample: January 2019–January 2026. Export and semiconductor variables are year-on-year growth rates; controls are monthly percentage changes.

As a supplementary measurement check, narrower export measures are reconstructed from monthly UN Comtrade HS data using official HS–SITC correspondence tables (United Nations Statistics Division, 2008, 2026) and compared with corresponding DOSM series over matched months. The exercise covers SITC 75+76+77, integrated-circuit trade, aggregate exports and re-export shares, with further details provided in Supplementary Table S1.

3.2 Empirical Specification

Let y_t denote year-on-year growth in Malaysia's SITC Section 7 exports, s_t worldwide semiconductor-sales growth, D_t an indicator equal to one from January 2023 onward, and $\mathbf{x}_t$ the control vector. The baseline model is

$$y_t = \alpha + \beta s_t + \mathbf{x}_t' \gamma + \varepsilon_t. \quad (1)$$

The post-AI interaction specification is

$$y_t = \alpha + \beta s_t + \lambda D_t + \delta(s_t \times D_t) + \mathbf{x}_t' \gamma + \varepsilon_t. \quad (2)$$

Here, β captures pre-2023 responsiveness and δ the additional post-AI association.

To allow the export response to unfold over time, consistent with the production and shipment sequencing discussed in Section 2.1, an unrestricted finite distributed-lag specification is estimated over lags 0–6:

$$y_t = \alpha + \sum_{k=0}^6 \beta_k s_{t-k} + \lambda D_t + \sum_{k=0}^6 \delta_k (s_{t-k} \times D_t) + \mathbf{x}_t' \gamma + \varepsilon_t. \quad (3)$$

The baseline cumulative response, additional post-AI cumulative contrast and total post-AI cumulative response are defined as

$$B = \sum_{k=0}^6 \beta_k, \Delta = \sum_{k=0}^6 \delta_k, B + \Delta. \quad (4)$$

Two hypotheses are distinguished. The cumulative-contrast test evaluates

$$H_0: \sum_{k=0}^6 \delta_k = 0, \quad (5)$$

whereas the joint Wald test evaluates

$$H_0: \delta_0 = \delta_1 = \dots = \delta_6 = 0. \quad (6)$$

The first concerns the net cumulative difference, whereas the second concerns the interaction coefficients jointly.

3.3 Estimation and Diagnostics

All models are estimated by ordinary least squares with Newey–West heteroskedasticity- and autocorrelation-consistent inference (Newey & West, 1987). Maximum HAC lags are three months for the contemporaneous specifications and six months for the distributed-lag model. Cumulative confidence intervals are calculated from the full HAC covariance matrix.

Stationarity diagnostics are conducted for all six continuous variables using augmented Dickey–Fuller and KPSS tests (Said & Dickey, 1984; Kwiatkowski et al., 1992), with Zivot–Andrews tests allowing for an endogenous break (Zivot & Andrews, 1992). Sensitivity checks include alternative post-AI dates, Andrews sup-F diagnostics under alternative trimming choices (Andrews, 1993), and alternative HAC bandwidths.

Statistical precision is also summarised using approximate minimum detectable effects:

$$MDE \approx (z_{.975} + z_{.80})SE = 2.802 \times SE, \quad (7)$$

for a two-sided significance level of .05 and 80% power. These are treated as descriptive measures of detectable effect magnitude.

A recursive-endpoint check re-estimates Equation (3) over progressively expanding sample endpoints while holding the specification fixed. The additional cumulative contrast and its

HAC confidence interval are recomputed at each endpoint. Because the samples are nested, the sequence is interpreted as a stability diagnostic rather than as a test of a deterministic trend.

Data preparation and estimation were implemented in Python using a reproducible workflow, with revision scripts and outputs retained separately to preserve the audit trail.

4. RESULTS AND DISCUSSION

4.1 Semiconductor-Cycle Responsiveness

Figure 1 shows broad cyclical co-movement between Malaysia's SITC Section 7 export growth and global semiconductor-sales growth, although the export series is more volatile. Both weaken around the 2022–2023 semiconductor correction and recover subsequently, indicating continued exposure of Malaysia's broader machinery and electronics-related trade to the global semiconductor cycle.

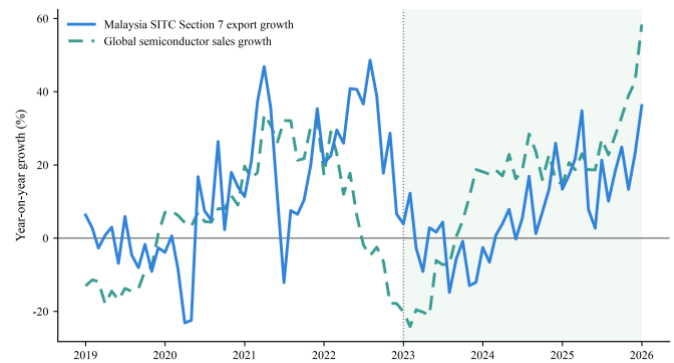


Fig. 1. Malaysia export growth and the global semiconductor cycle

Note. The vertical line marks January 2023; shading indicates the post-AI period.

Table 3 provides the corresponding regression evidence. Global semiconductor-sales growth is positively associated with Section 7 export growth in the baseline model ($\beta = 0.343$, HAC SE = 0.107, $p < .01$) and remains positive in the interaction and extended-control specifications (0.405 and 0.395, respectively). This is consistent with Malaysia's established integration into regional electronics production networks (Athukorala, 2014; Prabheesh & Vidya, 2025). Because Section 7 extends beyond semiconductor trade, the estimates are interpreted as broad export responsiveness rather than semiconductor-specific transmission.

The post-AI interaction is -0.032 in Model 2 (95% CI $[-0.448, 0.383]$) and -0.040 in Model 3 (95% CI $[-0.460, 0.381]$); neither is statistically distinguishable from zero. This occurs during a period of strong external demand, when global semiconductor sales increased by 26.2% to USD 795.6 billion in 2025 (WSTS, 2026a). Strong semiconductor-market growth therefore does not, by itself, establish that Malaysia's broad export responsiveness strengthened during the AI-related expansion.

Table 3. Baseline regression results

Variables	(1) Baseline	(2) Post-AI interaction	(3) Extended controls
Global semiconductor sales growth	0.343***	0.405**	0.395**

Variables	(1) Baseline	(2) Post-AI interaction	(3) Extended controls
	(0.107)	(0.188)	(0.180)
Post-AI regime		-7.868 (5.283)	-7.389 (5.259)
Semiconductor-sales growth × Post-AI regime		-0.032 (0.212)	-0.040 (0.214)
USD/MYR monthly change	0.061 (0.698)	-0.144 (0.642)	-0.479 (0.681)
WTI monthly change	-0.088 (0.130)	-0.124 (0.141)	-0.093 (0.142)
SOX monthly change			-0.256 (0.177)
Shipping-cost proxy monthly change			0.005 (0.103)
Constant	7.263** (3.050)	10.328** (4.417)	10.872** (4.300)
Observations	85	85	85
R-squared	0.147	0.208	0.223
AIC	705.8	703.4	705.9

Note. Dependent variable: year-on-year growth in Malaysia's SITC Section 7 exports. Newey–West HAC standard errors in parentheses (lag = 3). *** $p < .01$, ** $p < .05$, * $p < .10$.

4.2 Lag-Specific Responses

Figure 2 reports the baseline and additional post-AI coefficients over lags 0–6. The estimates vary across the lag window, with several confidence intervals spanning zero, indicating that the relationship is distributed over time rather than concentrated in the contemporaneous month.

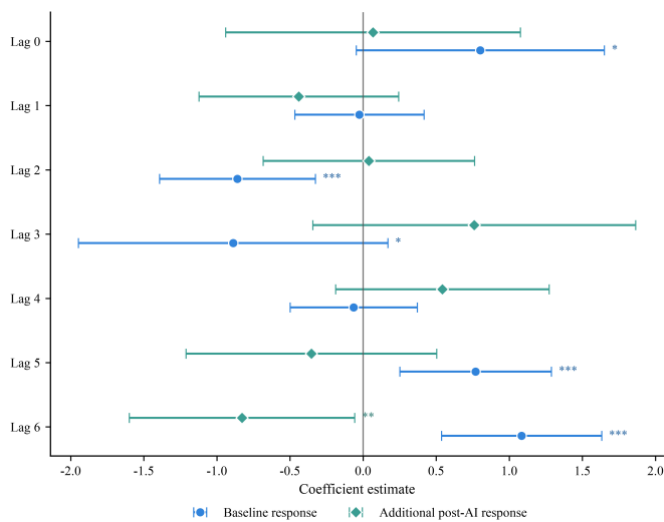


Fig. 2. Lag-specific export responses to semiconductor-sales growth

Note. Horizontal bars indicate 95% confidence intervals. *** $p < .01$, ** $p < .05$, * $p < .10$.

Delayed responses are plausible in fragmented production systems because changes in external demand may pass through procurement, production scheduling and shipment before appearing in recorded exports (Baldwin & Venables, 2013). The additional post-AI coefficients also vary in sign, but the model does not identify a specific operational mechanism behind this pattern.

The lag structure nevertheless matters for interpretation. Contemporaneous export growth alone may miss adjustments that emerge over subsequent months, while variation at individual lags need not translate into a change in the overall cumulative response. High-frequency monitoring should therefore distinguish the timing of export responses from their net magnitude.

4.3 Cumulative Response and Stability

Table 4 reports the cumulative effects over lags 0–6. The baseline cumulative response is 0.818 (95% CI [0.432, 1.204]), while the total post-AI cumulative response is 0.606 (95% CI [0.457, 0.756]). The additional post-AI cumulative contrast is -0.212 (95% CI [-0.619, 0.196], $p = .308$). The evidence therefore supports continued cumulative responsiveness without establishing a precise strengthening or weakening after January 2023.

The joint Wald test rejects the hypothesis that all seven post-AI lag interactions are zero ($p = .003$). This differs from the cumulative test: the lag-specific interaction coefficients are not jointly zero, whereas their sum is not statistically distinguishable from zero. Lag-specific adjustment should therefore not be interpreted automatically as a change in overall cumulative responsiveness.

Table 4. Distributed-lag cumulative-response estimates

Panel A. Cumulative-response estimates				
Cumulative quantity	Estimate	HAC SE	95% CI	p-value
Baseline cumulative response, lags 0–6	0.818	0.197	[0.432, 1.204]	< .001
Additional post-AI cumulative contrast, lags 0–6	-0.212	0.208	[-0.619, 0.196]	.308
Total post-AI cumulative response, lags 0–6	0.606	0.076	[0.457, 0.756]	< .001
Panel B. Model diagnostics				
Model diagnostic	Value			
Joint Wald test, $H_0: \delta_0 = \dots = \delta_6 = 0$	21.884 ($p = .003$)			
Observations	79			
R-squared	0.653			

Note. Cumulative effects are sums over lags 0–6 using the full HAC covariance matrix (lag = 6). The cumulative contrast tests $H_0: \sum_{k=0}^6 \delta_k = 0$, whereas the joint Wald test evaluates $H_0: \delta_0 = \dots = \delta_6 = 0$.

Figure 3 visualises this distinction. Panel A compares the baseline and total post-AI cumulative responses, while Panel B isolates the additional post-AI contrast. By the end of the lag window, the additional estimate remains negative but its confidence interval spans zero.

Figure 4 provides a recursive-endpoint stability check. Holding the specification fixed, the additional cumulative contrast attenuates from -1.160 in the sample ending January 2024 to -0.212 in the full sample ending January 2026. Earlier recursive windows are statistically distinguishable from zero, whereas the estimate loses precision as later observations are incorporated.

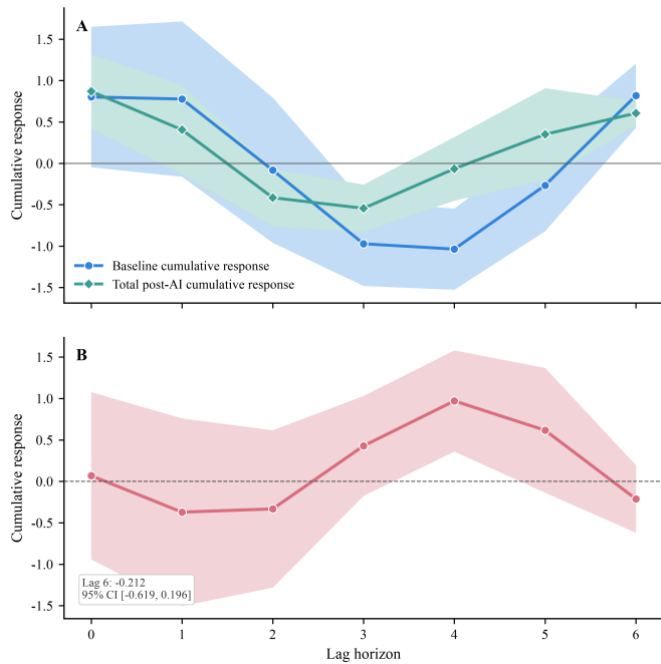


Fig. 3. Cumulative export responses to semiconductor-sales growth

Note. Panel A shows the baseline and total post-AI cumulative responses; Panel B shows the additional post-AI cumulative contrast. Shaded bands indicate 95% confidence intervals.

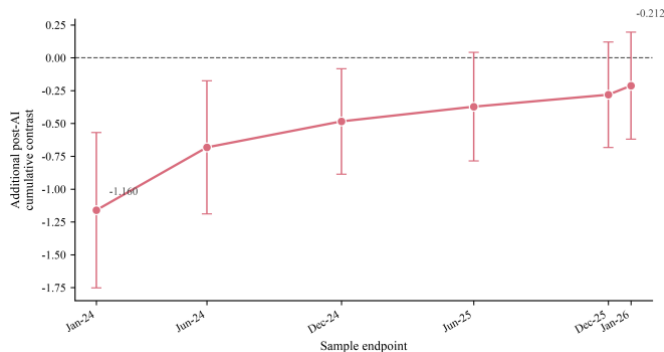


Fig. 4. Recursive estimates of the post-AI cumulative contrast

Note. Error bars show 95% confidence intervals. Because the samples are nested and progressively expanded, the sequence is interpreted as a stability diagnostic rather than a formal trend test.

Because the recursive windows are nested, the sequence does not establish a deterministic trend. It does show that conclusions drawn from short post-event windows can change as additional observations become available. For policy evaluation, early responses to a major demand shock should therefore not be treated as evidence of lasting structural change unless they remain stable over a longer observation period.

4.4 Robustness and Measurement Sensitivity

Stationarity diagnostics are consistent for the dependent variable and the four control variables: the ADF and Zivot–Andrews tests reject a unit root, while the KPSS test does not reject stationarity. Global semiconductor-sales growth shows mixed evidence. For this series, the ADF ($p = .65$) and Zivot–Andrews ($p = .38$) tests do not reject a unit root, whereas the KPSS test does not reject stationarity ($p = .07$). The main explanatory series should therefore not be characterised as uniformly stationary across tests.

The remaining sensitivity checks do not materially alter the main inference. Alternative post-AI dates and Newey–West bandwidths yield the same qualitative conclusion, while the Andrews sup-F diagnostics do not identify a stable interior breakpoint aligned with January 2023.

The approximate minimum detectable effects are larger than the estimated post-AI effects. Statistical non-significance should therefore be interpreted as an absence of sufficiently precise evidence of change rather than as evidence that the underlying effect is exactly zero.

Measurement sensitivity raises a separate issue. Supplementary Table S1, constructed from DOSM monthly trade statistics and UN Comtrade records (DOSM, 2026; United Nations Statistics Division, 2026), shows close cross-source agreement for reconstructed SITC 75+76+77 measures in 2024 but material divergence in 2025. The discrepancy is particularly pronounced for integrated-circuit trade, where the average difference rises from approximately 12% to 58%. By contrast, the total-export gap remains broadly stable, while the observed increase in re-export activity is insufficient to reconcile the IC divergence.

The narrower reconstructed series are therefore retained as validation evidence rather than substituted for the internally consistent DOSM Section 7 series used in the principal analysis. This does not imply that either source is inherently incorrect; rather, it reflects unresolved source sensitivity in high-frequency product-level measurement.

This measurement result also has a practical implication. Product-level semiconductor policy assessment depends on the consistency of the underlying trade series. More transparent reconciliation and consistently available monthly official semiconductor statistics would strengthen both policy monitoring and future empirical evaluation.

Table 5. Diagnostic and robustness checks

Diagnostic	Specification	Result
ADF	Constant	−3.527 ($p = .007$)
KPSS	Level stationarity	0.198 ($p > .10$)
Zivot–Andrews	Intercept break	−6.136 ($p < .001$)
Zivot–Andrews	Intercept + trend break	−6.031 ($p = .002$)
Alternative post-AI dates	Jan / Jun / Jul 2023	Interaction p : .879 / .240 / .150; cumulative p : .308 / .269 / .336
Andrews sup-F	15% / 20% / 25% trimming	7.455 (Jun 2020) / 7.455 (Jun 2020, boundary) / 5.612 (Aug 2023)
HAC bandwidth	6 / 12 / 18	Cumulative p : .308 / .238 / .211
Approx. MDE	Interaction	0.594; estimate = −0.032
Approx. MDE	Cumulative contrast	0.582; estimate = −0.212

Note. Stationarity rows report diagnostics for the dependent variable; corresponding diagnostics for the explanatory and control variables are summarised in Section 4.4. KPSS $p > .10$ reflects the tabulated upper bound. Approximate MDE = $2.802 \times \text{HAC SE}$.

4.5 Policy Implications

The results suggest that exposure to the global semiconductor cycle and technological upgrading should be treated as distinct policy outcomes. Malaysia remains responsive to global semiconductor demand, but the analysis does not identify a statistically precise post-2023 increase in broad contemporaneous or cumulative export responsiveness. This distinction is consistent with evidence that participation in

semiconductor production does not necessarily translate into equivalent domestic technological deepening or movement into higher-value activities (Wang & Lim, 2023).

This distinction is particularly relevant to Malaysia's National Semiconductor Strategy. The NSS identifies higher-value activities including IC design, advanced packaging, advanced manufacturing equipment, technology development and R&D as strategic priorities (MITI, 2024). Its 2025 implementation plan further targets the development of 110 high-value Malaysian semiconductor firms (MITI, 2025). These objectives place greater emphasis on domestic technological capability and value creation than on export scale alone.

The present findings therefore suggest that progress towards semiconductor upgrading should not be assessed through aggregate export growth alone. Lag-specific post-AI differences may exist without producing a statistically precise cumulative change, while the recursive estimates show that conclusions based on short post-event windows can weaken as the sample expands. Policy monitoring would consequently benefit from combining trade responsiveness with indicators of domestic IC-design capability, advanced packaging, R&D activity and locally anchored high-value firms. Such a broader assessment is also consistent with Malaysia's continuing technological diversification and strategic repositioning within a changing semiconductor supply chain (Lu & Moorthy, 2026).

5. CONCLUSION

This study examines whether Malaysia's export responsiveness to the global semiconductor cycle changed during the post-2023 AI-related expansion. Using monthly data from January 2019 to January 2026, the results show that SITC Section 7 export growth remains positively associated with global semiconductor-sales growth. However, the evidence does not identify a statistically precise post-2023 change in contemporaneous or cumulative responsiveness. Although at least one lag-specific post-AI interaction differs from zero, their cumulative contrast is not statistically distinguishable from zero. The study therefore shows why changes in the timing of export responses should be distinguished from changes in their net cumulative strength.

The recursive analysis adds a second contribution. The additional post-AI cumulative contrast becomes progressively less negative as the sample expands, indicating that the full-sample result is not the endpoint of a stable negative relationship. At the same time, cross-source validation reveals material divergence in narrower semiconductor-related trade measures, particularly for integrated circuits. This measurement evidence shows that product-level inference can depend materially on the data source and period used. The findings should therefore be interpreted as evidence on broad export responsiveness rather than semiconductor-specific transmission.

These findings also have implications for how Malaysia's semiconductor upgrading is assessed. Because lag-specific post-AI differences do not necessarily translate into a detectable change in the aggregate cumulative response, overall export growth alone may obscure important changes in the underlying response structure. This is particularly relevant as Malaysia's National Semiconductor Strategy targets IC design, advanced packaging, advanced manufacturing equipment, technology

and R&D, including the development of 110 high-value Malaysian semiconductor firms (MITI, 2025). Future research revisiting this question with officially validated, division-level semiconductor trade series, once consistently available at monthly frequency, would allow contemporaneous, lag-specific and cumulative responsiveness to be assessed using a semiconductor-specific rather than a broad trade measure. Until such data become available, Malaysia's semiconductor transition is better evaluated through a combination of trade responsiveness and domestic capability indicators than through aggregate export growth alone.

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APPENDIX

Supplementary Table S1. Cross-source validation of Malaysian export measures

Validation check	2024	2025
SITC Section 7: Comtrade relative to DOSM	−0.47% [−3.46%, +1.79%], <i>n</i> = 12	+28.05% [+22.99%, +34.90%], <i>n</i> = 12
SITC 75+76+77: Comtrade relative to DOSM	−0.37% [−2.60%, +1.97%], <i>n</i> = 11	+30.21% [+24.48%, +37.68%], <i>n</i> = 11
Average monthly SITC 75+76+77 exports	DOSM: RM50.55 bn; Comtrade: RM50.37 bn	DOSM: RM60.07 bn; Comtrade: RM78.44 bn
HS8542 vs DOSM IC	+11.94% [+6.11%, +17.75%], <i>n</i> = 11	+58.49% [+50.71%, +69.78%], <i>n</i> = 11
DOSM 75+76+77 re-export share	25.88%, <i>n</i> = 10	30.67%, <i>n</i> = 10
Total exports: Comtrade relative to DOSM	+23.09% [+18.31%, +31.32%], <i>n</i> = 11	+22.38% [+18.36%, +26.39%], <i>n</i> = 11

Note. Level difference = $100 \times (\text{Comtrade}/\text{DOSM} - 1)$. Comtrade values are converted to RM using the monthly USD/MYR series. Section 7 uses Jan–Dec; SITC 75+76+77, HS8542–IC and total exports use Feb–Dec; re-export shares use Feb–Nov.