



Geopolitical rivalry and structural change in semiconductor markets: evidence from long-memory dynamics

Andoni Maiza-Larrarte¹ · Luis Alberiko Gil-Alana^{2,3} ·
Gloria Claudio-Quiroga³

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Abstract

This paper analyzes the long-memory properties in U.S. semiconductor industry production and price series. The analysis is framed within the context of the U.S.-China geopolitical rivalry, which is hypothesized to present a series of persistent economic shocks. The paper aims to determine whether the policy measures and strategic responses characterizing this rivalry have permanently altered the time-series properties of economic variables. It is demonstrated that the global semiconductor market is undergoing a fundamental and irreversible bifurcation, with statistically significant changes in the long memory parameter: the U.S. internal market shifted toward stability and resilience, while the external market fell subject to greater volatility and permanent price shocks.

Keywords Semiconductors · Production · Prices · Persistence · Long memory

JEL Classification C22 · L63 · F13

1 Introduction

The semiconductor industry is no longer defined by the predictable deflationary trends of the past. The path described by Moore's Law has given way to a new regime of heightened volatility and market fragmentation, driven by strategic geopolitical rivalry (Honglin, 2024; Leiserson et al., 2020; Luo & Van Assche, 2023; Ren et al.,

✉ Luis Alberiko Gil-Alana
alana@unav.es

¹ University of the Basque Country, UPV/EHU, Leioa, Spain

² University of Navarra, Pamplona, Spain

³ Department of Economics, Universidad Francisco de Vitoria, Madrid, Spain

2023). The manufacturing of semiconductors is an intensely capital-intensive process: construction of a single leading-edge fabrication facility costs billions of dollars and requires years to complete (Braun & MacDonald, 1978). The combination of these high fixed costs, along with highly specialized human capital and volatile demand, makes the industry prone to cycles of oversupply and undersupply (Lee et al., 1997; Liu, 2005; Weng, 2017). Moreover, geographic concentration in a few specialized companies makes the entire value chain extremely vulnerable to supply chain shocks (Ernst, 2021; U.S. Congressional Research Service, 2020; Xiong et al., 2024).

In this context of rising trade and political tension, strategic high-tech sectors have transitioned from drivers of global integration into key sources of systemic macroeconomic risk and strategic levers for states seeking to reshape their hierarchical positioning (Caravella et al., 2024; Edler et al., 2023; Giunta et al., 2025). As highlighted by Juhász et al. (2024), this reflects a broader emergence of a ‘new economics of industrial policy, where governments target structural economic transformation to address geopolitical competition and supply chain resilience. In particular, the semiconductor industry is increasingly regarded as a key asset for developing advanced technologies and a critical element in national security strategy. While the U.S. semiconductor industry was once characterized by intense trade friction with Japan, South Korea, and Taiwan in the 1980s, the People’s Republic of China (PRC) has become the main focus of trade conflicts since the mid-2000s (Bown, 2020; Mathews & Cho, 2000).

This research investigates how the U.S.-China rivalry has altered the long-term statistical behavior of key variables within the U.S. semiconductor industry. Major market shocks, such as the COVID-19 pandemic, have been amplified by a series of targeted state-level policy interventions. By analyzing these geopolitical events, we aim to determine whether policies intended for national security and supply chain resilience have paradoxically contributed to economic instability and permanently changed the industry’s dynamics.

This research contributes to the field of industrial economics by providing a quantitative measure of how industrial policy and geopolitical competition redefine market structures. Beyond the technical application of fractional integration, we leverage these dynamics to evaluate the “securitization” of the semiconductor supply chain. By measuring the persistence of economic shocks through the fractional parameter (d) we quantify the “economic memory” of the industry. This approach enables a clear distinction between policy interventions that induce transitory perturbations and those that fundamentally decouple the US domestic industry from global volatility.

Additionally, incorporating structural break analysis makes our model robust to sudden regime changes. This allows us to test whether the observed long-memory is an intrinsic property of the series or a result of major breaks corresponding to key policy dates. This explicit connection to geopolitical events makes the findings more meaningful and interpretable. By doing so, this study bridges the gap between macroeconomic time-series analysis and the non-macro structural literature on global value chains, offering a quantitative foundation to qualitative discussions on market fragmentation.

The paper is structured as follows: Sect. 2 summarizes the most relevant events affecting the U.S. semiconductor industry amidst rising tension with China. Section 3 describes the dataset; Sect. 4 is devoted to the methodology; Sect. 5 contains the empirical results, while Sect. 6 concludes the manuscript.

2 Background: the escalation of the US-China tech rivalry

The evolution of U.S.-China international relations is characterized by growing tensions caused by trade conflicts and, ultimately, by China's rising global influence. The semiconductor industry is central to this conflict as the rivalry shifted from general trade to a targeted technological confrontation (Malkin & He, 2023; Schindler, 2024); Shrivastava & Jash, 2025).

China's accession to the WTO on December 11, 2001, integrated it into the global economy. This paved the way for a massive entry of Chinese products into world markets, which in turn created a huge surge in demand for U.S.-produced chips used in Chinese electronics manufacturing. By 2005, the PRC had become the world's largest market for semiconductors, establishing a deeply interdependent relationship between the two nations (Fuller, 2016).

This interdependence soon shifted toward a more confrontational dynamic. Concerns about Huawei's ties to the Chinese military and government, including fears of espionage and intellectual property theft, began to be voiced by the U.S. government in 2007 (see Table 1). In September 2007, a joint agreement between Bain Capital and Huawei to acquire the U.S. networking company 3Com was announced. However, facing opposition from the Committee on Foreign Investment in the United States

Table 1 Major milestones in the U.S.-China semiconductor rivalry

Date	Event
2001-12-01	China's accession to WTO
2007-09-28	Bain Capital and Huawei announce their joint agreement to acquire 3Com
2014-06-24	China releases the National IC Industry Development Guideline and Big Fund – Phase I
2015-05-19	Beijing launches the “Made in China 2025” plan
2018-04-16	US government seven-year ban to the Chinese equipment maker ZTE
2019-05-16	The US Department of Commerce added Huawei to the “Entity List”
2019-10-22	China's Big Fund—Phase II
2020-03-11	The WHO declared the COVID-19 outbreak a global pandemic
2022-08-09	The U.S. government passed the CHIPS and Science Act
2022-10-07	The U.S. Department of Commerce's enacted export controls
2024-05-14	The U.S. Trade Representative announces tariff increase to 50%
2024-05-24	China's Big Fund—Phase III

Source: Own elaboration

(CFIUS) on national security grounds, the companies withdrew the bid in March 2008 (U.S. Congress, 2007). This was a first, relevant regulatory shock, indicating a fundamental shift in U.S. policy that would progressively escalate to hinder China's semiconductor industry development.

China responded with strategic plans to reduce its reliance on foreign technology. In June 2014, the State Council of the People's Republic of China released the "National IC Industry Development Guideline," a comprehensive strategy to accelerate sector growth (State Council of the PRC, 2014). The China Integrated Circuit Industry Investment Fund, "Big Fund I," was established with over US\$ 20 billion to support the industry. In 2015, with the "Made in China 2025" plan, the government identified semiconductors as a key industry, setting an ambitious target of 70% domestic self-sufficiency by 2025 (State Council of the PRC, 2015). These supply-side interventions had the potential to disrupt global capacity planning and investment cycles.

The rivalry then entered a period of direct conflict characterized by a series of tit-for-tat measures. In April 2018, the U.S. government placed a seven-year ban on American companies selling components to the Chinese telecommunications giant ZTE for violating trade sanctions. This was followed in July 2018 by the U.S. Trade Representative imposing 25% tariffs on semiconductors imported from China after an investigation into China's trade practices. The \$34 billion tariff list specifically targeted sectors benefiting from the "Made in China 2025" policy (Office of the U.S. Trade Representative, 2018). In May 2019, the U.S. Department of Commerce added Huawei to its "Entity List," severely restricting the company's ability to acquire U.S.-origin technology and software, including advanced chips (U.S. Bureau of Industry and Security, 2019).

Notably, the PRC chose to exempt integrated circuits and semiconductor manufacturing equipment from its trade war tariff retaliation, so that imports continued to increase throughout the trade war. Instead, China launched the Big Fund II in October 2019 with US\$ 29 billion of state financing to further boost the industry (Khan & Klonner, 2020).

Amid this escalating trade tension, the WHO declared the COVID-19 outbreak to be a global pandemic on March 11, 2020. The restrictive measures caused a massive shift in semiconductor demand, with a surge in electronics for remote work and a temporary slump followed by an explosive rebound in the automotive sector. These events, layered upon geopolitical tensions, led to a global chip shortage that lasted for years.

In August 2020, China's State Council issued the "Notice on Several Policies to Promote the High-quality Development of the Integrated Circuit Industry and Software Industry in the New Era" (State Council of the PRC, 2020). The directive sought to bolster the domestic semiconductor and software sectors through a series of measures including financial incentives, enhanced intellectual property protection, and increased research and development.

In August 2022, the U.S. government passed the CHIPS and Science Act, authorizing over \$52 billion in subsidies to encourage domestic semiconductor manufacturing and research (CHIPS and Science Act, 2022). This legislation represented a pivotal strategic shift toward bolstering U.S. supply chain resilience (Peters, 2023).

Recent literature suggests that such interventions have substantial localized economic footprints; notably, Erten et al. (2024) demonstrate that the CHIPS Act has already begun to impact employment dynamics in counties with high semiconductor activity, highlighting the broader socio-economic intent of these policy measures. Further, the global relevance of these early U.S. results is underscored by recent oversight assessments (European Court of Auditors, 2025), which benchmark the U.S. experience as a model for how industrial policy can successfully catalyze domestic structural shifts amidst increasing geopolitical fragmentation.

While the CHIPS Act focused on domestic revitalization through incentives, the U.S. strategy simultaneously moved toward a more defensive posture on the global stage. In October 2022, the U.S. Department of Commerce's Bureau of Industry and Security (BIS) enacted export controls that directly and significantly restricted China's ability to obtain high-end semiconductors, manufacturing equipment, and technology (U.S. Bureau of Industry and Security, 2022). This measure was a fundamental shift to a targeted, technology-focused confrontation, creating an immediate shock to both supply and demand. The export controls were tightened in October 2023, broadening their scope and closing loopholes that had allowed companies like Nvidia to sell slightly modified AI chips to China (U.S. Bureau of Industry and Security, 2023).

The rivalry continued to intensify into 2024. On May 14, 2024, the United States Trade Representative announced that the tariff rate for designated Chinese semiconductor products would increase from 25 to 50% on January 1, 2025 (Office of the U.S. Trade Representative, 2024). A few days later, China launched the Big Fund Phase III with US\$ 47.5 billion to boost domestic research and manufacturing capabilities, demonstrating its intensified commitment to achieving self-sufficiency (China Construction Bank Corporation, 2024).

These decisive policy interventions—ranging from the early regulatory pushback in 2008 to the targeted export controls of 2022—represent a fundamental shift from a market-driven industrial organization to a state-led industrial strategy. In the context of industrial economics, these milestones are not merely statistical break points; they represent significant shifts in the incentive structures and risk profiles of the global semiconductor network. This network acts as a hub-and-spoke system where 'chokepoint' nodes can be leveraged for geopolitical gain, a phenomenon known as 'Weaponized Interdependence' (Farrell & Newman, 2019). Consequently, these supply-chain bottlenecks and strategic dependencies have forced a paradigm shift in how states define their digital sovereignty, altering the hierarchical and competitive positioning of integrated economies (Guarascio et al., 2025).

Our analysis utilizes the fractional integration parameter (d) to test whether these state-led efforts to achieve 'technological sovereignty' have succeeded in insulating domestic production from the compounding, permanent shocks that characterize the fragmented global export market. The next section details the time series used to empirically test how the order of integration responded to these milestones.

3 The data

The research leverages a comprehensive set of publicly available data from the Federal Reserve Bank of St. Louis (FRED database). Selected series combine producer, export, and import price indexes with production and utilization series. This provides a holistic view of the U.S. semiconductor supply chain's health and responsiveness (See Appendix Table 10). This multivariate approach is essential for capturing the complex, interconnected nature of the industry and its response to external shocks.

The data originate from two primary sources with distinct adjustment methodologies. The Producer, Export, and Import Price Indices (PCU33443344, IY3344, and IZ3344) are provided by the Bureau of Labor Statistics (BLS). Notably, these indices utilize hedonic quality-adjustment techniques to account for the rapid technological improvements, ensuring that price changes are measured for a constant level of performance. This effectively captures the technological deflation (quality-adjusted price decline) characteristic of Moore's Law. The Industrial Production (IPG3344N) and Capacity Utilization (CAPUTLG3344S) series are provided by the Federal Reserve Board¹. By combining quality-adjusted price indices and production metrics, the analysis accurately reflects the market's immediate and lasting response to trade policy and supply chain disruption.

Admittedly, these series present some characteristics that necessitate careful interpretation. The high aggregation level (NAICS 3344) combines diverse products and technologies, potentially masking important sub-sector trends. To mitigate concerns regarding aggregation and potential 'dilution' effects, we supplement our primary analysis with a targeted robustness check. Specifically, we compare our baseline results with more granular technology series—semiconductors, printed circuit boards, and other—as well as with broader industrial aggregates. By focusing on this core technology component, we can verify whether the persistence dynamics identified in the broader NAICS 3344 aggregate are diluted or intensified when the 'noise' of lower-technology components within the baseline category is removed. This approach allows us to test the sensitivity of our findings to sectoral definitions and ensures that the observed hyper-persistence is indeed a structural characteristic of the high-end semiconductor supply chain.

The differing start dates, ranging from January 1967 (CAPUTLG3344S) to December 2005 (IY3344 and IZ3344), necessitate a careful approach to sample selection. All tests will use a common end date of July 2025. The analysis will proceed in two stages to maximize information and ensure consistency: (i) full-length analysis: testing the I(d) parameter for each series across its longest available period; and (ii) common-sample robustness: re-testing all five variables over the earliest common start date of December 2005 to assess the robustness of the fractional integration estimates.

¹ To preserve the underlying long-memory properties and avoid potential distortions from seasonal filters, Not Seasonally Adjusted data were used for all series except Capacity Utilization, which is only available from the source in Seasonally Adjusted form.

4 Methodology

The proposed methodology employs a multi-stage econometric approach. It begins with descriptive analysis and a structural break analysis to identify the statistical impact of key policy events, such as the October 2022 export controls. The research's central component is the estimation of the fractional differencing parameter, d , to quantify the degree of long-memory and determine if shocks have temporary or permanent effects on the series.

We use fractionally integrated methods. In doing so, we permit a higher degree of flexibility than the standard approaches based on stationarity/unit root tests that are based on orders of integration equal to 0/1 respectively. A process is said to be integrated of order d or $I(d)$ where d is a real value, if it can be represented as:

$$(1 - L)^d x(t) = u(t), \quad t = 1, 2, \dots \quad (1)$$

where L indicates the lag operator, $Lx(t) = x(t-1)$ and where $u(t)$ is $I(0)$ or integrated of order 0, which may be described as a process where the infinite sum of the autocovariances is finite and that may allow for weak autocorrelation, for example, of the autoregressive moving average, ARMA, form. Proposed in the early 80s by the Nobel Prize winner, Granger (1980, 1981) and Granger and Joyeux (1980) the $I(d)$ processes have now become popular in the analysis of economic and financial data (e.g., Abbritti et al., 2016; Bisaglia et al., 2025; Hualde & Nielsen, 2023; Zheng et al., 2018; etc.)

In the empirical application conducted in the following section, we suppose that $x(t)$ can be the errors in a regression model with deterministic terms like a linear function such that

$$y(t) = \alpha + \beta t + x(t), \quad t = 1, 2, \dots, \quad (2)$$

where α and β are unknown coefficients, t is a time trend, and $y(t)$ refers to the observed data.

Based on the above specifications, using (1) and (2) we determine the nature of market adjustments. Thus, if $d < 1$, $y(t)$ will display mean reversion, which in economic terms implies that the industry possesses an inherent stability; following a geopolitical shock or policy change, variables like production or capacity utilization eventually return to their long-run equilibrium and doing so faster the lower the value of d is. Conversely, $d \geq 1$ (persistence) indicates a “permanent” shift. In this scenario, a single policy intervention—such as an export ban—does not just cause a temporary dip, but fundamentally resets the industry's trajectory, inducing long-term structural change.

The estimation of the unknown terms, i.e., α , β , d , those potential terms of the short run dynamics, and σ^2 (the variance of the error term) will be determined by maximizing the likelihood function in the frequency domain, as specified in the testing procedure of Robinson (1994) widely used in empirical applications and particularized in the present work such as the one used in Gil-Alana and Robinson (1997). Thus, in the case of the differencing parameter, the confidence intervals will provide

us with the values of d where the null hypothesis cannot be rejected for a specific value. In addition, and as a robustness method, we also tried with alternative parametric (Sowell, 1992) and semi-parametric (Geweke & Porter-Hudak, 1983; Robinson, 1995) methods of fractional integration and the results were fairly similar to those reported in the present manuscript.

Given the historical shift in U.S.-China relations from economic integration to targeted technological rivalry, we partition the time series into several subperiods to test our central hypothesis. This approach allows us to determine if significant structural changes—or “persistent economic shocks”—have altered the long-memory properties of the series. The specific subperiods are chosen to align with key policy and geopolitical events identified in Sect. 2.

The series is divided into two main periods: (i) Pre-WTO (Beginning of data series—Nov 2001), and (ii) Post-WTO (Dec 2001—End of data series). The Post-WTO period is further divided into five sub-periods to capture the evolving impact of trade tensions (see Table 3):

- Sub-period 1: Economic Integration (Dec 2001–Aug 2007). This is the earliest unperturbed baseline, capturing the era of pure integration where market dynamics were driven by standard business cycles. It provides the benchmark d parameter to assess long-memory before the onset of geopolitical tensions.
- Sub-period 2: Nascent Security Concerns (Sep 2007–Apr 2014). This captures the beginning of the shift, characterized by growing U.S. concerns about Chinese state-backed firms and intellectual property theft.

Table 3 Estimates of d (full series)

Series	No terms	An intercept	An intercept with a linear time trend
(i) Original data			
Capacity utilization	1.05 (0.99, 1.11)	1.29 (1.23, 1.36)	1.29 (1.23, 1.36)
Export Price Index	0.97 (0.88, 1.08)	1.12 (1.03, 1.24)	1.12 (1.03, 1.23)
Import Price Index	0.98 (0.89, 1.09)	1.18 (1.09, 1.29)	1.17 (1.08, 1.29)
Ind. Production Index	0.90 (0.85, 0.97)	0.90 (0.85, 0.97)	0.90 (0.84, 0.96)
Producer Price Index	1.00 (0.93, 1.07)	1.17 (1.12, 1.23)	1.17 (1.12, 1.23)
(ii) Logged values			
Capacity utilization	1.00 (0.94, 1.06)	1.31 (1.24, 1.38)	1.31 (1.24, 1.38)
Export Price Index	0.98 (0.88, 1.09)	1.12 (1.03, 1.23)	1.12 (1.03, 1.23)
Import Price Index	0.98 (0.88, 1.09)	1.19 (1.10, 1.31)	1.18 (1.10, 1.30)
Ind. Production Index	0.97 (0.91, 1.04)	1.12 (1.07, 1.18)	1.12 (1.06, 1.18)
Producer Price Index	0.99 (0.92, 1.07)	1.16 (1.11, 1.22)	1.16 (1.11, 1.22)

The values are the estimates of the differencing parameter d , and in parenthesis, the 95% confidence intervals. The most relevant case for each series appears in bold

- Sub-period 3: Strategic Industrial Policy (May 2014–Mar 2018). This period marks China’s explicit move toward technological self-sufficiency, with the launch of the National IC Industry Development Guideline, Big Fund I, and the “Made in China 2025” plan.
- Sub-period 4: Direct Trade War and Pandemic Shocks (Apr 2018–Sep 2022). This period is defined by the direct, tit-for-tat trade war (e.g., U.S. ban on ZTE/Huawei, China’s Big Fund II) layered with the initial shocks and a significant portion of the global chip shortage triggered by COVID-19.
- Sub-period 5: Targeted Export Controls and Strategic Response (Oct 2022–End of series). This final sub-period represents the permanent bifurcation of the global semiconductor market, shifting from a broad trade war to a targeted confrontation. It begins with the U.S. export controls designed to restrict China’s access to advanced technologies. It also includes the U.S. CHIPS Act and China’s Big Fund III, allowing us to capture the long-term impact of state-led industrial policy. We hypothesize that d in this period will be significantly higher, potentially ≥ 1 , indicating a permanent structural shift in the industry’s risk profile.

To evaluate the robustness of our chosen sub-periods, we conducted endogenous structural break tests following Bai and Perron (2003). The results largely corroborate the historically motivated chronology. For the Industrial Production series, a single-break test identifies a shift in September 2017, just months prior to the formal onset of the 2018 Trade War. In the case of Capacity Utilization, the test identifies a major break in January 1992, matching the historical pivot of U.S. anti-dumping measures against South Korean DRAM products and validating the model’s sensitivity to policy shocks. Similarly, the Producer Price Index exhibits a break in February 2007, coinciding with the ‘Nascent Security’ era marked by the 3Com/Huawei regulatory pushback. While the price indices (Export/Import) did not yield statistically significant endogenous breaks—potentially due to the finite-sample constraints inherent in $I(d)$ processes—the alignment of the production and domestic price breaks with our exogenous timeline suggests that the data movements are consistent with the geopolitical narrative.

Consequently, we utilize the milestones of our exogenous breaks as a narrative framework. This allows us to test if the $I(d)$ parameters vary across distinct geopolitical regimes, providing a qualitative-to-quantitative bridge between policy shifts and industry persistence. The visual representation of these sub-periods is provided in Figs. 1 and 2. Figure 1 displays domestic industry metrics (Industrial Production, Capacity Utilization, and the Producer Price Index), while Fig. 2 focuses on trade-related price indices (Export and Import Prices). The vertical dashed lines in these figures mark the geopolitical boundaries of each sub-period, providing a narrative context for the statistical shifts observed.

To test our central hypothesis, we adopt the approach of testing the fractional differencing parameter, d , across the five pre-defined sub-periods, where the start/end dates correspond to key policy milestones. In summary, the econometric methodology provides a precise analysis of the long-term impact of geopolitical tensions. By partitioning the sample into five policy-driven sub-periods and estimating the differencing parameter for each subsample, we move beyond the rigid $I(0)/I(1)$ dichotomy

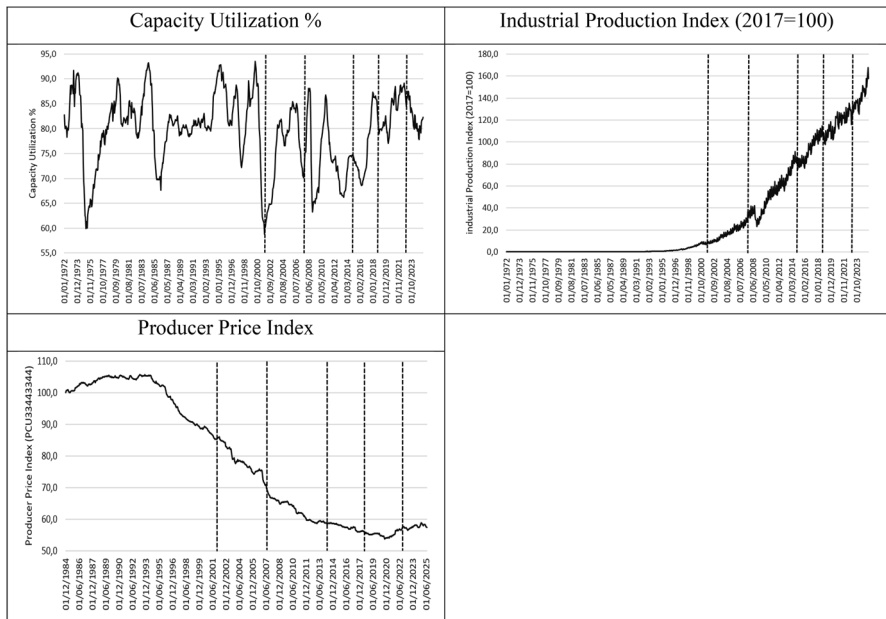


Fig. 1 Domestic industry series. Vertical dashed lines indicate key geopolitical milestones (see Table 2). Source: Board of Governors of the Federal Reserve System (Capacity Utilization and Industrial Production Index) and Bureau of Labor Statistics (Producer Price Index) via FRED. Own elaboration

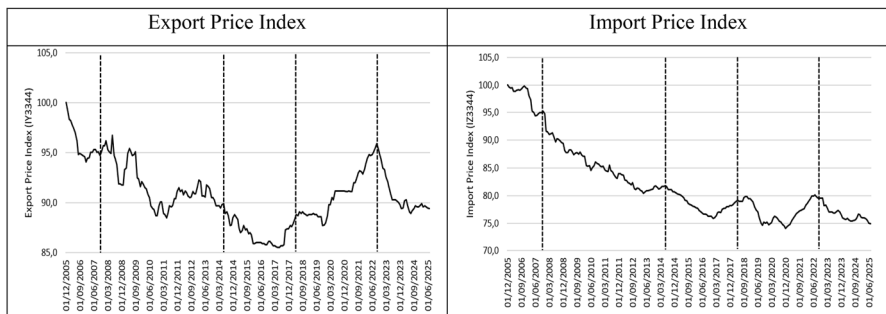


Fig. 2 Export and Import Price Index. Vertical dashed lines indicate key geopolitical milestones (see Table 2). Source: Bureau of Labor Statistics via FRED. Own elaboration

to quantify the degree of long-memory (d) across different phases of the US-China rivalry. The resulting fractional integration parameters will reveal the persistence of shocks to the semiconductor supply chain and provide a direct, interpretable measure of how policy interventions have fundamentally altered the industry's structural stability and risk profile.

Table 2 Relevant periods and sub-periods for the analysis

Period	Sub-periods
Pre-WTO period	Beginning of series, 2001-12-01
Post-WTO period	Sub-period 1. Economic integration: 2001-12-01, 2007-09-27
	Sub-period 2. Nascent security concerns: 2007-09-28, 2014-06-23
	Sub-period 3. Strategic Industrial Policy: 2014-06-24, 2018-04-15
	Sub-period 4. Trade War and Pandemic Shocks: 2018-04-16, 2022-10-06
	Sub-period 5. Targeted Export Controls: 2022-10-07, onwards

Source: FRED database. Own elaboration

5 Empirical results

The empirical analysis is structured in two parts: first, we present the results for the full sample, which establishes the general persistence properties of the series; second, we analyze the estimates of the fractional differencing parameter across the sub-periods defined in Sect. 4 to test the central hypothesis regarding the impact of the U.S.-China rivalry.

5.1 Full-sample fractional integration analysis

With the original data of the series, mean reversion is only obtained for the Industrial Production Index, with an estimate of d equal to 0.90 (see Table 3i). For all the other series—capacity utilization, export/import price and producer price indices—the estimates of d are significantly higher than 1. This strong evidence of $d > 1$ (super-persistence) implies that external shocks have permanent effects on these series. From an industrial economics perspective, this suggests that the US semiconductor market exhibits significant structural rigidities that prevent quick re-equilibration. Instead, the high fixed costs and strategic nature of the industry mean that a single disruption—such as a trade tariff or a global shortage—fundamentally resets the industry’s baseline, preventing a return to prior price or production levels. Notably, when considering the log-transformed Industrial Production Index, the estimate of d increases to 1.12 with intercept and trend (see Table 3ii), thereby rejecting mean reversion. This confirms that once accounting for exponential growth or volatility, the entire semiconductor ecosystem exhibits permanent structural responses to shocks.

A positive time trend is found in the original data for the Industrial Production Index and the Producer Price Index, with a negative one for the Import Price Index (See Appendix Table 11-i). For the Producer Price Index, the log-transformed data indicates a significant, albeit small, negative time trend (−1.85), which is consistent with the long-term deflationary pressure predicted by Moore’s Law (see Appendix Table 11-ii). Seasonality seems only relevant for the Industrial Production Index.

Using homogenized data with all series starting at 2005m12, the results are very similar to those above, showing evidence of no reversion to the mean in all cases, now including the Industrial Production Index (original data). For this series, an estimate of d is below 1, but the unit root null hypothesis cannot be rejected using the

confidence band. The only significant trend is found also in this case with a positive value. Again, seasonality is only important for this variable (See Table 4 and Appendix Table 12).

In summary, the full-sample analysis suggests that the U.S. semiconductor industry is predominantly characterized by non-stationary processes with permanent shocks, which contrasts with the short-memory behavior typically associated with efficient markets.

5.2 Fractional integration with structural breaks

To test whether the U.S.-China rivalry caused a structural shift in persistence, the data was analyzed using the sub-periods defined in Sect. 4. This analysis reveals distinct changes in the long-memory parameter, particularly in the series most sensitive to supply-chain dynamics.

Comparing pre-WTO and post-WTO data, there are no substantial overall differences: the estimate of d is significantly above 1 in capacity utilization and Producer Price Index in both sub-periods (see Table 5). The Industrial Production Index is very similar (0.92 pre-WTO vs. 0.93 post-WTO), though the former suggests mean reversion (95% confidence band below 1), while this hypothesis cannot be rejected in the post-WTO sub-period. Nevertheless, performing tests of equality in the orders of integration (Hualde, 2013) we were unable to reject the null hypothesis of homogeneity in the integration orders.

Table 4 Estimates of d (homogenized series 2005m12)

Series	No terms	An intercept	An intercept with a linear time trend
(i) Original data			
Capacity utilization	0.99 (0.90, 1.11)	1.54 (1.40, 1.73)	1.55 (1.39, 1.73)
Export Price Index	0.97 (0.88, 1.08)	1.11 (1.02, 1.23)	1.11 (1.02, 1.22)
Import Price Index	0.99 (0.90, 1.09)	1.18 (1.09, 1.29)	1.17 (1.08, 1.28)
Ind. Production Index	0.93 (0.82, 1.07)	0.95 (0.86, 1.07)	0.95 (0.84, 1.07)
Producer Price Index	0.99 (0.91, 1.10)	1.19 (1.12, 1.30)	1.19 (1.11, 1.29)
(ii) Logged values			
Capacity utilization	0.98 (0.90, 1.09)	1.56 (1.41, 1.75)	1.56 (1.41, 1.75)
Export Price Index	0.98 (0.88, 1.09)	1.11 (1.02, 1.23)	1.11 (1.02, 1.23)
Import Price Index	0.98 (0.88, 1.09)	1.19 (1.10, 1.31)	1.18 (1.09, 1.30)
Ind. Production Index	0.95 (0.86, 1.06)	1.04 (0.95, 1.16)	1.04 (0.95, 1.16)
Producer Price Index	0.98 (0.88, 1.09)	1.18 (1.10, 1.28)	1.17 (1.10, 1.27)

The values are the estimates of the differencing parameter d , and in parenthesis, the 95% confidence intervals. The most relevant case for each series appears in bold

Table 5 Estimates of d (Pre-WTO and Post-WTO)

Series	Pre-WTO			Post-WTO		
	d (95% band)	Intercept (tvalue)	Time trend (tvalue)	d (95% band)	Intercept (tvalue)	Time trend (tvalue)
Capacity utilization	1.22 (1.16, 1.30)	4.420 (242.30)	–	1.54 (1.40, 1.70)	4.087 (305.01)	–
Export Price Index	–	–	–	1.12 (1.03, 1.23)	4.606 (224.20)	–
Import Price Index	–	–	–	1.19 (1.10, 1.31)	4.606 (891.41)	–
Industrial Production	0.92 (0.86, 0.99)	–3.561 (–43.20)	0.0158 (5.61)	0.93 (0.85, 1.01)	1.999 (16.97)	0.0107 (2.19)
Producer Price Index	1.18 (1.11, 1.26)	4.604 (1565.05)	–	1.14 (1.07, 1.23)	4.452 (829.53)	–0.0014 (–2.17)

The values are the estimates of the differencing parameter d , and in parenthesis, the 95% confidence intervals

A nuanced analysis by variable and sub-period reveals distinct changes in the long-memory parameter, particularly in the series most sensitive to supply-chain dynamics. For capacity utilization (see Table 6i and Fig. 3i), d is consistently and significantly above 1 for Sub-periods 1 through 4 (economic integration through trade war). This indicates that capacity utilization historically exhibited persistent, non-mean-reverting fluctuations, reflecting slow adjustments to capital-intensive investment cycles.

By contrast, Sub-period 5 (targeted export controls) shows a dramatic drop in persistence, where the unit root null hypothesis is rejected in favor of mean reversion. The imposition of targeted, rigid export controls and domestic investment (e.g., the CHIPS Act) appears to have resulted in a statistically more stable regime for capacity utilization, where shocks are now temporary. A significant negative time trend is also found, possibly reflecting the mandated re-allocation of production capacity or a deceleration in domestic utilization growth. This represents a clear structural change.

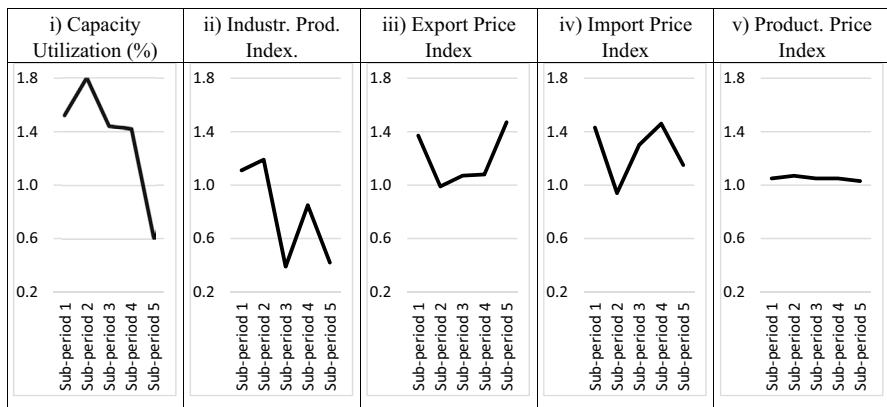
The Industrial Production Index shows the most dynamic changes in persistence across the geopolitical timeline (see Table 6ii and Fig. 3ii). During Sub-periods 1 & 2, d is near or above 1 (e.g., Sub-period 2), suggesting non-stationarity during the early years of interdependence and initial security concerns. In Sub-period 3, d drops sharply ($d=0.39$), providing strong evidence of stationary long memory. This change corresponds to the 2014–2018 era when China’s “Made in China 2025” plan accelerated global production, possibly introducing a more stable, highly-autocorrelated long-memory dynamic driven by sustained policy efforts, rather than non-reverting stochastic shocks. In Sub-period 5, persistence stays low ($d=0.42$). While the confidence band contains 1, the point estimate is consistent with the long-memory structure found in Sub-period 3, suggesting that production dynamics remain highly correlated but potentially mean-reverting.

For the Export Price Index, persistence is highest in Sub-period 1 ($d=1.37$) and Sub-period 5 ($d=1.47$), while the unit root null hypothesis cannot be rejected in Sub-periods 2, 3, or 4 (see Table 6iii and Fig. 3iii). The increasing non-stationarity in the final period suggests that supply chain fragmentation and loss of market access due to

Table 6 Estimates of d in the sub-periods

	Subperiods	d (95% band)	Intercept (tvalue)	Time trend (tvalue)
(i) Capacity utilization (%)	Sub-period 1	1.52 (1.36, 1.79)	4.087 (433.93)	–
	Sub-period 2	1.80 (1.55, 2.16)	4.256 (284.11)	–
	Sub-period 3	1.44 (1.28, 1.72)	4.310 (536.77)	–
	Sub-period 4	1.42 (1.13, 1.89)	4.456 (373.77)	–
	Sub-period 5	0.61 (0.30, 0.99)	4.468 (275.64)	– 0.0028 (– 2.50)
(ii) Industrial Production Index	Sub-period 1	1.11 (0.85, 1.38)	1.981 (10.98)	–
	Sub-period 2	1.19 (1.03, 1.40)	3.408 (23.76)	–
	Sub-period 3	0.39 (0.25, 0.57)	4.362 (92.93)	0.0061 (3.51)
	Sub-period 4	0.85 (0.65, 1.14)	4.369 (75.76)	–
	Sub-period 5	0.42 (0.14, 1.13)	4.818 (120.95)	0.0072 (3.48)
(iii) Export Price Index	Sub-period 1	1.37 (1.15, 1.67)	4.608 (1083.32)	–
	Sub-period 2	0.99 (0.82, 1.22)	4.550 (611.22)	–
	Sub-period 3	1.07 (0.89, 1.39)	4.487 (983.89)	–
	Sub-period 4	1.08 (0.91, 1.33)	4.485 (1130.95)	0.0013 (1.82)
	Sub-period 5	1.47 (1.22, 2.01)	4.553 (1450.26)	–
(iv) Import Price Index	Sub-period 1	1.43 (1.16, 1.84)	4.606 (953.38)	–
	Sub-period 2	0.94 (0.80, 1.14)	4.554 (662.74)	– 0.0018 (– 3.48)
	Sub-period 3	1.30 (1.19, 1.47)	4.405 (1648.62)	–
	Sub-period 4	1.46 (1.28, 1.74)	4.372 (1030.32)	–
	Sub-period 5	1.15 (0.84, 1.48)	4.377 (944.29)	–
(v) Production Price Index	Sub-period 1	1.05 (0.86, 1.30)	4.453 (569.93)	– 0.0033 (– 2.92)
	Sub-period 2	1.07 (0.92, 1.29)	4.218 (966.49)	– 0.0018 (– 2.88)
	Sub-period 3	1.05 (0.83, 1.38)	4.074 (1192.15)	–
	Sub-period 4	1.05 (0.93, 1.23)	4.029 (806.21)	–
	Sub-period 5	1.03 (0.67, 1.55)	4.053 (732.04)	–

The values in parenthesis in columns 4 and 5 are the t-values for the intercept and the time trend respectively. – indicates lack of significance

**Fig. 3** Order of integration d in Sub-periods 1 to 5. Source: Own elaboration

targeted controls have intensified the permanent impact of price shocks on U.S. semiconductor exports. This finding is consistent with the broader international evidence provided by Attinasi et al. (2023), who demonstrate that geopolitical ‘friend-shoring’ and the resulting fragmentation of global value chains strip international markets of their traditional ability to smooth out price fluctuations.

Ultimately, this confirms that targeted controls increased the long-run impact of export price shocks, signaling heightened volatility and permanent market fragmentation. Furthermore, this escalation of non-stationarity in export prices provides empirical evidence of how “weaponized interdependences” dynamically reshape international markets in alignment with recent conceptualizations of strategic value-chain disruptions (Farrell & Newman, 2019; Guarascio et al., 2025). When strategic dependencies are concentrated within specific technological chokepoints, the unilateral imposition of export controls strips the global value chain of its traditional capacity to absorb and smooth out macroeconomic shocks. Consequently, the international trade interface becomes an open conduit for permanent friction, disrupting the pursuit of digital sovereignty by forcing trading partners to operate under a regime of persistent, unyielding price shocks.

For the Import Price Index, d is significantly above 1 and highly non-stationary across all key policy periods except for Sub-periods 2 and 5 (where non-stationarity cannot be rejected). The estimate generally remains high, reflecting that global semiconductor price shocks are permanent to the U.S. economy, consistent with the industry’s concentrated global supply structure (See Table 6iv and Fig. 3iv).

Finally, for the Production Price Index, the unit root null hypothesis cannot be rejected in any subsample, and the estimates of d are quite similar across them (see Table 6v and Fig. 3v). The fractional parameter remains extremely stable across all sub-periods. Unlike capacity utilization, the geopolitical conflict has not led to a statistically significant change in the persistence of domestic prices; they remain driven by factors that cause permanent stochastic shifts, possibly reflecting the high cost and permanence of investments in fabrication facilities.

In summary, the structural break analysis in Sub-period 5 reveals a clear market bifurcation as targeted export controls took effect. The Capacity Utilization Index experienced a dramatic shift toward stability, moving from a highly non-stationary process ($d \approx 1.5$) to a mean-reverting process ($d = 0.61$). From an industrial economics perspective, this suggests that domestic production has become more resilient and “shielded.” While shocks still possess long-memory characteristics, the internal market now has an inherent equilibrating force. This stabilization implies that state-led strategies—most notably the CHIPS and Science Act—have successfully insulated the U.S. industrial base through domestic subsidies and restrictive investment covenants. Crucially, this result aligns with the empirical evidence provided by Erten et al. (2024), who demonstrate that the CHIPS Act has already catalyzed significant employment and investment shifts, often occurring in anticipation of the legislation. Such interventions ensure that domestic factory floors operate within a managed regime that prioritizes structural resilience over global market volatility.

Conversely, the Export Price Index became significantly more non-stationary, jumping to $d = 1.47$ and indicating an intensified, permanent impact of shocks on U.S. exports. This super-persistence suggests that the international trade interface has

become the primary conduit for geopolitical friction, where price spikes no longer mean-revert but instead establish a new, higher baseline. The divergence observed between domestic capacity utilization and export prices provides statistical evidence that the U.S.-China rivalry has created an irreversible division: the internal market has become more stable and resilient, while the external market has become permanently volatile. By pushing instability onto the export border, policymakers have achieved a form of “technological sovereignty” at the cost of a fragmented global trade environment.

5.3 Robustness checks: sectoral comparisons and sample sensitivity

To ensure that the observed super-persistence is a structural feature of the semiconductor industry—and not a general characteristic of durable manufacturing or an artifact of the NAICS 3344 aggregation—we conduct a series of robustness checks. More precisely, we compare our baseline results (Semiconductors and other electronics, NAICS 3344) with more granular technology series and broader industrial aggregates.

The results reveal a clear hierarchy: as the “high-tech” intensity and capital complexity of the series increase, the order of integration (d) rises significantly (Table 7).

Table 7 Comparative order of integration (d)—robustness checks

Series	FRED Code	Series description	d (95% bands)
Logged values			
Baseline	IPG3344N	Original ser.: semicond. and other electron	0.97 (0.91, 1.04)
Core technol.	IPB53122S	Semicond., printed circ. boards, and other	1.49 (1.43, 1.56)
High-tech focus	IPG334S	Computer and electronic product	1.31 (1.26, 1.35)
	IPG3342S	Communications equipment	1.21 (1.16, 1.27)
	IPB53121S	Computer and other board assemblies	1.09 (1.06, 1.13)
Broad and traditional manufacturing	IPX4HTMVS	Manuf. excl. hi-tech and motor vehicles	1.18 (1.13, 1.25)
	IPX4HTK2S	Manuf. excl. computers and semiconductors	1.15 (1.09, 1.23)
	IPG3335S	Electrical equipment and appliances	1.13 (1.09, 1.19)
	IPG3364S	Aerospace product and parts	1.07 (1.01, 1.14)

The original baseline yields a d of 0.97, behaving essentially as a standard unit root (I(1) process. However, when isolating the Core Technology (Semiconductors, PCBs, and Other—IPB53122S), the estimate of d jumps to 1.49 (1.43, 1.56). This confirms that the super-persistent long-memory property is a distinct feature of the semiconductor core, which is often “masked” or diluted when aggregated into broader industry classifications that include lower-technology components. This aggregation effect is consistent with the theoretical framework of Robinson (1978) and Granger (1980), where the combination of heterogeneous micro-processes can manifest as macro-level fractional integration; here, the ‘dilution’ in NAICS 3344 suggests that the hyper-persistence is a specific property of the leading-edge semiconductor units.

This disaggregation is particularly salient given recent industrial policies, such as the CHIPS and Science Act, which primarily target leading-edge logic and AI processors. Our results in Table 7 confirm that as we move from aggregates toward these specialized technology cores, the degree of long-memory persistence increases, suggesting that the ‘geopolitical sensitivity’ of a series is positively correlated with its order of integration (d).

In contrast, traditional durable goods—such as aerospace (1.07) and electrical equipment (1.13)—remain closer to the unit root boundary. Crucially, the 95% confidence intervals for the Core Technology group do not overlap with those of the baseline or the traditional manufacturing sectors, providing unambiguous statistical evidence that the semiconductor core represents a unique outlier in the U.S. industrial base.

Additionally, to validate our central hypothesis regarding the impact of the U.S.-China rivalry, we repeat the sub-period analysis using the semiconductors, printed circuit boards, and other series (IPB53122S). As shown in Table 8, this series provides a powerful validation of the market bifurcation narrative. During Sub-periods 1–4 the semiconductor core exhibited extreme super-persistence (d ranging from 1.43 to 1.86). However, a dramatic structural shift occurs in Sub-period 5 (Targeted Export Controls). Consistent with our findings for capacity utilization, the d parameter for the semiconductor core collapses to 1.06. In this final sub-period, the 95% confidence interval (0.82, 1.72) includes the value of 1.0; consequently, the unit root null cannot be rejected. This transition from a super-persistent regime ($d \approx 1.5$) to a standard unit root regime ($d \approx 1.0$) suggests that recent policy interventions—such as

Table 8 Estimates of d . semiconductors, printed circuit boards, and other

	Sub-periods	d (95% band)	Intercept (tvalue)	Time trend (tvalue)
Dur. Goods Materials: Semiconductors, Printed Circuit Boards, and Other—IPB53122S	Sub-period 1	1.55 (1.35, 1.91)	170.95 (1.81)	0.026 (3.02)
	Sub-period 2	1.86 (1.59, 2.25)	3.303 (212.73)	–
	Sub-period 3	1.54 (1.38, 1.79)	4.400 (784.56)	–
	Sub-period 4	1.43 (1.07, 1.98)	4.659 (367.23)	–
	Sub-period 5	1.06 (0.82, 1.72)	4.874 (375.05)	0.008 (1.72)

The values in parenthesis in columns 4 and 5 are the t-values for the intercept and the time trend respectively. – indicates lack of significance

the CHIPS Act and targeted export restrictions—have successfully “de-coupled” the core technology from the compounding, non-stationary volatility of the global market, effectively stabilizing the domestic industrial dynamics. Further, the recent push for the creation of a ‘Unified Economic Statecraft Entity’ to manage the semiconductor supply chain and long-term technological security (U.S.-China Economic and Security Review Commission, 2025), supports the idea that this shift is not merely a transient reaction to a ‘trade war’ but reflects a permanent institutionalization of U.S. industrial strategy.

Finally, we also conduct a sensitivity test to address the reliability of the d parameter when estimated over relatively short horizons, such as the post-October 2022 window (Sub-period 5). By merging Sub-period 4 (trade war and pandemic) and Sub-period 5 (targeted export controls) into a single “Conflict and Crisis” period spanning April 2018 to July 2025, we obtain a more robust sample ($N=87$) to verify if the observed shifts in persistence are structural or merely artifacts of sample size.

The results of this analysis (Table 9) confirm the robustness of the industry’s divergent dynamics. Notably, the Capacity Utilization Index yields a point estimate of $d=1.07$ in the merged sample; while higher than the $d=0.61$ found in the standalone Sub-period 5, it represents a substantial and statistically significant decline from the extreme super-persistence observed in the earlier integration and security-concern eras (d ranging from 1.52 to 1.80). Although the 95% confidence interval (0.91, 1.33) now includes the value of 1.0, meaning the unit root null hypothesis cannot be rejected for this broader period, the downward shift toward the $I(1)$ boundary suggests that the ‘persistence collapse’ identified in the most recent period is part of a broader structural trend toward domestic stabilization.

The Export and Import Price Indices maintain high degrees of super-persistence ($d=1.33$ and 1.39, respectively), with 95% confidence intervals strictly above the unit root boundary. This reinforces our finding that the international trade interface has become a permanent conduit for non-reverting geopolitical shocks throughout the entire trade war era. Finally, the Producer Price Index ($d=1.05$) and Industrial Production ($d=0.88$) remain remarkably consistent with their full-sample estimates, suggesting that the underlying capital-intensive nature of semiconductor manufacturing imposes a “persistence floor” that remains resilient to varying sample specifications.

Table 9 Estimates of d : merged “conflict and crisis” period (2018m04–2025m07)

The values in parenthesis in column 2 are the 95% confidence bands for d ; those in column 3 are the t -values for the intercept: – indicates lack of significance at the 5% level

Series	d (95% bands)	Intercept (tv)	Time trend (tv)
Capacity utilization	1.07 (0.91, 1.33)	86.224 (70.40)	–
Export Price Index	1.33 (1.19, 1.51)	88.800 (270.95)	–
Import Price Index	1.39 (1.24, 1.60)	79.255 (235.06)	–
Ind. Production Index	0.88 (0.74, 1.09)	103.644 (14.77)	–
Producer Price Index	1.05 (0.92, 1.24)	56.211 (190.27)	–

6 Conclusions

This paper investigates whether the U.S.-China rivalry has fundamentally altered the long-term persistence of the U.S. semiconductor industry's economic dynamics, utilizing a fractional integration framework with geopolitical structural breaks. The analysis reveals that the majority of the series initially exhibit super-persistence, where shocks have permanent and potentially explosive effects, justifying a long-memory approach beyond standard unit root tests. However, the true significance lies in the sub-period analysis, which provides statistical evidence of a complex market bifurcation. The most critical finding is the economic and statistical divergence in persistence following the October 2022 Targeted Export Controls.

Specifically, the Capacity Utilization Index has shifted from a highly non-stationary process to a mean-reverting, stationary process in the final period ($d=0.61$). This change indicates that domestic operational logic has transitioned from a market-driven regime to a policy-buffered one. We argue that the CHIPS Act functions as a structural counter-cyclical cushion; by providing capital grants and domestic-content incentives, these policies decouple domestic utilization from pro-cyclical volatility propagation—a stabilization corroborated by the localized employment and investment shifts documented by Erten et al. (2024). By acting as a structural floor, this framework prevents the amplification of demand shocks, ensuring that domestic supply fluctuations are no longer permanent but are pulled back toward a policy-induced mean. In stark contrast, the Export Price Index reached its highest persistence, signaling that geopolitical “frictions” have inhibited global price-smoothing mechanisms. In a fragmented market, export prices can no longer be equilibrated through global arbitrage; instead, decoupling traps inflationary shocks within specific trade corridors, making export profitability permanently vulnerable to external geopolitical shifts.

This statistical bifurcation empirically reflects how ‘weaponized interdependence’ (Farrell & Newman, 2019) and supply-chain bottlenecks alter the hierarchical competitive positioning of economies, thereby shaping the modern pursuit of digital sovereignty (Guarascio et al., 2025). Our results expose a stark structural boundary to such policy: state-backed incentives can stabilize the domestic factory floor, but they ultimately shift permanent price volatility onto the international trade interface.

Furthermore, the Industrial Production Index shows a beneficial shift toward a stationary long-memory process during periods of focused industrial strategy. This demonstrates that production is now being governed by sustained, long-term policy drivers that provide a stable “floor” for output, rather than being subject to pure non-reverting stochastic trends. Conversely, the Producer Price Index (PPI) proved highly resilient to policy, remaining statistically invariant across all geopolitical breaks and adhering to a pure unit root process. This confirms a fundamental supply-side rigidity inherent in the industry's capital structure. While state-led initiatives can dictate where chips are made and how much capacity is utilized, it cannot override

the massive fixed-cost depreciation schedules and specialized input costs that define the sector. This suggests that the “high-cost” profile of domestic manufacturing is a structural reality that remains exogenous to current geopolitical tensions.

These results firmly validate the central hypothesis that national security policies have fundamentally altered the industry’s economic profile in a complex and divergent manner. Our sectoral robustness analysis reinforces this validity by identifying a ‘High-Tech Persistence Gradient,’ demonstrating that as technological intensity increases, the order of integration (d) rises. Crucially, isolating the high-end technology core confirms that this super-persistence is not an artifact of data aggregation but an intrinsic feature of the semiconductor supply chain, where the compounding effect of global shocks is most extreme. While our primary analysis relies on historically motivated sub-periods, the endogenous break tests (Bai & Perron, 2003) verified that the empirically detected shifts largely coincide with these milestones.

Finally, though our fractional integration approach provides robust empirical evidence of persistent price shocks, certain limitations should be acknowledged. First, robustness checks indicate that the estimated fractional integration parameters ($d > 1$) remain highly consistent across alternative sectoral definitions, but our reliance on macro-level indices aggregates heterogeneous product categories, which may obscure distinct sub-sectoral dynamics. Second, even though we capture the most critical phases of recent geopolitical friction, the different time-horizons of the series constrain our capacity to evaluate long-run, cross-decade structural dynamics under an identical temporal window.

To address these limitations, future research should extend these long-memory models to test whether the observed extreme persistence ($d > 1$) represents a permanent structural transformation of global trade. In doing so, utilizing specialized fractional break procedures could further refine the lead-lag relationship between specific policy enactments and the evolution of this statistical persistence. Additionally, it would be insightful to scale this framework by integrating multi-country input-output networks to track how these non-stationary price shocks cascade down to the firm level across different institutional frameworks, such as U.S. industrial policies versus European strategic autonomy.

Appendix

See Tables 10, 11 and 12.

Table 10 Series of data used in the analysis

FRED series	Data range	Units	Main descriptive statistics
PCU33443344 Producer price index by industry: semiconductor and other electronic component manufacturing	Dec 1984–Jul 2025	Index Dec 1984 = 100, not seasonally adjusted	$N=488$ Mean = 78.723 Standard deviation = 19.528 Max = 105.700 Min = 53.800
IY3344 Export Price Index (NAICS): semiconductor and other electronic component manufacturing	Dec 2005–Jul 2025	Index Dec 2005 = 100, not seasonally adjusted	$N=236$ Mean = 90.823 Standard deviation = 3.065 Max = 100.000 Min = 85.500
IZ3344 Import Price Index (NAICS): semiconductor and other electronic component manufacturing	Dec 2005–Jul 2025	Index Dec 2005 = 100, not seasonally adjusted	$N=236$ Mean = 82.061 Standard deviation = 6.836 Max = 100.000 Min = 74.000
IPG3344N Industrial production: manufacturing: durable goods: semiconductor and other electronic component (NAICS = 3344)	Jan 1972–Jul 2025	Index 2017 = 100, not seasonally adjusted	$N=643$ Mean = 32.005 Standard deviation = 45.481 Max = 167.837 Min = 0.028
CAPUTLG3344S Capacity utilization: manufacturing: durable goods: semiconductors and other electronic components (NAICS = 3344)	Jan 1972–Jul 2025	Percent, seasonally adjusted	$N=643$ Mean = 79.387 Standard deviation = 7.307 Max = 93.520 Min = 58.778

Source: FRED database. Price indices (PCU33443344, IY3344, and IZ3344) are provided by the Bureau of Labor Statistics (BLS); Industrial Production (IPG3344N) and Capacity Utilization (CAPUTLG3344S) series are provided by the Federal Reserve Board. Own elaboration

Table 11 Estimated coefficients on the selected models (full series)

Series	No terms	An intercept	An intercept with a linear time trend	Seasonal AR
(i) Original data				
Capacity utilization	1.29 (1.23, 1.36)	83.224 (62.93)	–	–
Export Price Index	1.12 (1.03, 1.24)	100.163 (194.63)	–	0.117
Import Price Index	1.17 (1.08, 1.29)	100.173 (225.32)	– 0.117 (– 1.71)	0.116
Ind. Production Index	0.90 (0.84, 0.96)	–0.457 (–2.11)	0.237 (2.70)	0.072
Producer Price Index	1.17 (1.12, 1.23)	99.951 (299.31)	0.070 (– 1.73)	0.921
(ii) Logged values				
Capacity utilization	1.31 (1.24, 1.38)	4.421 (265.39)	–	–
Export Price Index	1.12 (1.03, 1.23)	4.606 (824.20)	–	0.114
Import Price Index	1.19 (1.10, 1.31)	4.606 (889.12)	–	0.111
Ind. Production Index	1.12 (1.07, 1.18)	–3.542 (–33.39)	–	0.054
Producer Price Index	1.16 (1.11, 1.22)	4.605 (1026.04)	0.0009 (– 1.85)	0.943

The values in parenthesis in columns 3 and 4 are the t-values for the intercept and the time trend respectively. – indicates lack of significance

Table 12 Estimated coefficients on the selected models (homogenized series 2005m12)

Series	No terms	An intercept	An intercept with a linear time trend	Seasonal AR
(i) Original data				
Capacity utilization	1.54 (1.40, 1.73)	84.207 (78.13)	–	– 0.122
Export Price Index	1.11 (1.02, 1.23)	99.452 (190.35)	–	0.115
Import Price Index	1.18 (1.09, 1.29)	99.673 (222.46)	–	0.076
Ind. Production Index	0.95 (0.84, 1.07)	18.439 (2.76)	0.567 (1.65)	0.923
Producer Price Index	1.19 (1.12, 1.30)	74.644 (229.84)	–	0.056
(ii) Logged values				
Capacity utilization	1.56 (1.41, 1.75)	4.433 (322.52)	–	– 0.104
Export Price Index	1.11 (1.02, 1.23)	4.599 (810.39)	–	0.110
Import Price Index	1.19 (1.10, 1.31)	4.602 (881.14)	–	0.054
Ind. Production Index	1.04 (0.95, 1.16)	2.935 (26.751)	–	0.929
Producer Price Index	1.18 (1.10, 1.28)	4.312 (845.36)	–	0.057

The values in parenthesis in columns 3 and 4 are the t-values for the intercept and the time trend respectively. – indicates lack of significance

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Declarations

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