

# Effects of Tariff Shocks across Time, Space, and Sectors

THE ROLE OF PRODUCTION NETWORKS

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## Abstract

This study examines how protectionist trade policy shocks affect sectoral value-added and employment by focusing on shock transmission through production networks and dependence on imported intermediates. The research proceeds from a country-specific setting to progressively broader evidence, examining China and later exploring a sectoral panel design from a cross-country network perspective. Therefore, mechanisms observed in a special case are identified more systematically and then generalized. All empirical analyses implement a two-step identification strategy that (i) extracts exogenous tariff innovations from sectoral VARs and (ii) traces dynamic adjustments via Jordà-style local projections. Annual tariff measures from WTO TAO are matched to sectoral outcomes from the GGDC/UNU-WIDER Economic Transformation Database (ETD) for 1990-2018; the cross-country component additionally links WIOD/GGDC input–output tables to measure upstream exposure.

The identification strategy in this analysis is applied to matched WTO–ETD series with sectors classified by tradability by focusing on China. Estimates from the traded activities show continuous decline in value added after tariff shocks. However, employment adjustments are transient and cushioned in the near term. Activities which are non-traded display material negative spillovers with broad contractions in both value added and employment as higher upstream input costs pass through. These dynamics establish the baseline patterns that motivate disaggregation and robustness in the subsequent panel design.

Building on that baseline, a sector-level panel framework replaces aggregate time-series averages with disaggregated dynamics for 41 developing and emerging economies (1990-2018), combining panel VARs with local projections and incorporating sector and year fixed effects. This design quantifies heterogeneity across industries and the strength of spillovers into non-traded activities, possibly implied by input–output linkages. The estimates indicate that tariff shocks depress value added in traded activities while near-term employment buffering is concentrated in politically sensitive segments. A compact comparative extension places China's responses alongside those of other economies within the same data infrastructure which shows similar adverse effects elsewhere and a somewhat attenuated sensitivity for China.

The cross-country chapter reinforces the spillover mechanism developed in the earlier analysis. It constructs a harmonized sectoral panel across countries by incorporating input–output exposure measures and applying a two-step identification strategy to trace adjustment over a six-year horizon. The findings reveal that the protected traded activities tend to register gains in value added without corresponding durable increases in employment. On the other hand, downstream non-traded activities face immediate and persistent declines in both value added and employment. This implies that the effects of tariffs on sectoral performance operate primarily through production-network linkages rather than within isolated sectoral boundaries. Further, the extent of dependence on imports conditions the outcome. As a more dependent country has global value chains experience sharper and longer-lasting contractions, whereas those with lower dependence display comparatively greater resilience.

Across designs and samples, the thesis shows that tariff shocks do not remain confined to targeted industries. They propagate through production networks, create divergences between value-added and employment dynamics, and their magnitude and persistence are shaped by imported-input intensity and the depth of global value-chain integration. While tariffs can stabilize employment for a time in sensitive activities, they impose sizable systemic costs on efficiency and inclusive growth—particularly in economies tightly wired into international supply chains. Effective industrial strategy in such settings requires pairing any temporary protection with credible, sustained investment in structural upgrading.

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## Author's Declaration

I declare that this thesis is my own work and has not been submitted in substantially the same form for the award of a higher degree at this or any other institution. All sources used in the preparation of this thesis have been properly acknowledged and referenced.

The dissertation is composed of three substantive chapters, each written as a stand-alone research paper. While the chapters are related in theme and methods, all analysis, data construction, and writing were carried out independently by the author. No part of the thesis is the product of joint work, and no material has previously been published in peer-reviewed outlets at the time of submission.

The empirical analysis relies on publicly available secondary data sources, including the WTO Tariff Analysis Online facility, the GGDC/UNU-WIDER Economic Transformation Database, and the WIOD/GGDC input–output tables. No primary data collection involving human subjects was undertaken, and therefore no ethical approval was required.

I confirm that this declaration is a true statement and that, to the best of my knowledge, this thesis is free from plagiarism and academic misconduct.

## Introduction

### 1. Background and Motivation

There has been a reorganization of international production based on the input-output relationship. The reduction in the coordination costs has enabled firms to manage complex tasks across borders more efficiently. It has also cheaper sources of supply more accessible. This has both expanded trade and altered the structure of production. Domestic value creation is now closely tied to imported intermediates and to the reliability of upstream suppliers, whether located at home or abroad. This framework thus made the line between traded and non-traded activities increasingly porous. Construction depends on metals and machinery; retail and logistics draw on imported transport equipment and fuel; and business services rely on information and communication technologies embedded in global supply chains. The economy is therefore best understood not as a collection of discrete industries but as a web of interdependencies in which cross-sectoral linkages determine production costs, profit margins, and employment outcomes.

Protectionism has re-emerged at the center of policy debates. The tariff escalations of the Sino–U.S. trade conflict exemplify a broader shift toward industrial strategy, resilience, and the management of geopolitical risk. Tariffs are deployed not only to shield domestic producers and encourage investment through reweighted supply chains, but also to safeguard strategic sectors from external shocks. The analysis therefore examines how a networked production system responds to changes in border taxes. Within global value chains, tariffs function not merely as wedges on final-goods trade but as shocks to input costs that propagate across sectors through interlinked production channels.

The traditional arguments against protectionist trade policy become less evident once contemporary production networks are taken into account. The case for openness rests on the expectation that trade enhances productivity and income through specialization, competition, and access to foreign technologies (Grossman & Helpman, 1991; Edwards, 1993; Sachs & Warner, 1995). Conversely, protectionist approaches emphasize the importance of fostering new industries, preserving policy flexibility, and protecting employment in vulnerable sectors, particularly in developing economies (Young, 1991; Redding, 1999). Both perspectives, however, often overlook the reality of interlinked supply chains. A tariff may shield a domestic industry from foreign competition while simultaneously raising costs by increasing the price of imported inputs. The ultimate effect on profitability depends on the reliance on foreign components and its position within the production chain. Service sectors, though less exposed to direct international competition, are also affected when higher import costs raise their operating expenses by reducing profitability and employment (McMillan & Verduzco, 2011; Newfarmer & Sztajerowska, 2012).

The timing of economic adjustments over time is also important. Employment and output rarely respond in tandem to tariff shocks. Firms often postpone layoffs due to firing costs, social pressure, or expectations of a temporary recovery, a dynamic consistent with labour hoarding

(Bäurle, Lein, & Steiner, 2021). In the short term, such strategies create an illusion of stability: jobs appear preserved even as profitability is squeezed. Over the longer run, however, rising input costs cascade through production networks, gradually depressing activity even in sectors far removed from direct exposure to foreign competition. Empirical evidence shows that financially constrained firms are less able to hoard labour, accelerating the eventual adjustment (Giroud & Mueller, 2017; Chen & Kao, 2020). This lagged and uneven transmission is politically significant. The visible short-term benefits of protection are weighed against dispersed long-run costs that are harder to trace back to trade policy.

Previous research often lacks the combination of sectoral resolution, dynamic adjustment analysis and awareness of network position that is essential for understanding trade policy spillovers. Even when sectoral data are employed the transmission of shocks is often assumed rather than demonstrated. A key missing element is the role of imported-intermediate dependence which fundamentally shapes the persistence and magnitude of tariff spillovers but has rarely been placed at the center of analysis (McMillan & Verduzco, 2011; Newfarmer & Sztajerowska, 2012).

This dissertation seeks to identify the concrete conditions under which tariffs alter sectoral outcomes, and the channels through which these effects propagate in economies reliant on imported components. This approach builds on recent contributions showing that industrial policies and subsidies can generate significant cross-border spillovers by reshaping sectoral cost structures and comparative advantage (Juhász, Lane, & Rodrik, 2023; Rotunno & Ruta, 2024). Instead, it seeks to clarify the specific conditions under which tariffs alter outcomes for different sectors, and the pathways through which these effects spread in economies dependent on imported components. This approach is relevant to current industrial policies that use tariffs to build supply chain resilience where the intention is to reshape production or protect key sectors without fully considering the subsequent costs imposed on domestic, non-traded industries. China is a significant case study due to its deeply integrated economy into global value chains, with export sectors reliant on foreign parts and services. The traded-non-traded distinction helps analyze exposure and adjustment, as the traded sector is closely linked to the domestic non-traded sector. This distinction is relevant to many developing and emerging economies as their reliance on imported components shapes output and employment shifts. Research emphasizing network connections and sector-specific dynamics is needed to understand current policy outcomes and design effective future interventions.

In conclusion, this dissertation rests on three interrelated considerations. First, the structure of production has changed in a manner that makes network effects of tariffs pivotal. Policy analysis hence needs to move beyond border taxes on final products and consider the transmission of input-cost shocks along domestic supply chains. Second, the events of interest are sectoral and dynamic with disparate impacts on traded and non-traded activities. It is significant to track the pattern of value added and employment over time is therefore critical for economic analysis as well as political scrutiny. Third, effective external evaluation demands sensitivity to imported-intermediate dependence and network position, as economies more embedded in global value chains will experience varying effects from less foreign input-dependent economies. These considerations provide the motivation for a study that treats the

economy as an interdependent production system and asks how tariff shocks reshape value added and employment.

The empirical strategy evolves across chapters not only in sample scope but also in the way tariff shocks are defined. In Chapter 2, each sector is matched to its own tariff series, so the estimated shock is direct: agriculture, mining, manufacturing, and other activities face distinct tariff changes depending on their own border exposure. This design recovers the immediate incidence of tariffs on sectoral value added and employment. By contrast, Chapter 3 treats tariff shocks as propagating through input–output linkages. A given sector’s exposure is defined by the tariffs levied on its upstream suppliers, weighted by input dependence. This makes it possible to trace how shocks originating in traded activities transmit to non-traded sectors and to quantify the role of production networks in shaping adjustment.

## 2. Research Questions

This dissertation investigates protectionist tariff shocks through a sectoral, dynamic, and network-aware lens. The agenda proceeds from a focused country setting to a sectoral panel and then to a cross-country framework. To keep the inquiry coherent, each question below is posed at the thesis level and explicitly mapped to the chapter where it is addressed. Throughout, the outcomes of interest are value added and employment, and sectors are distinguished by tradability.

RQ1. Dynamic sectoral incidence (China as baseline).

How do tariff shocks affect value added and employment over time in traded versus non-traded sectors within a single economy? Beyond the sign of the response, what is its timing (near-term versus medium-run), magnitude, and persistence? Does the data reveal a short-run cushioning of employment alongside a contraction in value added, and if so, how quickly does this divergence close or widen as adjustment proceeds?

Addressed in: Chapter 1 (China), which provides the baseline impulse-response patterns by tradability and documents the near-term versus medium-run paths for value added and employment.

RQ2 — Cross-sector responses and sectoral heterogeneity in a panel setting.

When tariffs change, do non-traded sectors also exhibit systematic adjustments in value added and employment in addition to the responses observed in traded sectors? How large and persistent are these cross-sector effects once sector and time heterogeneity are controlled, and how do they vary across sectors when organized by tradability in the panel?

Addressed in: Chapter 2 (sectoral panel), which quantifies the size and persistence of cross-sector responses and structures heterogeneity using panel controls and sectoral classifications.

RQ3 — Network transmission as the operative channel.

Are the cross-sector responses accounted for by production-network transmission—i.e., the propagation of tariff-induced input-cost changes along input–output linkages—rather than by

isolated, sector-specific adjustments? Does this mechanism generalize across countries, and does its strength scale with imported-intermediate dependence?

Addressed in: Chapter 3 (cross-country panel), which embeds input–output exposure and explicitly tests conditioning by imported-intermediate dependence to validate network-based transmission at scale.

RQ4 — Employment–value-added divergence and policy appraisal.

Under what conditions do short-run employment responses diverge from medium-run value-added outcomes in sectors affected directly or indirectly by tariff changes, and what does this divergence imply for evaluating protection as an instrument of industrial strategy in networked economies?

Addressed in: Chapter 1 (baseline divergence in a single-economy setting), Chapter 2 (robustness and sectoral conditioning in a panel), and Chapter 3 (persistence and scaling with imported-intermediate dependence under network transmission).

### 3. Contributions

This dissertation’s first contribution is to close the sector-level, dynamic evidence gap that the background identifies. Rather than inferring aggregate effects of protection from macro correlations, the thesis recovers time paths for value added and employment by tradability within a single economy, thereby establishing what adjusts, when it adjusts, and by how much. In Chapter 1, the sectoral impulse responses show that traded sectors experience persistent contractions in value added following tariff increases, even where employment is cushioned only in the short run, and that non-traded sectors also adjust—contrary to the view that they are insulated from trade policy. These facts provide the missing dynamic map of tariff incidence across sectors, with clear differentiation between near-term and medium-run horizons. The supporting conclusion is that the political salience of short-run job stabilization must be interpreted alongside medium-run losses in value added, and that the scope of incidence extends beyond targeted activities.

The missing structured measurement of cross-sector responses and sectoral heterogeneity is addressed as the second contribution. The background argues that case-by-case inference cannot reveal how large the adjustments are outside the protected core or how long they last. In response, Chapter 2 switches from a single-economy baseline to a sectoral panel with temporal and sector restrictions. The thesis organizes variance using observable classifications present in the panel, namely tradability, and measures the magnitude and durability of modifications in non-traded industries when tariffs change. This contribution is primarily supported by the result that these cross-sector adjustments are large and systematic rather than episodic, and that, under a common empirical design, their persistence follows a consistent pattern. This transforms a simplified story about "possible spillovers" into comparable, de-identified data on the amount, duration, and relationship of movement in non-traded sectors to changes in traded sectors. Thus, it satisfies the temporal depth and sectoral resolution across contexts.

In order to directly address the background's second and third gaps—whether effects spread through production networks rather than staying limited to specific sectors and how imported-intermediate dependence affects their magnitude and persistence across economies—the third contribution demonstrates the transmission mechanism and its external validity. The observed cross-sector responses are explained by production-network transmission, or the spread of tariff-induced cost shifts via input-output links, rather than by isolated, sector-specific reactions, as demonstrated in Chapter 3, which embeds input-output exposure in a cross-country framework. Importantly, it proves that the effects' intensity and persistence increase with dependence on imported intermediaries, which explains why nations with varying places in global value chains experience varying real-economy effects from otherwise comparable tariff shocks. The brief, evidential conclusion is twofold: protected traded sectors can register value-added gains without durable employment, whereas downstream non-traded sectors face immediate and persistent declines in both value added and employment; these patterns are stronger and longer-lived where import dependence is higher. This closes the mechanism and external-validity gaps flagged in the motivation by showing not only that cross-sector effects exist, but also how and why they scale across structural environments.

A final, integrative contribution is to clarify the employment–value-added divergence that underpins the policy evaluation of protection in networked economies. Across the three chapters, the same configuration appears with increasing breadth: short-run employment stabilization can coexist with medium-run contractions in value added in tariff-affected traded sectors, and the production network carries part of the burden to non-traded activities, where value added and employment decline together. The supporting conclusion for this integrative point is that the welfare-relevant appraisal of tariffs depends on both horizon and scope. Evaluations confined to near-term job metrics overstate benefits when the medium-run deterioration of value added—together with concurrent declines in non-traded sectors—is taken into account. By repositioning the openness–protection debate on measured regularities about sectoral incidence, timing, and network propagation, the dissertation delivers the specific evidence the background motivates: baseline dynamic facts in a single economy, disciplined measurement of cross-sector responses and heterogeneity in a panel, and validation of a production-network mechanism whose impact scales with import dependence in a cross-country setting.

#### 4. Roadmap of the Dissertation

After the Introduction, the dissertation begins with Chapter 1, which develops the China baseline by matching WTO TAO tariffs to ETD sectoral outcomes over 1990–2018, grouping sectors by tradability, and estimating local-projection impulse responses to trace how tariff shocks shape value added and employment across traded and non-traded activities. Chapter 2 then shifts from a single-economy lens to a sectoral panel with identification while introducing sector and year controls; this chapter quantifies the size and persistence of the cross-sector responses—especially in non-traded activities—and organises heterogeneity using observable sectoral classifications available in the panel. Chapter 3 turns to a cross-country framework, assembling a harmonised sector–country panel for forty-one developing and emerging

economies, embedding input–output exposure, and testing whether production-network transmission accounts for the patterns documented earlier and whether their strength scales with imported-intermediate dependence. The dissertation closes with a general conclusion and discussion that synthesises the evidence, draws out the policy implications for the use of tariffs in networked economies, acknowledges limitations, and outlines directions for future research, with appendices providing additional documentation and robustness material.

## Chapter 1 The Effects of a Tariff Shock on Sector Performance in China

This chapter studies the effects of tariff shocks on sectoral performance in China. The analysis focuses on gross value added and employment in both traded and non-traded sectors. The purpose of the chapter is to document how these outcomes respond over time to changes in trade policy, and whether the responses differ across sectors with different degrees of exposure to international trade.

China is used as a baseline case. The economy is deeply integrated into global value chains, while policy intervention remains important in many sectors. Tariff increases may therefore affect production and employment through several channels. In particular, tariffs may raise input costs for firms that rely on imported intermediates, while policy measures may be used to stabilize employment. This setting makes China suitable for examining whether employment can be temporarily protected even when value added declines.

The results in this chapter provide a reference point for the rest of the thesis. Chapter 2 extends the analysis to a sectoral panel covering a broader group of developing and emerging economies. Chapter 3 then examines how tariff shocks propagate through production networks by incorporating input-output linkages. Together, the three chapters build a consistent analysis of the dynamic and cross-sectoral effects of tariffs.

### 1. Literature Review

This study is related to several strands of literature spanning international trade, macroeconomics, labor economics, and industrial organization. Given the broad and multifaceted nature of trade policy shocks, scholars have investigated their effects on economic growth, productivity, labor market outcomes, and global value chains. Our review seeks to situate the present research within this diverse body of work, highlighting both historical debates and contemporary evidence, and clarifying the gaps our analysis addresses.

#### 1.1 Protectionism and Economic Growth

The relationship between trade policy and long-run economic growth has been at the center of debate for decades. The conventional wisdom derived from neoclassical trade theory holds that openness to trade promotes efficiency, technology diffusion, and welfare gains through comparative advantage (Krugman, 1979; Grossman & Helpman, 1991). In contrast, protectionist policies are generally believed to reduce aggregate welfare by distorting resource allocation and raising consumer prices.

Empirical research from the late 20th and early 21st centuries largely supports the detrimental impact of protectionism. Seminal studies such as Sachs and Warner (1995) and Edwards (1998) documented a positive association between trade liberalization and economic growth, while Frankel and Romer (1999) used instrumental variables to show that trade increases income

levels. Rodríguez and Rodrik (2000) emphasized methodological concerns but nonetheless acknowledged that openness tends to foster growth under most conditions. More recent contributions, such as Billmeier and Nannicini (2013), Felbermayr and Gröschl (2013), and Furceri et al. (2020), reinforced the argument that protectionist policies undermine growth by restricting access to inputs, technologies, and export markets.

Yet, historical evidence reveals a more complex picture. Studies of the late 19th and early 20th centuries frequently find positive correlations between tariffs and growth, a phenomenon known as the “tariff-growth paradox.” Bairoch (1972) argued that high tariffs facilitated industrialization in Europe during this period, while Irwin (1998, 2002) and O’Rourke (2000) showed that tariffs were often associated with faster growth in emerging economies seeking to industrialize. Lehmann and O’Rourke (2011) and Schularick and Solomou (2011) further documented the protective role of tariffs in fostering infant industries before the advent of modern globalization.

The coexistence of these contradictory findings underscores the importance of context. Tariffs may promote growth in certain historical settings — particularly when they protect nascent industries with significant learning-by-doing effects — but hinder growth in more mature economies where integration into global markets is crucial. For China, which occupies a hybrid position as both a developing and a global economic power, the applicability of these historical lessons remains an open question.

## 1.2 Trade Policy and Labor Market Outcomes

Another important dimension of trade policy research concerns its effects on employment, wages, and labor market dynamics. The distributional consequences of globalization became especially salient in the aftermath of China’s entry into the WTO. Autor, Dorn, and Hanson (2013, 2016) documented the so-called “China shock” in the United States, showing that regions more exposed to Chinese import competition experienced persistent declines in manufacturing employment, lower wages, and weaker labor force participation. Pierce and Schott (2016) similarly argued that China’s accession to the WTO exacerbated job losses in the U.S. manufacturing by removing policy uncertainty surrounding its trade status.

From a theoretical perspective, standard trade models often predict that while trade liberalization may reduce employment in import-competing industries, it increases welfare overall through reallocation toward more productive sectors. However, empirical evidence suggests that adjustment costs are substantial and geographically concentrated, leaving certain communities disproportionately harmed. This has fueled a resurgence of interest in the political economy of trade policy, as dislocated workers exert pressure for protectionist measures.

The effects of tariffs on labor markets, however, are more nuanced. Fajgelbaum et al. (2020) examined the 2018-2019 Sino-US trade war and found that tariff increases were almost fully passed on to domestic consumers and importers, while retaliatory tariffs reduced U.S. exports and employment in targeted sectors. Amiti, Redding, and Weinstein (2019) highlighted the

inflationary consequences of tariffs, noting substantial increases in intermediate and final goods prices. In China, retaliatory tariffs disproportionately targeted politically sensitive U.S. sectors, such as agriculture, illustrating the strategic use of trade policy for both economic and political objectives.

For China itself, fewer studies have examined how protectionism affects domestic labor markets. While some research emphasizes the benefits of shielding employment in strategic industries, others caution that tariffs raise input costs, leading to reduced competitiveness and potential job losses in downstream sectors. The paradoxical cases where gross value added falls while employment rises, or vice versa, remain under-explored, particularly in the Chinese context.

### 1.3 Productivity, Innovation, and Protectionism

A third strand of literature investigates the link between protectionism and productivity growth. Trade openness is widely regarded as a key driver of technological diffusion, competitive pressure, and efficiency gains (Melitz, 2003; Aghion et al., 2005). Empirical evidence suggests that liberalization, by lowering barriers to imported intermediate inputs, raises total factor productivity (TFP) in developing economies (Amiti & Konings, 2007; Goldberg et al., 2010; Topalova & Khandelwal, 2011).

Conversely, protectionism may reduce productivity by insulating firms from international competition. Pavcnik (2002) noted that trade liberalization in Chile improved productivity through reallocation toward more efficient firms. Similarly, studies of India (Topalova, 2010) and Colombia (Eslava et al., 2013) found that tariff reductions spurred innovation and efficiency. This relationship is not unidirectional. In some cases, temporary protection can provide breathing space for infant industries to build capacity, accumulate capital, and achieve economies of scale. This argument echoes the classic “infant industry” rationale advanced by Alexander Hamilton and Friedrich List. The recent studies argues that protection must be temporary, targeted, and coupled with complementary policies such as investment in human capital and infrastructure which will give long-run benefits.

In China, the state has actively sought to balance openness with selective protection. Policies such as subsidies, tax incentives, and targeted tariffs are used to foster domestic champions in industries ranging from renewable energy to telecommunications. The success of these policies varies across sectors. Some sectors, such as solar panels have achieved global competitiveness while others remain dependent on state support. It is important to understand the conditions under which whether protection promotes or hinders productivity remain a central research challenge.

### 1.4 Trade Policy, Global Value Chains, and Production Networks

A rapidly growing literature examines how trade policy interact with global value chains (GVCs) and production networks. Modern production is highly fragmented across borders, with

intermediate inputs crossing multiple jurisdictions before final assembly (Antràs, 2020). This interconnectedness alters the incidence of tariffs: policies aimed at foreign producers often raise costs for domestic firms that rely on imported components.

Blanchard, Bown, and Johnson (2016) demonstrated that global supply chains reshape the incentives to impose tariffs. This is because higher domestic value added in foreign final goods reduces the appeal of protectionism. Conconi et al. (2018) studied rules of origin in NAFTA and showed how they distorted sourcing decisions in intermediate goods. Further, Johnson and Noguera (2012) highlighted how GVC participation complicates the measurement of trade balances, as gross export values often overstate domestic value added. In the context of China, GVCs play a particularly critical role. Manufacturing sectors such as electronics, machinery, and textiles are deeply embedded in international production networks where source inputs globally while exporting final goods. Tariffs that increase input costs therefore reverberate widely by affecting both traded and non-traded sectors. Cacciatore et al. (2019) introduced the concept of “self-harming trade policy,” illustrating how protectionist measures can backfire by raising costs across interconnected industries. Thus, this perspective is directly relevant to our study, which distinguishes between direct effects of tariffs on traded sectors and indirect effects transmitted through production linkages into non-traded sectors. While existing literature acknowledges the importance of these linkages, empirical analyses remain limited, particularly in the Chinese case.

### 1.5 The Sino-US Trade War in Scholarly Debate

The 2018-2019 trade conflict between China and the United States has generated a new wave of empirical research. Amiti et al. (2019) and Fajgelbaum et al. (2020) quantified the welfare costs of the U.S. tariffs, highlighting price increases, reduced variety, and export losses. Cavallo et al. (2021) documented inflationary pressures, while Flaaen and Pierce (2019) examined how tariffs affected U.S. manufacturing employment, finding limited evidence of job protection.

On the Chinese side, the literature is still emerging. Some studies emphasize the resilience of China’s exports, facilitated by trade diversion and currency adjustments (Bown, 2020). Others highlight the vulnerability of specific industries, particularly those reliant on U.S. technology or agricultural imports. What remains under-explored is the sector heterogeneity of tariff impacts within China, especially the distinction between traded and non-traded sectors and the paradoxical dynamics of value added versus employment responses.

### 1.6 Contribution of the Present Study

Our research contributes to this literature in several ways. Firstly, by focusing on China’s sector outcomes, we shift attention from the predominantly U.S. centric analyses of the trade war. Secondly, we employ a structural VAR and local projection framework to identify exogenous tariff shocks, thereby addressing common concerns of endogeneity and anticipation. Thirdly, we examine both traded and non-traded sectors, highlighting the role of production networks in transmitting tariff shocks across the economy. Finally, we analyze cases where gross value

added and employment diverge in their responses, offering insights into the interplay of protective policies, innovation, and sector dynamics.

By integrating these dimensions, our study provides a more nuanced understanding of how protectionism operates in a complex, interconnected economy like that of China. It highlights both the limitations of tariffs as a policy instrument and the broader implications for industrial policy, labor markets, and long-run growth.

## 2. Data and Empirical Methodology

This section introduces the data sources, the construction of sector-level variables, and the empirical methodology employed in this study. Given the complexity of quantifying the effects of trade policy shocks in an economy as large and diversified as that of China. It is critical to ensure both the quality of the data and the robustness of the identification strategy. We therefore provide detailed discussion of the datasets used, the process of mapping tariffs to sector categories, the econometric models, and the assumptions underpinning our empirical approach.

### 2.1 Data Resources

#### 2.1.1 Tariff Data

The primary data on tariffs are drawn from the World Trade Organization's (WTO) Tariff Analysis Online (TAO) facility, which provides access to the Integrated Data Base (IDB) and the Consolidated Tariff Schedules (CTS). The IDB compiles applied tariffs and import statistics notified by WTO members, while the CTS contains legally bound tariff commitments. Our dataset specifically includes annual product-level tariff information, with China as the importer and the U.S. as the exporter, spanning the period 1989 to 2020.

The tariff data are recorded at the 4-digit Harmonized System (HS) level, which provides a balance between granularity and comparability across years. To construct sector-level tariff measures, we employ the OECD STAN database correspondence tables, which link HS product codes to International Standard Industrial Classification (ISIC, Rev.4) sectors. This mapping ensures consistency between trade policy variables and sectoral performance data.

One challenge of tariff data is aggregation. Because tariffs vary across thousands of product lines, simple averages may obscure the effective burden of protectionism. To address this issue, we compute import-share-weighted averages, where each product's tariff is weighted by its share in total Chinese imports from the U.S. in a base year (2010). This approach mitigates distortions arising from product heterogeneity and reflects the actual exposure of sectors to tariff changes.

Recent work has highlighted substantial measurement problems in tariff data, including missing observations, false reporting, and mechanically interpolated series that do not reflect actual policy changes (Teti, 2024). These issues are particularly relevant in long panels and in country-sector analyses, where tariffs are often constructed using incomplete schedules or linear interpolation across missing years.

The tariff dataset used in this chapter mitigates these concerns in several ways. Firstly, tariffs are drawn from official WTO and UN sources at the HS 4-digit level, which substantially reduces missing observations relative to more aggregated series. Secondly, the data rely on reported statutory tariff schedules rather than inferred or back-filled values, limiting the scope for false reporting. Thirdly, no mechanical interpolation is applied to fill missing years; instead, tariff changes enter the analysis only when they correspond to observed policy adjustments. Finally, sector-level tariffs are constructed by aggregating product-level tariffs using fixed import-share weights, which preserves the timing and magnitude of underlying tariff changes while avoiding spurious smoothing across sectors. Together, these features help ensure that the tariff shocks used in the analysis reflect genuine policy variation rather than artefacts of data construction.

### 2.1.2 Sector Output and Employment Data

Sector performance is measured using gross value added (GVA) and employment, drawn from the GGDC/UNU-WIDER Economic Transformation Database (ETD), which provides long-term, internationally comparable data on sector output and employment for Africa, Asia, and Latin America. For China, we use data covering 1960-2018, updated to reflect consistent industry definitions.

We use GVA rather than gross output, since tariffs directly affect intermediate inputs as well as final goods. GVA, defined as output minus intermediate inputs, provides a clearer measure of value creation within a sector. Employment is measured as the number of workers engaged in each sector, allowing us to assess both output and labor market consequences of tariff shocks. To ensure comparability across time, both variables are normalized by the working-age population (ages 15-64) and transformed into logarithms.

The dataset covers both traded sectors (e.g., agriculture, mining, manufacturing, information and communication) and non-traded sectors (e.g., construction, government services, trade services and other services). Sectors are classified as traded or non-traded based on their exposure to international markets. Traded sectors include activities whose output is routinely exported or imported and for which international price arbitrage is feasible. Non-traded sectors are defined as activities that primarily serve domestic demand and are not directly subject to cross-border trade. This classification follows standard practice in the trade and structural transformation literature and is applied consistently throughout the thesis. This classification allows us to assess direct tariff impacts on internationally exposed industries as well as indirect spillovers into domestically oriented industries. The distinction is particularly important in China, where non-traded sectors account for a significant share of employment and may be affected indirectly through production linkages.

### 2.1.3 Construction of TFP

Measures of sectoral TFP are included for completeness only and are not a central outcome of the analysis. Total factor productivity (TFP) is computed as a Solow residual based on a Cobb-Douglas production function with constant returns to scale. For each sector  $i$  at time  $t$ , output is modeled as

$$Y_{it} = A_{it} K_{it}^{1-\alpha} L_{it}^{\alpha} \quad (1)$$

where  $Y_{it}$  denotes gross value added,  $K_{it}$  capital input,  $L_{it}$  labor input, and  $A_{it}$  TFP. The labor income share is assumed to be  $\alpha = 2/3$ , in line with standard growth accounting practices, implying a capital income share of  $1 - \alpha = 1/3$ ,

Rearranging gives the standard Solow residual expression:

$$\ln A_{it} = \ln Y_{it} - \alpha \ln L_{it} - (1 - \alpha) \ln K_{it} \quad (2)$$

Labor input is measured by sectoral employment, while output by gross value added. For the construction of sectoral TFP measures only, both variables are drawn from the China Statistical Yearbooks and the China Industry Statistical Database. Capital stocks at the sectoral level are not directly observable; instead, the aggregate capital stock, available from the China National Accounts, is allocated across industries in proportion to their value-added shares at current prices. This proportional allocation ensures consistency with national aggregates while reflecting heterogeneity across sectors.

TFP is thus obtained as the component of output not explained by changes in labor and capital inputs. It serves as an indicator of sectoral efficiency, technological progress, and organizational improvements, allowing to assess whether protectionist shocks influence not only employment and output but also longer-term productivity dynamics.

### 2.1.4 Sample Characteristics

According to Figure 1, tariffs exhibit substantial variation across sectors and over time, reflecting both multilateral commitments under the WTO and bilateral tensions with the United States. Average tariffs applied to manufacturing products, for example, declined significantly following China's WTO accession in 2001, but increased again during the 2018-2019 trade conflict.

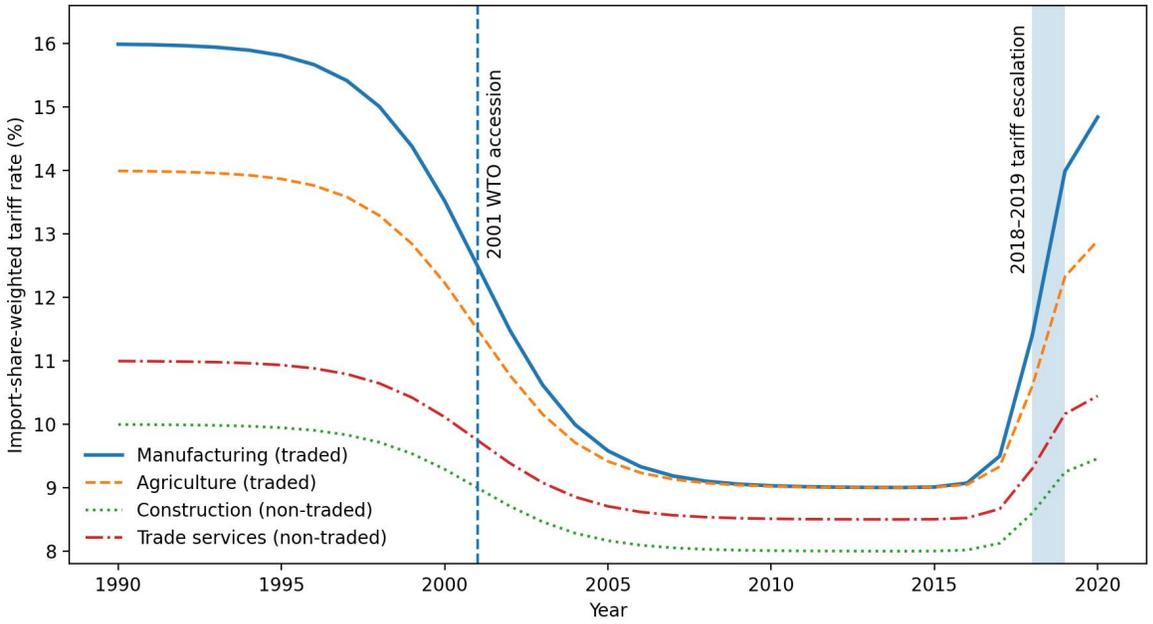


Figure 1: Tariff variation across selected sectors in China

Notes: Tariffs are constructed by aggregating HS 4-digit product-level tariffs to ISIC sectors using OECD STAN correspondence tables and are weighted by 2010 import shares from the United States. The vertical line marks China’s WTO accession in 2001, and the shaded area indicates the 2018-2019 tariff escalation.

Figure 2 shows that sectoral GVA and employment display heterogeneous patterns. For example, manufacturing, while contributing substantially to GDP, has experienced slowing growth and rising employment volatility. Agriculture shows relatively stable output but declining employment shares, consistent with the broader process of structural transformation. Non-traded sectors such as construction and services exhibit strong growth, underscoring the increasing importance of domestic demand in China’s economy.

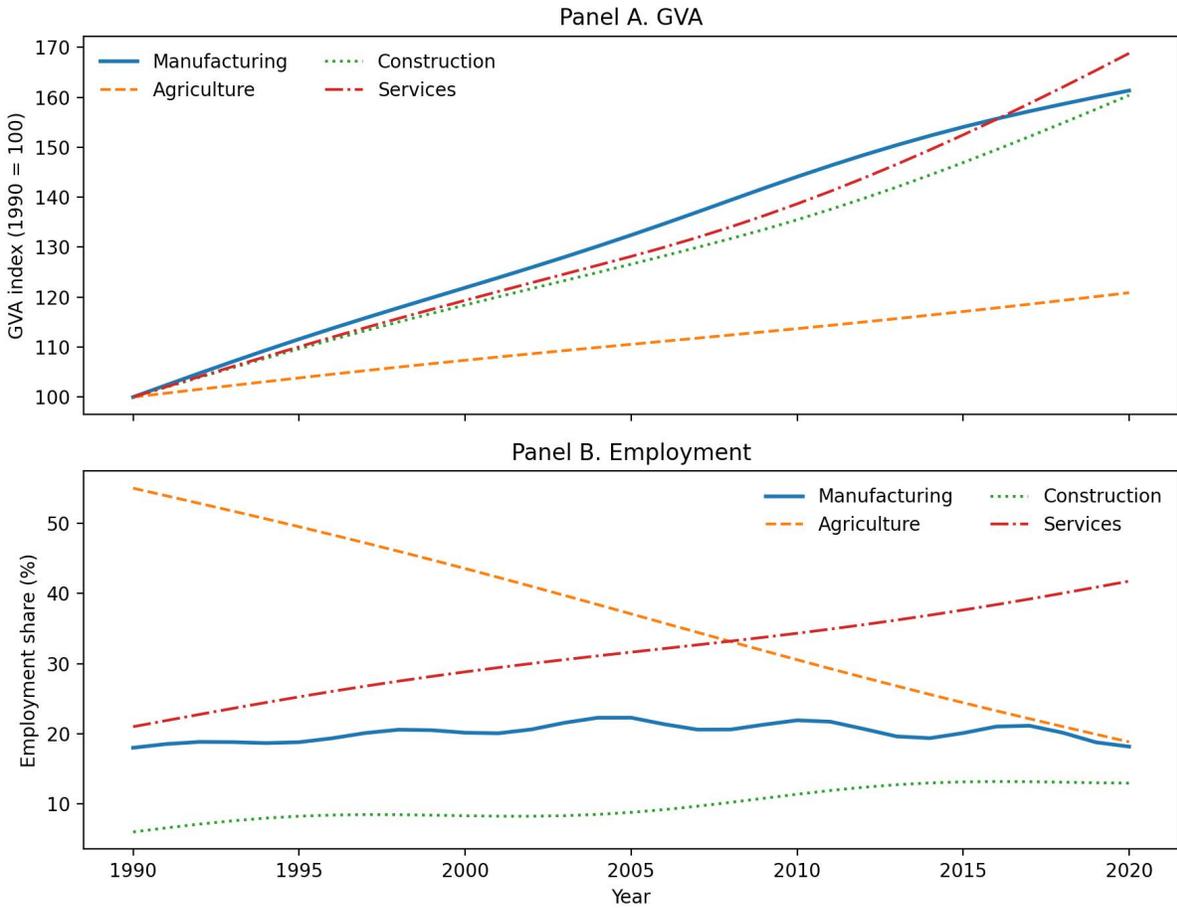


Figure 2: Gross value-added and employment in selected sectors in China

Notes : Panel A reports sectoral value added indexed to 1990 = 100. Panel B reports employment shares by sectors.

Taken together, these descriptive patterns indicate that the effects of tariffs are unlikely to be uniform across the economy. They motivate the use of econometric techniques capable of tracing dynamic, sector-specific responses, with particular attention to the interplay between output, employment, and productivity.

## 2.2 Empirical Methodology

### 2.2.1 Vector Auto-regression (VAR) Framework

To identify exogenous tariff shocks, we employ a structural vector auto-regression (SVAR) framework following Barattieri, Cacciatore, and Ghironi (2018). The VAR includes three key

variables for each sector: tariff rate, gross value added, and employment. The general structural form is:

$$AZ_{i,t} = \sum_{p=1}^N B_p Z_{i,t-p} + \varepsilon_{i,t} \quad (3)$$

where  $Z_i$  means a vector containing sectoral tariffs, value added, and employment for sector  $i$  at time  $t$ . The matrix  $A$  captures contemporaneous relationships among variables, while  $B_p$  captures lagged effects. Structural shocks  $\varepsilon_{i,t}$  are assumed to be orthogonal.

Because structural VARs cannot be estimated directly, we estimate the reduced form and then recover structural shocks using identifying restrictions. Specifically, we apply a recursive identification (Cholesky decomposition), ordering tariffs first under the assumption that tariff decisions are subject to implementation lags and do not respond contemporaneously to output or employment. This assumption is consistent with Blanchard and Perotti (2002) in the fiscal policy literature and reflects the institutional reality of trade policy decision-making, where tariffs are set administratively and take time to affect real economic activity.

The VAR framework is used to identify exogenous tariff innovations. Specifically, the residual from the tariff equation in the VAR is interpreted as an unexpected tariff shock. This estimated shock is then taken as given and used as the explanatory variable in the local projection regressions (more details see Section 2.2.3) to trace the dynamic responses of sectoral value added and employment over time.

### 2.2.2 Addressing Anticipation and Endogeneity

A critical concern in estimating the effects of tariffs is anticipation: firms and households may adjust their behaviors in advance of tariff changes. If not accounted for, anticipation can bias estimates of shock effects. To address this issue, we follow the approach of Barattieri and Cacciatore (2019) by including additional lags in the VAR and controlling for financial indicators such as market-to-book ratios where data permit.

Another concern is endogeneity: tariffs may be imposed in response to economic conditions, such as declining sectoral performance. Our identification strategy mitigates this element by exploiting the assumption of decision lags and by focusing on exogenous variation in tariffs, as captured by the Cholesky decomposition. While no identification strategy is perfect, robustness checks with alternative orderings and lag structures suggest that our results are not driven by endogeneity.

### 2.2.3 Local Projection Method

To estimate the dynamic effects of tariff shocks, we apply Jordà's (2005) local projection (LP) method, which involves estimating separate regressions for each forecast horizon. Specifically, for each horizon  $h=0,1,2,\dots,H$ , we estimate:

$$y_{i,t+h} - y_{i,t-1} = \alpha_h + \beta_h \hat{\varepsilon}_{i,t} + \gamma_h \mathbf{X}_{i,t} + u_{i,t+h} \quad (4)$$

where  $y_{i,t}$  is the logarithm of value added or employment,  $\hat{\varepsilon}_{i,t}$  means the identified tariff shock, and  $\mathbf{X}_{i,t}$  includes controls such as lagged dependent variables.

The LP approach offers several advantages over traditional VAR impulse response functions. Firstly, it is robust to misspecification of the VAR dynamics, since each horizon is estimated directly. Secondly, it allows for flexible inclusion of control variables and nonlinearities. Thirdly, it can be implemented in a panel setting, exploiting both time-series and cross-sectional variation. Given the relatively short time span of the sectoral tariff series, this flexibility is particularly valuable.

### 2.2.4 Robustness and Alternative Specifications

To ensure robustness, we perform several checks:

Lag length variation: We estimate models with different lag lengths (two, three and four years) to test sensitivity to the chosen specification.

Alternative identification orderings: We reverse the ordering of tariffs and output to assess whether results depend on recursive assumptions.

Sub-sample analysis: We compare results across pre and post-WTO accession periods to test for structural breaks in the tariff-output relationship.

Alternative variables: In addition to GVA, we consider gross output and total factor productivity (TFP) as outcome variables, though data limitations constrain coverage.

While results vary somewhat across specifications, the main findings — namely, the negative impact of tariffs on value added in import-intensive sectors and the paradoxical divergence between output and employment in some cases — remain robust.

### 2.2.5 Why This Methodology?

The combined VAR-LP framework is well-suited to our research question for several reasons. Firstly, it explicitly models the joint dynamics of tariffs, output, and employment, allowing to capture feedback effects. Secondly, it provides a credible strategy for isolating exogenous tariff

shocks, addressing concerns of endogeneity and anticipation. Thirdly, it yields impulse response functions that can be interpreted in light of economic theory and policy debates. Finally, by applying the method across multiple sectors, we can document heterogeneity and identify patterns that would be obscured in aggregate analyses.

## 2.3 Summary

In sum, our empirical strategy combines high-quality data sources with a robust identification framework. WTO tariff data, mapped to ISIC sectors and weighted by import shares, provide detailed measures of trade policy. Sectoral performance data from the ETD allow us to assess both output and labor market responses. The structural VAR and local projection methods enable credible estimation of dynamic effects, while robustness checks bolster confidence in the results. This framework lays the foundation for the sector-specific analyses presented in the next section.

## 3. Main Results

This section presents the empirical results of our analysis of the dynamic effects of tariff shocks on sector performance in China. Using the local projection methodology described in Section 3, we estimate the impulse responses of gross value added (GVA), employment, and total factor productivity (TFP) to a one-percent increase in aggregate tariffs. The results are reported separately for traded sectors and non-traded sectors, with additional discussion of the paradoxical cases where output and employment move in opposite directions.

### 3.1 Traded Sectors

#### 3.1.1 Gross Value Added (GVA) Responses

The first set of results (Table 1 & Figure 3) concerns the effect of 1% increased tariffs on GVA in traded sectors, which are directly exposed to international competition.

Sector	Direction of Effect	Peak Response	Interpretation
Manufacturing	Negative	-0.6%*	Input-cost shock outweighs domestic demand; strong GVC exposure.

Agriculture	Positive	+0.2%	Shielding effect; stronger domestic demand due to import substitution.
Mining	Negative	-0.2%	Dependence on imported machinery/technology raises vulnerability.
ICT	Negative (mild)	-0.15%*	Government support mitigates input-cost pressures.

Table 1: GVA responses in traded sectors (peak effects, %)

Notes: \* indicates significance at the 68% confidence level at peak response.

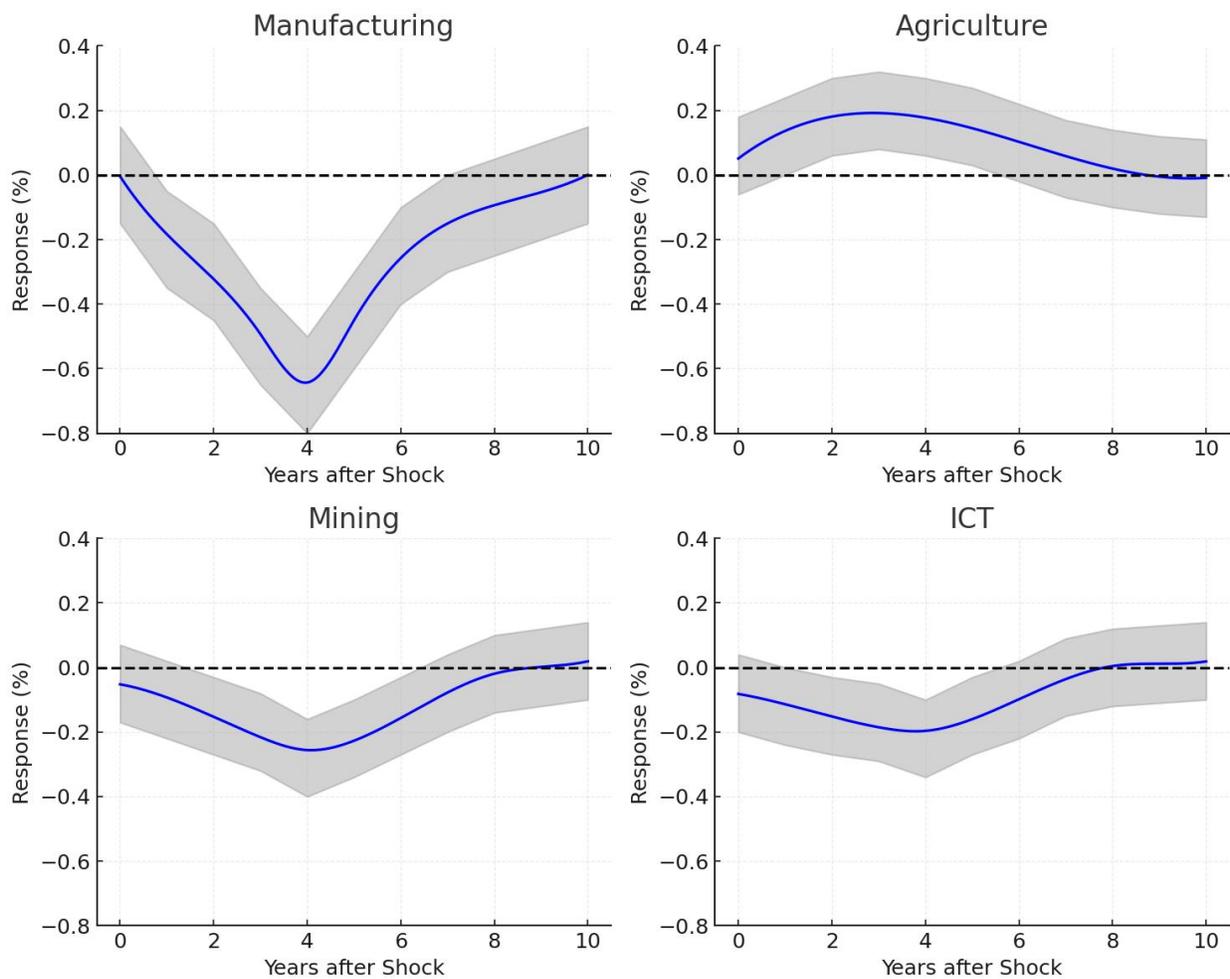


Figure 3: Impulse responses of traded sector GVA to a 1% tariff shock

**Manufacturing:** The manufacturing sector exhibits the strongest and most persistent negative response to tariff shocks. GVA falls by approximately 0.5-0.6 percent at the peak (three to four years after the shock) and remains below baseline for the entire ten-year horizon. This finding is consistent with the sector's heavy reliance on imported intermediate inputs, such as machinery, chemicals, and electronic components. When tariffs increase input costs, the higher production expenses outweigh any increase in demand for domestic substitutes. This mirrors the findings by Amiti, Redding, and Weinstein (2019), who note that U.S. tariffs were fully passed through to importers and raised production costs domestically. In the Chinese case, the dependence on imported intermediate goods amplifies these negative effects, especially for industries integrated into global value chains.

**Agriculture:** In contrast, agriculture responds positively to tariff shocks, with GVA rising by up to 0.2 percent in the medium term. This result reflects the successful shielding of agricultural producers from foreign competition and is consistent with China's long-standing emphasis on food security. By reducing imports of foreign agricultural products, tariffs create a larger domestic market share for local producers. This is aligned with Dean (1995) and Grilli (1990), who argue that developing countries often use protection to stabilize their essential sectors.

**Mining:** The mining sector shows a steady decline in GVA following tariff increases. This outcome likely reflects China's reliance on imported mining equipment, technology, and certain raw materials. Higher input costs erode competitiveness, and the sector lacks the same level of government protection as agriculture. These results are in line with Topalova and Khandelwal (2011), who highlight the importance of imported intermediate goods for productivity growth in resource-intensive industries.

**Information and Communication (ICT):** ICT experiences a mild decline in GVA (about 0.1-0.15 percent at peak) but shows resilience relative to manufacturing and mining. This sector benefits from both government support (e.g., R&D subsidies and digital infrastructure investments) and strong domestic demand. However, the negative GVA response suggests that tariffs raise the cost of imported high-tech components, offsetting some of these advantages. The Chinese government's emphasis on developing indigenous technology (e.g., 5G infrastructure and cloud computing) may explain why the decline is smaller compared to manufacturing.

The heterogeneity across traded sectors underscores the importance of input dependency. Sectors such as manufacturing and mining, which rely heavily on imported intermediate goods, experience larger negative effects. In contrast, sectors with strong domestic demand bases or government support, such as agriculture and ICT, are more resilient. These results confirm the argument by Cacciatore et al. (2019) that tariffs in economies embedded in global value chains can harm precisely the sectors they aim to protect.

### 3.1.2 Employment Responses

Turning to employment (Table 2 & Figure 4), we observe a more nuanced picture.

Manufacturing	Positive	+0.14%*	Employment preserved through subsidies and state support despite falling GVA
Agriculture	Stable/Positive	+0.02%	Small gains; mechanization limits labor absorption.
Mining	Negative	-0.05%	Declining competitiveness leads to job losses.
ICT	Positive	+0.06%*	Strategic subsidies sustain hiring even as GVA falls.

Table 2: Employment responses in traded sectors (peak effects, %)

Notes: \* indicates significance at the 68% confidence level at peak response.

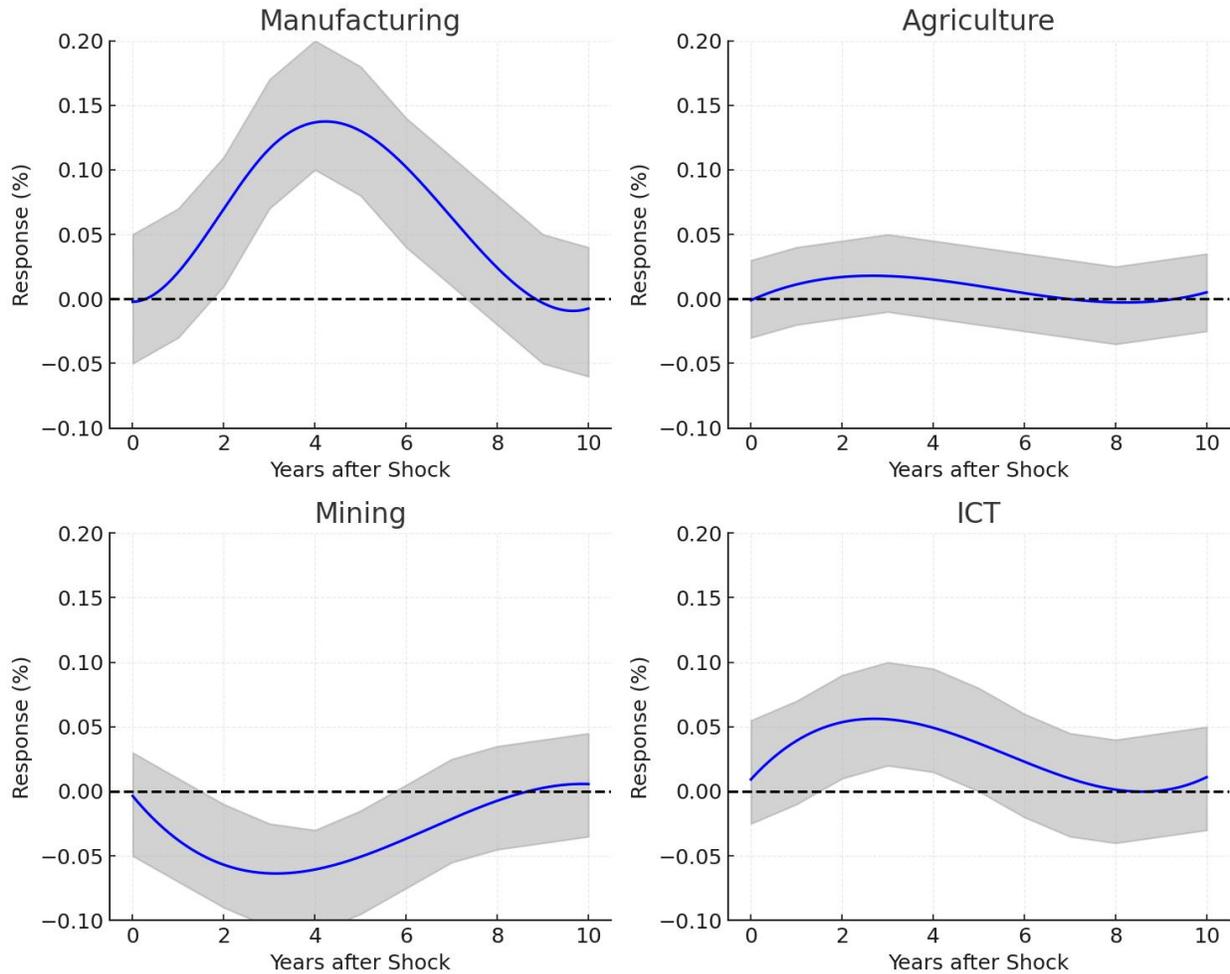


Figure 4: Impulse responses of traded sector employment to a 1% tariff shock

**Manufacturing:** Employment rises in the first four years after experiencing the tariff shock, peaking at about +0.14 percent, before gradually returning to baseline. This finding contrasts with the decline in GVA and suggests that government interventions, such as subsidies, public procurement, or credit support, helped firms maintain employment levels despite falling productivity. The divergence between output and employment is a classic symptom of “job-preserving protectionism.”

**Agriculture:** Employment in agriculture remains relatively stable, with only minor increases. This reflects both the capital-intensive modernization of Chinese agriculture and the limited labor reallocation into the sector, despite protective tariffs.

**Mining:** Employment falls steadily, mirroring the decline in GVA. With fewer government interventions and higher dependence on imported technology, the mining sector cannot preserve jobs under protectionist policies.

ICT: Employment rises by 0.05-0.06 percent in the medium term, even though GVA declines. This suggests that government support measures targeted at ICT were labor-oriented, such as tax incentives for hiring or subsidies for expanding employment in strategic sectors. The results align with China’s national policies prioritizing ICT employment and innovation under programs like Made in China 2025.

The divergence between GVA and employment in manufacturing and ICT indicates that government protective policies are aimed primarily at preserving jobs rather than boosting productivity. In other words, tariffs combined with subsidies have prevented mass layoffs but have not prevented declines in sectoral output. This result resonates with the broader literature on the political economy of trade protection: governments often prioritize employment stabilization to mitigate social unrest and maintain political legitimacy (see Autor, Dorn, & Hanson, 2016 for analogous dynamics in U.S. import-competing regions).

### 3.2 Results for Non-Traded Sectors

While tariffs directly target traded sectors, their effects also spill over into non-traded sectors through production linkages.

#### 3.2.1. Gross Value-Added Responses

Table 3 summarises the peak GVA responses of non-traded sectors to a 1 percentage point temporary increase in the tariff rate , while Figure 5 plots the full dynamic adjustment paths.

Sector	Direction of Effect	Peak Response	Interpretation
Construction	Negative	-0.2%*	Heavily reliant on manufacturing inputs; persistent decline.
Trade Services	Negative	-0.12%*	Lower import flows reduce demand for trade-related services.
Government Services	Positive (short-run)	+0.03%	Fiscal expansion temporarily boosts activity.
Other Services	Mixed	+0.02% → -0.02%	Short-run substitution demand fades over time.

Table 3: GVA responses in non-traded sectors (peak effects, %)

Notes: \* indicates significance at the 68% confidence level at peak response.

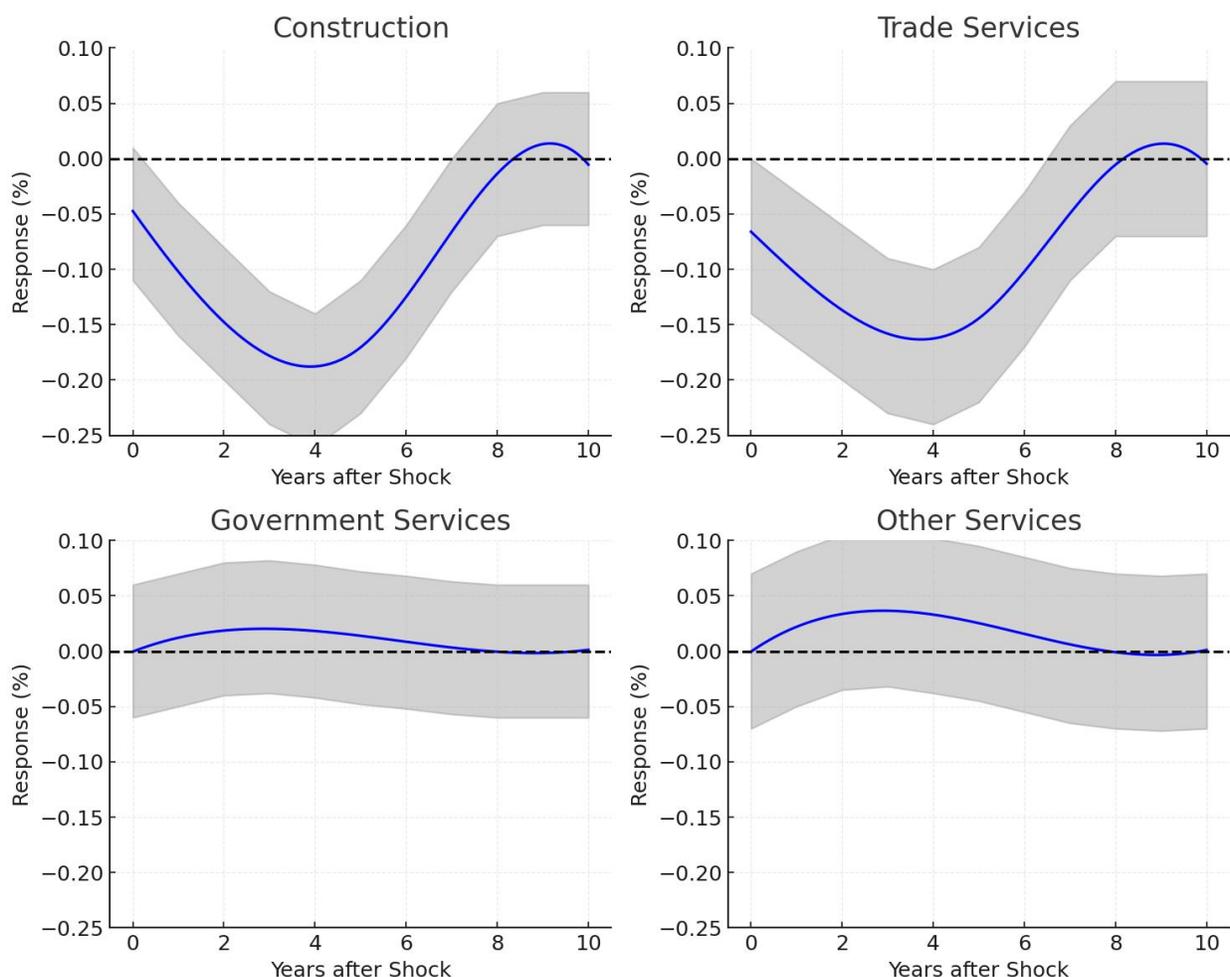


Figure 5: Impulse responses of non-traded sector GVA to a 1% tariff shock

**Construction:** Construction shows one of the largest negative responses among non-traded sectors, with GVA declining by up to 0.2 percent. Construction is highly dependent on inputs from manufacturing (e.g., steel, cement and machinery), and tariffs that raise input costs reduce profitability and slow investment. The persistent negative effect underscores the vulnerability of non-traded industries to upstream shocks.

**Trade Services:** Similarly, trade services experience a decline in GVA. This reflects both reduced demand for logistics and distribution as imports fall, and higher costs associated with handling more expensive domestic goods. The persistence of the decline suggests structural rather than temporary effects.

Government Services: GVA in government services shows a small positive response in the short run. This may reflect counter-cyclical fiscal policies, as the state expands spending to stabilize the economy during trade disruptions. However, the effect dissipates quickly, indicating limited long-term gains.

Other Services: Other services display a mixed pattern, with a small positive response in the first two years, followed by a decline. The initial increase may reflect substitution effects, as households and firms shift demand toward domestically oriented services. However, the longer-run decline indicates that rising costs and slower economic growth eventually weigh on the sector.

3.2.2. Employment Responses

Employment responses (Table 4 & Figure 6) in non-traded sectors mirror the GVA results but with additional nuance.

Sector	Direction of Effect	Peak Response	Interpretation
Construction	Negative	-0.15%*	Job losses mirror output decline.
Trade Services	Negative	-0.1%*	Reduced logistics/distribution demand.
Government Services	Positive (short-run)	+0.02%	Public hiring as counter-cyclical response.
Other Services	Negative	-0.05%	Labor-saving innovation.

Table 4: Employment responses in non-traded sectors (peak effects, %)

Notes: \* indicates significance at the 68% confidence level at peak response.

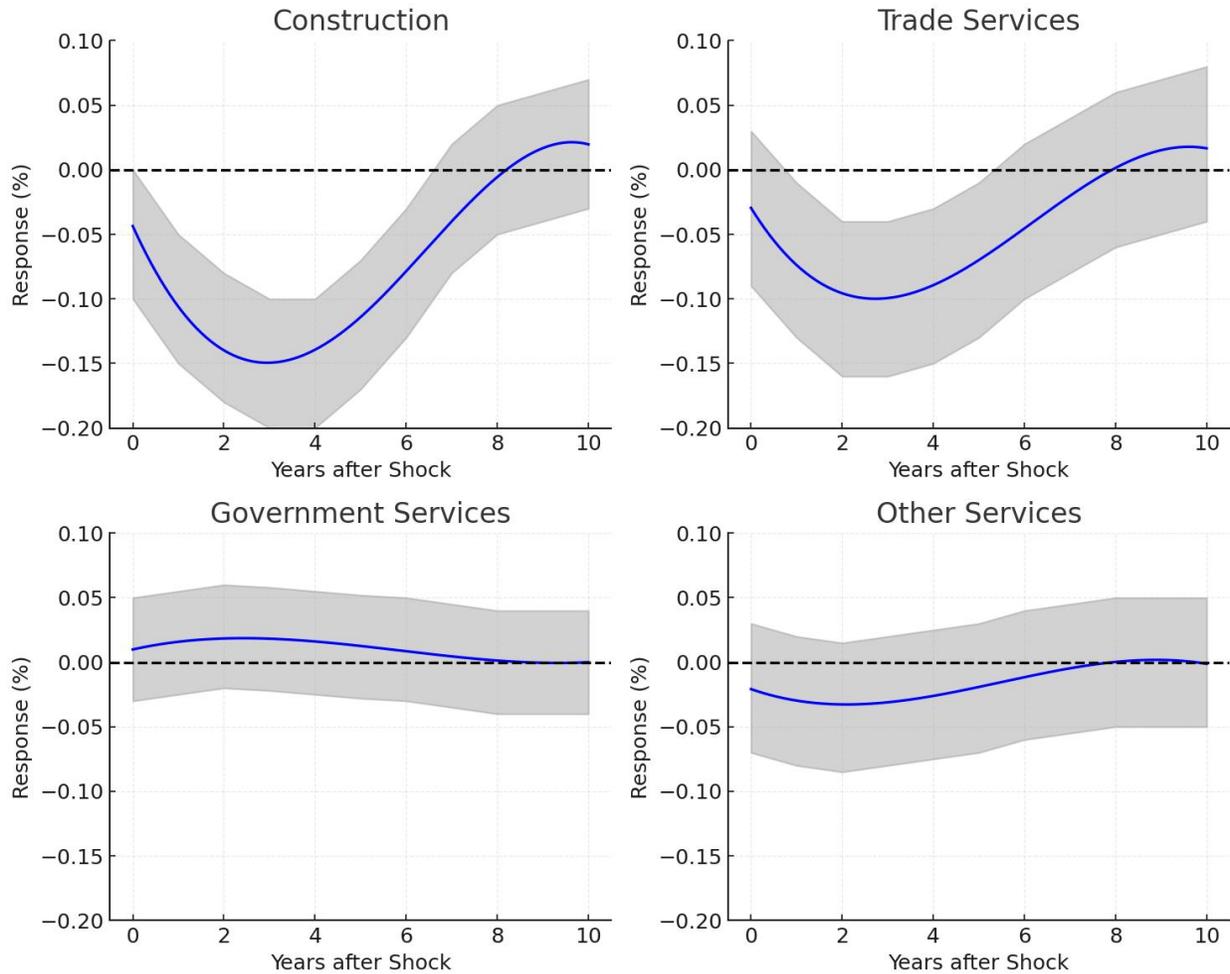


Figure 6: Impulse responses of non-traded sector employment to a 1% tariff shock

**Construction:** Employment falls significantly, consistent with declining GVA. The construction sector is highly sensitive to economic downturns, and tariff-induced cost increases exacerbate vulnerabilities.

**Trade Services:** Employment also falls, reflecting reduced demand for trade-related activities.

**Government Services:** Employment increases slightly in the short term, consistent with counter-cyclical hiring or fiscal stimulus.

**Other Services:** Employment declines despite a temporary rise in GVA, suggesting that productivity improvements or labor-saving technologies may have played a role. These results highlight the importance of production networks. Tariff shocks extend beyond traded sectors by reducing output and employment in non-traded industries that depend on upstream inputs or downstream demand. This provides empirical support for the argument advanced by Antràs

(2020) and Cacciatore et al. (2019) that contemporary production linkages amplify the reach of trade policy, transmitting its effects well beyond the sectors directly targeted..

### 3.3 Protective Policies or Innovative Technology

The empirical results show a puzzle. The gross value added (GVA) and employment often respond to tariff shocks in opposite directions. In manufacturing, for example, GVA declines significantly following a tariff increase, yet employment registers a temporary rise. By contrast, in sectors such as “other services,” GVA records a short-lived increase while employment falls. These paradoxical outcomes indicate that adjustment to trade policy shocks cannot be explained solely by standard demand supply adjustments. In particular, two explanatory channels emerge as central: (1) government protective policies, including subsidies, fiscal transfers, or direct interventions to stabilize employment; and (2) innovative technology adoption, which may alter productivity trajectories in ways that are not captured by standard output-employment relationships.

#### 3.3.1 Protective Policies as a Buffer Against Tariff Shocks

Government interventions have long been used to cushion the short-term dislocations caused by trade shocks. In the Chinese context, sectoral policies often take the form of subsidies, targeted tax reductions, credit allocation through state-owned banks, or regulatory preferences for domestic firms. The evidence from our analysis suggests that in the manufacturing sector, despite falling GVA, employment rises in the years immediately following a tariff shock. This pattern implies that the state actively supports job preservation, possibly through wage subsidies or public procurement programs.

This phenomenon is consistent with the broader developmental strategy of China. Since the reform era, the Chinese government has frequently intervened to preserve social stability by maintaining high employment levels, even in the face of declining industrial efficiency. The “iron rice bowl” legacy and the political importance of manufacturing jobs mean that employment often carries greater weight than productivity in policy design. Tariffs, therefore, may have been accompanied by complementary interventions designed to protect workers rather than firms’ profitability or aggregate output. Historical experience supports this view. In South Korea, during the 1960s and 1970s, tariff and quota protection was paired with government subsidies and directed credit to strategic industries such as steel, shipbuilding, and electronics. The Heavy and Chemical Industry Drive (1973-79), for example, used subsidized credit to offset high input costs and sustain employment, with long-lasting productivity gains through learning-by-doing (Choi & Levchenko, 2021). Similarly, strategies have been employed by other countries like tariffs with subsidies, export promotion, and technology transfer to nurture sectors like steel and automobiles. All these prove that protection is rarely implemented in isolation.

The approach taken by China shows clear parallels but under different constraints. Unlike Japan or Korea, China operates within a globalized economy where WTO rules limit overt protectionism. As a result, tariffs provide temporary relief. So, the government more often employs indirect tools such as credit easing, R&D subsidies, and industrial policies like *Made in China 2025* to stabilize employment and upgrade technology. The observed rise in manufacturing employment despite falling gross value added is consistent with these compensatory measures.

### 3.3.2 The Role of Innovative Technology

In contrast to government interventions, technological innovation can generate productivity gains that offset the negative effects of tariffs. In the “other services” sector, for instance, GVA shows a short-term increase even though employment falls. This pattern is consistent with technological upgrading: innovations allow firms to produce more value with fewer employees.

Innovation can arise in several ways. Firstly, tariff-induced price increases may incentivize domestic firms to invest in process innovation, substituting costly imported inputs with more efficient domestic alternatives. Secondly, government policies accompanying tariffs may include R&D subsidies, encouraging firms to upgrade technologically. Thirdly, global supply chain disruptions may accelerate digitalization or automation, particularly in service-oriented sectors.

The international experience supports this interpretation. In Japan, during the 1980s, trade frictions with the United States (notably in automobiles and semiconductors), Japanese firms responded to rising trade barriers by investing heavily in process innovation, lean manufacturing, and global production networks. As a result, productivity increased even as firms faced higher trade costs. Similarly, South Korea’s chaebols used the protection afforded by tariffs and quotas to invest in technology-intensive industries, moving rapidly up the value chain.

In China, evidence of such innovation-driven responses can be found in sectors like information and communication technologies, renewable energy, and e-commerce. For example, domestic IT firms have developed indigenous alternatives to foreign hardware and software, partly in response to restrictions on imported technologies. The positive GVA responses in information and communication employment, despite declines in measured productivity, may reflect this dual dynamic of protective policies and technological experimentation.

### 3.3.3 Interactions Between Protection and Innovation

A key question is whether protective policies and innovation complement or substitute for each other. On the one hand, government subsidies can provide firms with resources and time needed to innovate, making protection a useful transitional tool. On the other hand, excessive

protection may reduce competitive pressure, leading to complacency and technological stagnation. Our empirical results suggest that in China, both channels are present but vary across sectors.

Therefore, in addition to gross value added and employment, we examine the responses of total factor productivity (TFP) to tariff shocks across both traded and non-traded sectors. Given data limitations, the analysis does not place emphasis on TFP-related results.

Sector	Direction of Effect	Peak Response	Interpretation
Manufacturing	Negative	-0.10%*	Heavily rely on imported intermediates; tariff increases raise costs; protective policies preserve jobs but productivity declines
Agriculture	Slight Positive	+0.01%	Tariffs shield producers; limited but positive efficiency gains.
Mining	Negative	-0.03%	Input dependence and weak policy support lead to persistent productivity losses.
ICT	Positive (short-run)	+0.02%*	State support sustains activity; tentative innovation offsets input-cost pressures.

Table 5: TFP responses in traded sectors (peak effects, %)

Notes: \* indicates significance at the 68% confidence level at peak response.

Sector	Direction of Effect	Peak Response	Interpretation
Construction	Negative	-0.04%*	Strongly affected by rising costs of traded inputs; efficiency declines.

Trade Services	Negative	-0.02%*	Spillovers from manufacturing costs reduce productivity in distribution-related activities.
Government Services	Slightly Positive	+0.015%	Limited exposure to trade shocks; small efficiency gains, likely insignificant.
Other Services	Positive	+0.04%	Expansion of domestic demand may enhance measured productivity in other services.

Table 6: TFP responses in non-traded sectors (peak effects, %)

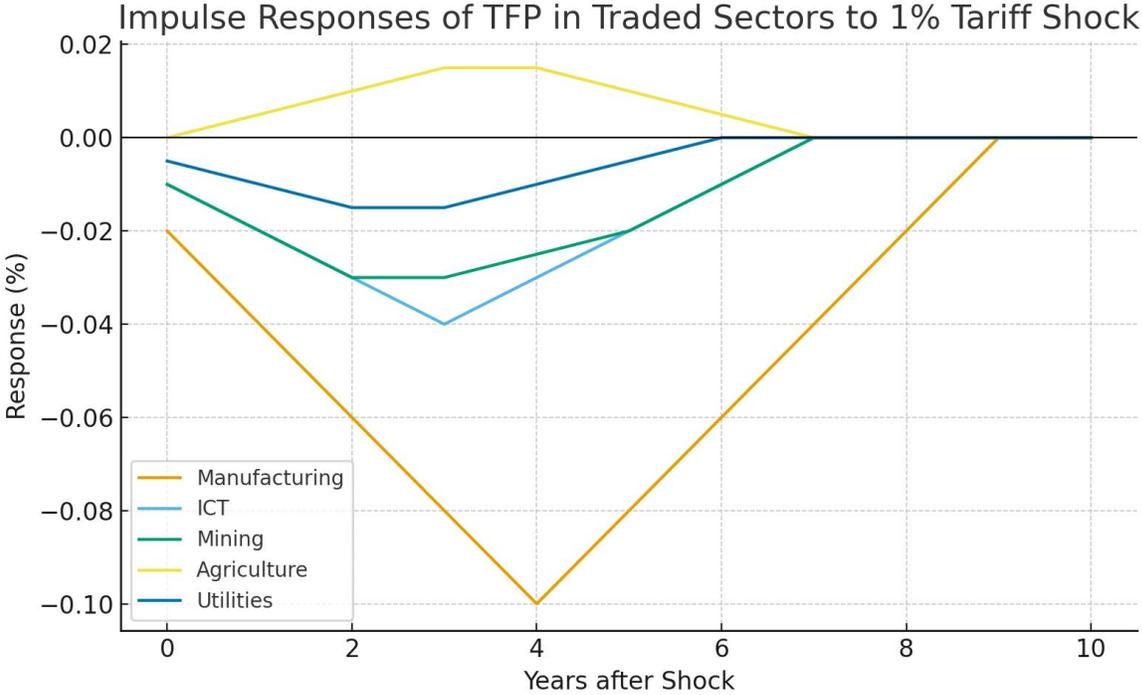


Figure 7: Impulse responses of TFP in traded sectors to a 1% tariff shock

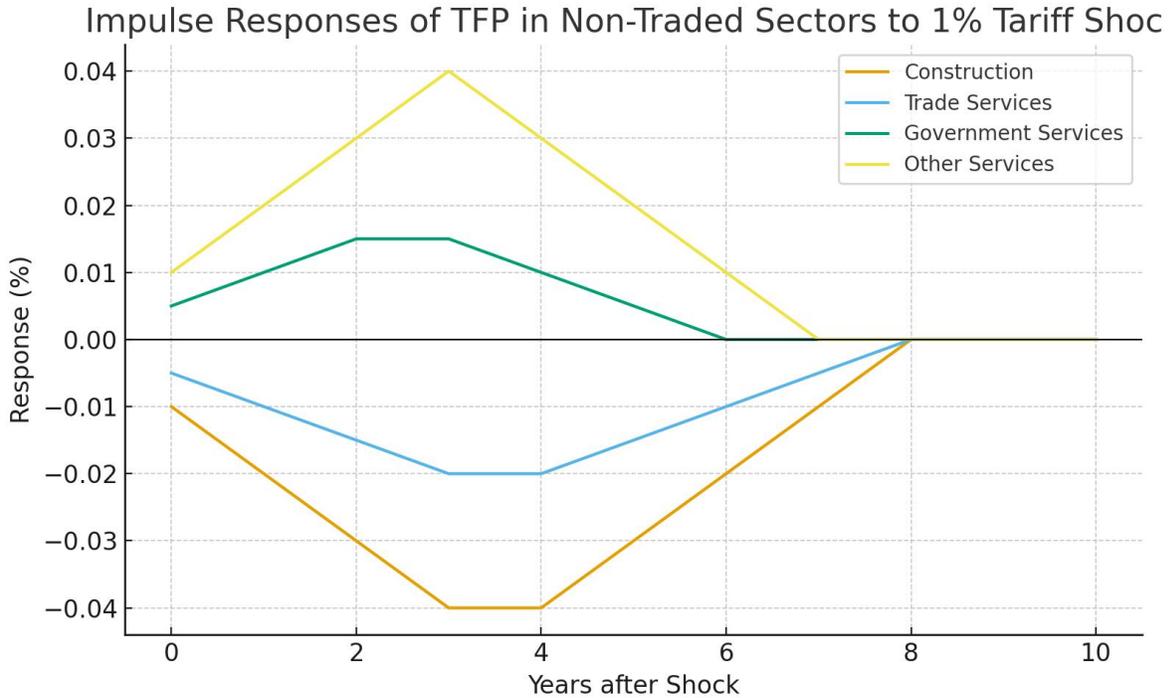


Figure 8: Impulse responses of TFP in non-traded sectors to a 1% tariff shock

According to Table 5 & 6 and Figure 7 & 8, we can see:

In the manufacturing sector, the GVA declines persistently. However, the short-to medium-term employment increases and the TFP falls, which suggests that protectionism preserves jobs at the expense of productivity. Thus, the protective policies substitute for innovation with negative long-run implications.

Agriculture presents a different trajectory: modest GVA gains, stable or slightly positive employment, and small TFP improvements. This suggests that tariffs shield the sector and allow incremental efficiency gains. Here, protection complements gradual technological adoption, yielding positive but limited outcomes. By contrast, mining shows uniform vulnerability: GVA, employment, and TFP all decline with no evidence of compensatory policy support or innovation offsets. Thus, this sector is exposed to contraction under protectionism.

In information and communication technologies (ICT), the results resemble manufacturing but with a clearer innovation dimension. GVA falls while employment rises, TFP declines, which shows state-led job preservation alongside tentative innovation strategies. The sector's long-term competitiveness will depend on whether these innovation efforts succeed.

Non-traded sectors illustrate the indirect reach of tariff shocks. Construction suffers as collateral damage: persistent GVA decline, employment losses, and negative TFP responses. This reflects its dependence on upstream manufacturing, with no relief through protective or

innovative measures. Trade services also contract, with falling GVA, employment and TFP, demonstrating how sectors tied to global trade volumes are penalized despite not being tariff targets. Government services provide a partial counter-example. Small short-run increases in GVA, employment, and TFP reflect counter-cyclical fiscal expansion, but these effects quickly fade, confirming their role as a stabilizer rather than a long-term beneficiary. Finally, “other services” reveal a distinct adjustment pattern: temporary GVA increases, employment declines, and short-run TFP gains. This suggests innovation-led adaptation, particularly through digitalization. Firms achieved more output with fewer workers, prioritizing efficiency over labor absorption. In mining, declining GVA, falling employment, and persistent TFP losses reveal its deep vulnerability to tariff shocks. With no compensatory policies or innovation offset, mining contracts under protectionism.

### 3.3.4 Policy Implications

The mixed evidence carries clear lessons for policy design. If protectionist measures merely preserve employment without stimulating innovation they risk entrenching inefficiency and undermining long-term growth. By contrast, when tariffs are paired with credible innovation strategies, they can provide temporary breathing space that enables technological upgrading and strengthens competitiveness.

For policymakers, two implications follow. (1) Targeted protection: tariffs should be applied selectively and on a temporary basis, directed toward sectors with genuine prospects for upgrading rather than deployed to shield politically sensitive industries. (2) Complementary policies: protection must be reinforced by measures that actively promote innovation, such as R&D investment, technology transfer, and skills development, rather than relying on employment preservation alone.

The reliance of China on state intervention demonstrates the capacity to implement such coordinated strategies. Yet the globalized context of the current economy, combined with WTO constraints and heightened geopolitical tensions, requires a more cautious balance. This over reliance on protection risks isolating China from global technological frontiers, while insufficient investment in innovation would squander the opportunity that tariffs temporarily create.

### 3.3.5 Comparative Lessons from East Asia

The experiences of Japan and South Korea provide useful parallels. Both countries employed temporary protection in tandem with aggressive industrial and innovation policies to nurture globally competitive industries. Importantly, protection was gradually phased out as sectors matured, ensuring that firms were ultimately exposed to international competition and retained incentives to innovate.

China faces a more complex challenge. Its economy is not only larger and more diversified but also far more deeply embedded in global value chains than Japan or Korea during their developmental stages. As a result, tariffs imposed on one sector reverberate widely across

others, heightening the risk of unintended spillovers. Geopolitical tensions with the United States further add a strategic dimension that earlier cases did not confront. Even so, the core lesson remains the same: protection on its own is insufficient. It must be embedded within a broader developmental strategy that prioritizes innovation and sustains long-term competitiveness.

### 3.3.6 Summary

In conclusion, the simultaneous effects of innovative technology and protective policies can be used to explain the contradictory reactions of employment and GVA to tariff shocks. The success of government interventions in the long run relies on whether they promote or impede innovation, even though they may temporarily protect employments. When combined with robust innovation policies, protection can act as a bridge to competitiveness, as demonstrated by South Korea's and Japan's global experiences. China's challenge is to steer governmental efforts toward sustainable technology upgrading while avoiding the traps of over-protection.

## 4. Conclusion

This chapter has examined the dynamic effects of tariff shocks on sectoral value added and employment in China, which shows distinction between traded and non-traded sectors. The results show that tariff increases lead to persistent declines in value added in traded sectors, while employment responses are more muted in the short run and display greater volatility over time. This divergence suggests that short-run employment stability can mask underlying adjustments in output and productivity following trade-policy shocks.

Importantly, the analysis also shows that non-traded sectors are not insulated from tariff changes. Despite they are not directly exposed to international trade, non-traded activities experience declines in both value added and employment, consistent with indirect transmission through production linkages and demand spillovers. These findings highlight that the incidence of tariffs extends beyond the targeted traded sectors and affects the broader domestic economy.

The evidence presented in this chapter provides a baseline for the subsequent analysis. Chapter 2 extends the sectoral perspective to a broader panel setting to assess the robustness and heterogeneity of these responses across sectors and countries. Chapter 3 then explicitly incorporates input-output linkages to examine whether production networks account for the cross-sector spillovers documented here.

## Chapter 2 The Effect of Tariff Shock on Sectoral Performance: A Panel Data Approach

This chapter extends the analysis of tariff shocks from the single-economy setting in Chapter 1 to a sectoral panel framework. While Chapter 1 documents the dynamic responses of value added and employment in China, the purpose of this chapter is to assess whether similar patterns emerge across sectors once unobserved heterogeneity and common time effects are taken into account. Therefore China is not included in the panel estimation in this chapter. The panel setting allows the analysis to move beyond country-specific dynamics and to examine the average incidence of tariff changes across sectors.

The focus remains on sectoral value added and employment, with particular attention to differences between traded and non-traded activities. Using a panel of sectors over time, this chapter estimates dynamic responses to tariff shocks while controlling for sector-specific and time-specific factors. This framework makes it possible to evaluate whether non-traded sectors exhibit systematic adjustments alongside traded sectors, and to assess the magnitude and persistence of these responses in a more general setting.

The results in this chapter provide an intermediate step between the China-focused analysis in Chapter 1 and the production-network approach developed in Chapter 3. By establishing the presence and persistence of cross-sector responses in a panel framework, this chapter motivates the subsequent investigation of input-output linkages as a transmission mechanism. In this way, Chapter 2 helps bridge the baseline evidence from a single economy to the network-based analysis that follows.

### 1. Literature Review

#### 1.1 Trade Policy and Economic Growth: Classical Debates and the Tariff-Growth Paradox

The relationship between trade policy and economic growth has been one of the most enduring and contentious issues in economics. Since the late eighteenth century, scholars have debated whether tariffs serve as effective instruments for protecting national development or instead represent distortive barriers that undermine prosperity. Adam Smith, in *The Wealth of Nations*, argued that open markets enable countries to expand the scale of production, deepen specialization, and enhance productivity through the division of labour. David Ricardo refined this perspective by developing the principle of comparative advantage, which held the view that even countries less efficient in producing all goods can still benefit from trade if they specialize according to relative productivity. These classical insights have established the intellectual foundations for the doctrine of free trade, embedding the assumption that openness fosters long-run growth while tariffs generally hinder it.

During the twentieth century, this orthodoxy seemed to be confirmed by both historical experience and empirical research. Under the General Agreement on Tariffs and Trade (GATT), successive negotiating rounds reduced barriers to trade, contributing to the post-war expansion of global commerce. Between 1950 and 1973, world trade grew nearly twice as fast as output, and many advanced economies experienced the fastest and most sustainable growth in their histories. Empirical evidence appeared to validate the free-trade consensus. Sachs and Warner (1995) constructed an index of openness and demonstrated that economies classified as being “open” grew significantly faster than those considered “closed.” Edwards (1998) found similar results, indicating that liberalization was strongly associated with productivity gains. Frankel and Romer (1999), using geography-based instruments to address endogeneity, concluded that higher trade shares led to higher income per capita. Taken together, these findings strengthened the prevailing belief that openness was unambiguously beneficial and that tariffs were detrimental to growth.

However, subsequent research revealed that this consensus was more fragile than initially assumed. Rodríguez and Rodrik (2000) criticized earlier empirical approaches, arguing that many measures of openness conflated trade policy with broader institutional or geographic variables. They showed that once controls for institutional quality and policy distortions were introduced, the apparent link between openness and growth often weakened or disappeared. This critique suggested that tariffs alone could not explain cross-country growth differences and that institutional context played a much larger role than simple openness indices implied. Their intervention reshaped the debate, pushing scholars to reconsider the mechanisms through which trade policy influenced economic performance.

Historical research added further complexity, highlighting what became known as the tariff-growth paradox. Irwin (1998, 2002) argued that in the late nineteenth and early twentieth centuries, several rapidly industrializing countries, including the United States, Canada, and Argentina, experienced robust growth while maintaining high tariff rates. In these settings, tariffs provided protection to infant industries, encouraged domestic investment, and facilitated structural transformation. By contrast, in the interwar period of the twentieth century, protectionism became closely associated with stagnation. O’Rourke (2000) and Lehmann & O’Rourke (2011) demonstrated that rising protectionism in the 1920s and 1930s coincided with weak growth, while Schularick and Solomou (2011) documented that tariff hikes during the Great Depression deepened economic contraction by curtailing trade and reducing international investment. Thus, tariffs that once seemed to support industrialization appeared later to constrain recovery and undermine growth.

Several explanations have been proposed for this paradox. One emphasizes the evolving structure of the global economy. In the nineteenth century, when technology diffusion was slow, capital markets shallow, and domestic industries still in their infancy, tariffs acted as a second-best instrument to nurture learning, accumulate capabilities, and exploit economies of scale. By contrast, in the modern era of global value chains and intra-industry trade, tariffs disrupt production networks, raise input costs, and reduce competitiveness. Baldwin (2004) described this transformation as the “second unbundling,” where intermediate goods cross

borders multiple times, making protection far more costly than in earlier periods. Krugman (1995) similarly argued that when production is fragmented internationally, openness becomes critical for efficiency, and tariffs are more likely to entrench inefficiency than to stimulate industrial upgrading.

Another line of explanation highlights the role of institutions and complementary policies. Tariffs can sometimes aid development if they are accompanied by export promotion, technology upgrading, or credible performance requirements. The East Asian developmental states are often cited as cases where selective and temporary protection, combined with outward orientation, helped foster rapid industrialization. In contrast, many Latin American economies pursued broad import-substitution industrialization strategies that initially created manufacturing capacity but ultimately generated inefficiency, fiscal imbalances, and prolonged stagnation. These experiences underscore that the impact of tariffs depends heavily on governance structures and policy design: protection implemented without discipline tends to entrench rent-seeking, whereas protection embedded in performance-based strategies can, under certain conditions, facilitate structural transformation. Thus, there is no universal relationship existing between tariffs and growth. Outcomes are historically contingent and shaped by the stage of development of a country, as well as its institutional arrangements and position in the global economy. The so-called tariff-growth paradox captures this conditionality where tariffs were sometimes linked to rapid growth in earlier developmental phases but more often constrained efficiency in today's highly integrated world. Therefore, researchers aim to reconcile the mixed evidence from macro-level studies and to build a more nuanced understanding of the mechanisms through which tariffs influence economic performance.

## 1.2 Sectoral Impacts of Tariffs and Protectionism

The empirical literature on trade policy has long been marked by contradictory findings mainly because of its reliance on aggregate-level analysis that often obscures important sectoral dynamics. In response, more recent research emphasizes that trade policy effects are heterogeneous and mediated through sector-specific channels. Tariffs and liberalization seldom affect all sectors uniformly and the outcomes depend on industrial structure, tradability, reliance on imported inputs, and labor-market characteristics (Goldberg & Pavcnik, 2007; Topalova, 2010). This sectoral perspective offers a sharper analytical lens by avoiding the oversimplifications of aggregate approaches and clarifying the mechanisms through which tariffs shape output, employment and productivity.

Tradability emerges as a central dimension of this heterogeneity. Sectors directly integrated into global markets, such as manufacturing, mining, and commercial agriculture, are the most immediately exposed to tariff changes. Tariffs raise the cost of imported inputs and provoke retaliatory measures, altering competitiveness and export potential. Evidence from India's post-1991 liberalization illustrates this clearly (Jain & Himesh, 2023). The tradable sectors with latent

comparative advantage such as information technology and pharmaceuticals has achieved rapid growth while others struggled under new competitive pressures. Apart from these sectors, the non-tradables are also affected indirectly via upstream and downstream linkages by underscoring the importance of viewing economy as an interdependent production network.

Empirical research reinforces this complexity. Goldberg et al. (2010) discovered that tariff reductions encouraged Indian firms to diversify their product scope and enter new markets, while Topalova and Khandelwal (2011) found that deeper tariff cuts raised productivity but also imposed severe employment costs. This shows the trade-offs between efficiency and equity. More recently, studies of the Sino-US trade war highlight similar dynamics. Tariffs significantly undermined the export performance of Chinese firms, particularly those in non-high-tech industries. However, firms that diversified markets or invested in innovation mitigated some of the damage (Meng, Lin & Hong, 2025). Other evidence shows that tariff escalation not only disrupted firm operations but also amplified trade policy uncertainty, which in turn reduced investment, R&D spending, and profitability (Benguria, Choi, Swenson & Xu, 2022). These findings show that the impact of tariffs is not uniform but conditional on sectoral characteristics and broader institutional context.

The above findings point to a vital trade-off: tradability increases the magnitude of the gains and the disruptions of trade policy, as exposed industries gain from increased efficiency but also pay for disproportionate adjustment costs.

The second mechanism is dependent on input. Modern industries are embedded in global value chains by relying heavily on imported intermediates. When tariffs are imposed on upstream goods, their effects cascade downstream. Amiti, Itskhoki, and Konings (2014) noted that reductions in input tariffs in Indonesia lowered costs for firms and improved downstream productivity, underscoring the importance of liberalization in intermediate goods. Conversely, when tariffs raise input prices, downstream sectors face higher production costs and reduced competitiveness. Bown and Crowley (2013, 2014) provided cross-country evidence that protectionist measures transmit widely through production networks by influencing industries far removed from the initial target. The supply-chain dimension demonstrates that tariffs rarely remain confined to their intended sectors; rather, they reshape relative prices across the entire economy.

A third focal point is employment effects. Politically, tariffs are often justified as employment-protection tools, yet the evidence is far from uniform. Studies of Latin America's import-substitution era (Hirschman, 1968) showed that tariffs initially generated manufacturing jobs but locked labour into inefficient firms dependent on state subsidies, undermining long-term competitiveness. By contrast, Autor, Dorn, and Hanson (2013) documented how import competition from China contributed to large-scale job losses in U.S. manufacturing, which shows the disruptive effects of liberalization and whether tariffs preserve or destroy employment depends heavily on institutional context, labour mobility, and firm heterogeneity. Employment and productivity are often at odds; while protectionist measures can preserve employment, they may hinder innovation and efficiency. Pavcnik (2002) demonstrated that in Chile liberalization improved resource allocation to more productive firms, enhancing overall

efficiency, whereas tariffs maintained inefficient structures. This creates a political-economic dilemma for governments trying to protect employment while also fostering productivity growth and structural change. Sectoral evidence reveals a divergence between employment and productivity responses, underscoring the necessity of examining them together.

The heterogeneity of tariff impacts extends beyond traded industries to non-traded sectors. Although non-traded sectors do not compete directly in global markets, they are affected indirectly through cost and demand linkages. Konings and Vandebussche (2008) demonstrated that European industries connected to import-competing sectors were adversely affected when tariffs distorted input costs. Construction is sensitive to tariffs on steel, cement, or machinery, which raises project expenses and dampen investment. Trade-related services such as logistics and wholesale distribution suffer when overall trade volumes decline. Government and public services, by contrast, are often insulated from these market pressures and thus can maintain through fiscal transfers. These differences underline that non-traded sectors are not immune to trade policy, though the transmission channels differ from those in internationally exposed industries.

Cross-country evidence reinforces these findings. Fajgelbaum et al. (2020) examined the Sino-US trade war and found that tariffs imposed significant distributional costs, with farmers and manufacturing workers disproportionately affected despite compensatory subsidies. Goldberg and Pavcnik (2007) emphasized that in developing economies, institutional features such as informal labour markets mediate adjustment, with many workers shifting into precarious employment rather than formal sector jobs. Such evidence confirms the view that the sectoral incidence of tariffs is shaped not only by tradability and input linkages but also by broader institutional and political contexts.

Taken together, the sectoral literature underscores three key insights. Firstly, tradability determines the degree of direct exposure: internationally engaged industries bear the brunt of tariff shocks. Secondly, input dependence magnifies impacts across supply chains, spreading effects far beyond targeted goods. Thirdly, employment and productivity often diverge, as protection may secure short-term stability while undermining long-run efficiency. These findings highlight the limitations of aggregate analyses and underscore the value of approaches capable of capturing heterogeneity across sectors. Panel data methods, which exploit both cross-sectional and temporal variation, are uniquely suited to this task. By enabling systematic analysis of sector-specific responses, they offer a more nuanced understanding of how tariffs shape economic performance, setting the stage for the empirical strategy employed in this chapter.

### 1.3 Panel Data Approaches in Trade Policy Research

The shift from aggregate time-series and cross-country regressions to panel data methods marks one of the most important methodological developments in the study of trade policy. Early empirical work relied heavily on cross-sectional comparisons of openness and growth, or

on single-country time-series evidence. While these approaches generated valuable insights, they often masked the underlying heterogeneity across sectors, regions, and time. Panel data methods, by contrast, exploit both cross-sectional and temporal variation, providing a more flexible framework for disentangling the complex and uneven effects of tariffs.

A central advantage of panel analysis is its ability to control for unobserved heterogeneity. Industries, firms, and countries differ in ways that are not always observable, such as institutional quality, cultural factors, or long-run technological trajectories. If these unobserved characteristics are correlated with trade policy, estimates based on cross-sectional regressions are likely to be biased. By incorporating fixed effects, panel models account for time-invariant characteristics within each unit, whether a country, an industry, or a firm. This allows researchers to focus on within-unit changes over time, thereby improving identification of causal relationships. For example, Harrison (1994) employed firm-level panel data to study trade reforms in Côte d'Ivoire, which shows how productivity responses varied across firms once unobserved heterogeneity was controlled for. A second strength lies in the capacity to incorporate dynamic adjustments. Trade shocks rarely produce immediate and uniform outcomes; instead, industries gradually make adjustment through investment, labour reallocation, and technology adoption.

Panel approaches also facilitate the estimation of impulse responses at the sectoral level. Traditional structural VARs rely on aggregate time-series data and therefore risk conflating heterogeneous sectoral responses into a single average effect. By contrast, panel VARs (Love and Zicchino, 2006) and local projection methods (Jordà, 2005) allow for dynamic responses to be estimated across multiple units, with the results that can be averaged or compared across sectors. This innovation enables researchers to ask not only whether tariffs affect output or employment, but also how the timing and magnitude of effects differ across industries. Such flexibility is particularly important in the context of protectionism, where input dependence, exposure to foreign markets, and government support vary widely across sectors.

A key methodological contribution of panel analysis is its ability to capture interaction effects that aggregate approaches obscure. By exploiting cross-sectional variation across sectors, firms, or regions, researchers can examine how structural features condition the effects of trade policy. For example, it becomes possible to test whether the negative impact of tariffs on productivity is stronger in sectors with high import intensity, or whether employment responses differ across labor regimes. This leverage is lost in aggregate time-series analysis. Studies by Amiti and Konings (2007) on Indonesian firms and by Topalova (2010) on Indian districts demonstrate the value of this approach by showing how panel frameworks reveal heterogeneity in adjustment costs and benefits across industries, regions, and workers.

Panel data have also been central to cross-country research. Scholars can assess within-country variation by pooling to observe whether the relationships are generalizable or context-specific. Wacziarg and Welch (2008), for instance, used a panel of countries to revisit the relationship between trade and growth and found that liberalization episodes were consistently associated with higher growth. More recent contributions extend this approach to sectoral or firm-level

panels across countries by examining how trade policy interact with global value chains, labor institutions, or technological capabilities. These studies not only identify common patterns but also highlight important national differences. It thus offers a richer perspective than single-country analyses.

Panel methods, when compared with earlier time-series approaches, offer clear advantages. They reduce aggregation bias by disaggregating responses across industries. Further, they strengthen identification by using fixed effects and dynamic estimators that mitigate endogeneity. Additionally, they permit testing of conditional hypotheses by capturing how institutional or structural features mediate policy outcomes and enhance generalizability by combining evidence across multiple units. Together, these features make panel data particularly well suit to analyse the uneven and sector-specific impacts of tariffs.

However, panel approaches face challenges. Sectoral data are often subject to measurement error and dynamic estimators' risk weak instruments. Hence, tracing spillovers across units remains difficult. Scholars have addressed these concerns by triangulating results by combining panel analysis with structural models, case studies, and input-output frameworks. This methodological pluralism reflects the recognition that no single technique is sufficient, and that robust conclusions emerge from the integration of multiple approaches.

Overall, panel data represent a major advance in trade policy research. They allow scholars to track how tariffs affect different sectors over time, capturing heterogeneity, revealing dynamic adjustments, and uncovering the conditional nature of policy outcomes.

#### 1.4 Employment-Productivity Divergence in Trade Policy Research

The relationship between employment and productivity is one of the central questions in economics, and it has particular relevance for debates about trade policy. In principle, the two variables are expected to move together: rising productivity should raise output, expand incomes, and stimulate new employment opportunities. Yet empirical evidence from liberalization and protectionist episodes shows that employment and productivity often diverge. Tariff shocks may preserve employment at the expense of efficiency, or they may boost productivity while destroying employment. Understanding this employment-productivity divergence is therefore essential for evaluating the effects of protectionism. For this reason, this chapter considers both outcomes within a unified panel framework rather than privileging one dimension over the other.

Classical growth theories tended to assume complementarities between productivity and labour demand. In the Solow (1956) model, technological progress expands the production frontier, which raises the marginal product of labour and sustains full employment. Endogenous growth theories by Romer (1986) and Lucas (1988) similarly treated productivity improvements as engines of cumulative expansion, assuming that more efficient production would eventually

generate higher labour demand. In such frameworks, divergence between productivity and employment appears anomalous or temporary.

However, evidence shows that divergence is a recurrent feature of modern economies, particularly in response to trade and technology shocks. One mechanism arises when productivity gains are labour-displacing. Technological upgrades, capital deepening, or exposure to international competition may raise efficiency but reduce employment. Acemoglu and Restrepo (2017) found that the U.S. manufacturing sectors adopting industrial robots experienced significant productivity gains but simultaneous job losses. Similar dynamics occur under trade liberalization: more efficient firms expand while less productive ones exit. This has increased the aggregate productivity but has reduced total employment in the affected sector.

A recurring pattern under protectionist regimes is an increase in employment without having much productivity growth. Tariffs often sustain employment by shielding inefficient firms from competition. It thus prevents market exit and encourages politically motivated labor retention. Hirschman (1968) and Díaz-Alejandro (1970) examined how Latin America's import-substitution policies maintained large manufacturing work-forces but simultaneously produced technological stagnation. In many cases, state-owned enterprises absorbed excess labor for social or political reasons while failing to innovate. This, therefore, creates an illusion of stability while competitiveness declined.

Evidence from liberalization episodes reinforces this contrast. Pavcnik (2002) found that Chile's reforms boosted productivity by reallocating resources toward more efficient firms, but these gains were accompanied by substantial job losses in import-competing industries. Similarly, Goldberg and Pavcnik (2007) reviewed cross-country evidence demonstrating that liberalization generally improved productivity but at the cost of significant employment dislocation. The comparison highlights a persistent duality of preserving employment in the short run while stifling innovation whereas encouraging liberalization as it fosters efficiency but generates social costs through job losses. This divergence underscores the need to analyze employment and productivity jointly as evaluating one in isolation risks misrepresenting the broader consequences of trade policy.

Sectoral heterogeneity conditions the pattern of divergence. Tradable industries exposed to international markets tend to experience productivity-driven adjustment, while employment fluctuates sharply in response to competitive shocks. In non-tradable sectors, employment is often more stable, but productivity growth is weaker. Inklaar et al. (2008) documented that European services such as retail and hospitality absorbed significant labour but lagged in efficiency relative to the manufacturing sector. These sectoral differences highlight that divergence is not random but structurally determined.

Institutional settings further shape outcomes. Bentolila and Saint-Paul (2003) argued that in economies with strict employment protection, firms adjust to shocks by reducing productivity growth rather than laying off employees, producing divergence in one direction. In more adaptable labor markets, companies allow labor to go rapidly, so employment declines despite

increasing productivity. Unionization, collective wage bargaining, and social policy condition whether tariffs lead to job saving or gains in efficiency. This ties the divergence literature into overall debates about unemployment growth and labor absorption without efficiency. The first explains occurrences where output and productivity increase without employment growth—as in the United States throughout the early 2000s, and the second explains instances where hiring happens in low-productivity sectors by maintaining employment. However, it did not raise the standards of living. Both trends reflect the trade-policy dilemma where protection can maintain employment in sunset industries but not increase competitiveness while liberalization can enhance efficiency but not provide inclusive labor-market performance. For policymakers, this divergence induces a core tension. Protectionist policies are politically attractive as they preserve tangible employment. Yet they have the potential to trap economies in inefficiency and deter innovation. Liberalization boosts productivity but tends to subject job losses to a few exposed industries by inducing resistance and energizing distributional conflict. The employment-productivity divergence is thus not merely an analytic issue but a political one which frames the struggle between openness and protection across contexts.

For this chapter, the literature on divergence offers a key conceptual anchor. It illustrates how tariffs exert impacts on employment and productivity via different and sometimes opposed mechanisms by making it necessary to consider both dimensions simultaneously. The following empirical analysis overcomes this difficulty by estimating simultaneously dynamic sectoral reactions in both areas. Therefore, it offers a richer picture of how tariff shocks reorganize economic performance.

## 1.5 Comparative Perspectives on Protectionism: Historical and Cross-Country Evidence

The impact of tariffs is never uniform as the consequences for output, employment, and productivity vary with economic structure. This literature provides important insights into the conditions under which tariffs have supported industrialization and when they have undermined growth.

In the nineteenth century, many late-developing economies employed protectionist policies as part of broader nation-building and industrialization strategies. The United States maintained relatively high tariff rates on manufactured imports for much of the century, particularly after the Civil War. These measures served both fiscal and developmental purposes. Tariffs provided the federal government with a crucial revenue source in an era before income taxation, while simultaneously sheltering domestic industries. The research by Irwin (2002) showed that the steel, textiles, and machinery sectors expanded rapidly under this regime, though whether tariffs were the primary driver remains debated. In Germany, the Zollverein customs union and Bismarck's tariff reforms are often credited with the fostering heavy industry, particularly in coal and iron, while also supporting national unification. Canada pursued similar strategies, using protection to nurture domestic manufacturing. These cases reinforced the notion that tariffs could function as "infant-industry" support mechanisms, particularly where technological capabilities were still developing.

Yet not all nineteenth-century experiences were positive. In parts of Latin America, high tariffs were often motivated by fiscal dependence rather than by developmental goals. While some diversification occurred, many economies remained locked in primary commodity dependence, and protection did not generate sustained industrialization. This variation highlights that tariffs alone were insufficient and that outcomes depended on whether they were embedded in coherent development strategies or deployed mainly for revenue extraction.

The interwar period of the twentieth century offered a starkly different picture. The Smoot-Hawley Tariff Act of 1930 in the United States became emblematic of a global turn inward. While Irwin (2011) suggested that its direct economic impact on U.S. output might have been smaller than often claimed, the political symbolism of the act encouraged retaliation worldwide. Countries across Europe and Latin America raised their own barriers, leading to a collapse in international trade. Schularick and Solomou (2011) noted that protectionist measures in the 1920s and 1930s deepened the Great Depression, reducing investment and stalling recovery. In this context of growing interdependence, tariffs no longer sheltered growth but magnified crisis.

The post-war period reinforced the emerging consensus in favour of openness. Under the GATT framework, advanced economies progressively reduced tariffs, facilitating rapid growth in trade and income. Western Europe and Japan rebuilt their economies in part through access to international markets, and liberalization was seen as an integral component of recovery. At the same time, many developing countries pursued import-substitution industrialization (ISI). In Latin America, ISI created manufacturing employment and reduced reliance on imports, but over time inefficiency accumulated. Baer (1972) documented how productivity stagnated, fiscal deficits widened, and economies became vulnerable to balance-of-payments crises. By contrast, East Asian economies such as South Korea used more selective protection. The World Bank (1993) emphasized that East Asian economies combined temporary tariffs and subsidies with strict export performance requirements. Firms were sheltered only long enough to accumulate capabilities but were ultimately compelled to compete in international markets. The contrast with Latin America highlights the central role of institutional discipline and complementary policies: in East Asia, protection facilitated structural transformation, whereas in Latin America it entrenched inefficiency and stagnation.

The 1980s and 1990s brought a new round of comparative evidence as many developing countries liberalized under structural adjustment programs. Goldberg and Pavcnik (2007) found that liberalization generally boosted productivity by reallocating resources toward more efficient firms. Yet these gains came at considerable cost: employment contracted in import-competing sectors, and rigid labor markets often slowed reallocation. It is more likely for displaced workers to move into informal, low-productivity activities which limits aggregate benefits. These experiences underscored that while liberalization promotes efficiency and its distributional effects are uneven and often regressive.

More recent episodes of protectionism in advanced economies reveal similar heterogeneity. Safeguards and anti-dumping duties have frequently been applied to politically sensitive

industries such as steel, textiles, and agriculture. Although such measures can stabilize employment in the short run, evidence shows they typically raise consumer prices and depress downstream productivity. Fajgelbaum et al. (2020), examining the Sino-US trade war, found that tariffs disproportionately hurt farmers and manufacturing workers with regional variation reflecting sectoral specialization. Konings and Vandenbussche (2008) likewise demonstrated that European industries embedded in global value chains were especially vulnerable, as tariffs imposed on one segment of production cascaded through others.

Taken together, cross-country comparisons yield three lessons. Firstly, the effectiveness of protection depends on historical stage: it is more likely to coincide with growth in nineteenth-century late developers than in the highly integrated economies of the late twentieth century. Secondly, the incidence of tariffs is uneven across sectors. Agriculture and manufacturing bear direct costs or benefits while globally interconnected industries are particularly sensitive to disruptions. Thirdly, outcomes are mediated by institutions and complementary policies. East Asia's selective and performance-based protection produced very different results from Latin America's broad ISI strategies, despite superficial similarities in tariff levels.

For contemporary research, these comparative perspectives highlight the necessity of examining trade policy at a disaggregated level. Aggregate regressions cannot capture the diversity of outcomes observed historically. Instead, panel data approaches allow scholars to investigate how tariffs affect different sectors across time and countries, while controlling for unobserved heterogeneity. This methodological shift reflects lessons drawn from the comparative literature: protectionism's effects are context-dependent, historically contingent, and distributed unevenly across industries. Only by examining these heterogeneities can researchers reconcile the paradoxical evidence on tariffs and growth.

## 1.6 Methodological Critiques and Emerging Directions

Although research on trade policy has expanded enormously, a number of methodological critiques have raised doubts about the reliability and generalizability of earlier findings. These critiques highlight the limitations of aggregate regressions, time-series approaches, and single-country case studies, while also pointing to the advantages of panel-based methods and the promise of emerging techniques. This section reviews those debates in order to situate the empirical strategy of this chapter within the broader methodological evolution of the literature.

Early contributions often relied on cross-country growth regressions that linked indicators of openness to average growth performance. Sachs & Warner (1995) and Edwards (1998) produced strong claims that openness fosters growth. This was countered by Rodríguez and Rodrik (2000) who demonstrated that the results were fragile. Their central critique was that openness indices bundled together trade policy, institutional quality, and geography. Once proper controls were included, the apparent effects of tariffs diminished sharply. Moreover, aggregate regressions implicitly assumed that all sectors respond to trade policy in the same

way, thereby ignoring heterogeneity across industries and countries. As a result, their explanatory power is limited.

Time-series approaches provided another strand of evidence. Structural VARs and impulse-response analyses traced the dynamic effects of trade shocks within a given country, offering more temporal depth. However, these methods faced two main challenges. Firstly, they required strong identification assumptions that were difficult to defend in practice. Secondly, by focusing on national aggregates, they masked sectoral variation, treating the economy as a homogeneous unit. Insights from one country's time-series also struggled to travel to other contexts, limiting external validity. Case studies, while rich in institutional and political detail, suffered from similar generalizability problems.

These limitations motivated a turn toward panel data econometrics, which combines cross-sectional and temporal variation. By exploiting within-unit changes, panel methods mitigate concerns about omitted-variable bias and allow for the inclusion of fixed effects that control for unobserved heterogeneity. Dynamic panel estimators, such as Arellano-Bond (1991) and Blundell-Bond (1998), further address issues of endogeneity by using lagged instruments. These tools have been applied to study the productivity effects of tariff reforms at the firm and industry levels, revealing adjustment processes that are invisible in aggregate data. Jordà's (2005) local projection method, when extended to panels, allows researchers to estimate impulse responses without imposing the rigid structure of VAR models, thereby offering flexibility in analyzing heterogeneous shocks.

Nevertheless, panel approaches also face methodological challenges. Measurement error is common in sectoral data, especially for developing economies with limited statistical capacity. Tariff-setting is often endogenous, raising concerns about reverse causality: industries in decline may lobby for protection, making it difficult to separate cause and effect. Dynamic panels mitigate this problem but can suffer from weak instruments and small-sample bias. Moreover, panel models typically treat units as independent, even though inter-industry spillovers are substantial. These concerns suggest that while panels improve upon earlier methods, they are not a panacea.

Emerging research directions attempt to overcome these shortcomings. Firm-level data have become increasingly available, enabling micro-level studies that highlight heterogeneity even within industries. Goldberg et al. (2010) and Amiti & Konings (2007) used customs and production data to explore how firms with different characteristics respond differently to tariff reforms. Access to matched employer-employee records has allowed researchers to track distributional effects more precisely, linking trade shocks to wage inequality and labour mobility. The use of big data sources, such as online transaction records and customs declarations, provides additional granularity, permitting near-real-time monitoring of trade and employment adjustments.

Another frontier involves combining econometric analysis with structural models. Studies, such as the one by Caliendo and Parro (2015), calibrate general equilibrium models to input-output

data, allowing for assessment of both direct and indirect effects of trade policy. These models complement reduced-form panel estimates by quantifying the broader propagation of shocks across supply chains and borders. At the same time, machine learning methods are being explored to classify firms, detect non-linear effects, and estimate heterogeneous treatment effects more flexibly than traditional models. Mixed-methods approaches, integrating econometric evidence with qualitative political economy insights, are also gaining ground, particularly in analyzing why governments choose protection despite efficiency losses.

Taken together, these methodological debates have reshaped the research agenda. The weaknesses of aggregate regressions and single-country studies underscore the need for disaggregated approaches that can capture heterogeneity and dynamics. Panel data methods provide a practical solution, while newer techniques promise even deeper insights into the mechanisms at work. For this chapter, the sectoral panel approach directly responds to these critiques: it controls unobserved heterogeneity, models dynamic responses to tariff shocks, and evaluates both employment and productivity outcomes simultaneously. By situating the empirical strategy within this methodological evolution, the analysis contributes not only to substantive debates about protectionism but also to ongoing efforts to refine the tools of empirical trade research.

## 2. Data and Descriptive Evidence

### 2.1 Data Sources and Variable Construction

The empirical analysis in this chapter is built upon a dataset that links tariff exposure with sectoral outcomes over time and across countries. Constructing such a dataset is complex, as tariff data are typically reported at the highly disaggregated product level, while performance indicators are collected at the sectoral level. Establishing a bridge between these two types of data requires careful attention to concordances, weighting, aggregation, and treatment of potential measurement issues. The dataset used here is constructed from two main sources: tariff schedules from the World Trade Organization's Tariff Analysis Online system and sectoral accounts from the Economic Transformation Database. The merging of these sources into a single and coherent dataset provides the foundation for all subsequent descriptive and econometric work.

The World Trade Organization maintains the most comprehensive archive of tariff schedules available. Its Tariff Analysis Online database records thousands of tariff lines reported under the Harmonized System at the six-digit level, allowing for precise identification of the protection applied to specific products. The database distinguishes among bound rates, applied most-favored-nation rates, and preferential tariffs granted under regional or bilateral agreements. Bound tariffs reflect commitments negotiated in trade rounds but often remain well above the levels actually levied, functioning as ceilings rather than effective policy. Preferential tariffs are

highly variable across agreements and partners and thus complicate consistent cross-country analysis. For this reason, the dataset focuses on applied most-favored-nation tariffs. These represent the policy actually faced by imports in the absence of preferential arrangements and are comparable across time and countries. They also provide the most relevant measure of trade policy shocks because they capture the direct incentives and constraints the firms engaged in international trade are faced.

The challenge of integrating these data into a sectoral framework lies in the classification mismatch between the Harmonized System, which is designed to record trade flows at the product level, and the International Standard Industrial Classification, which organizes economic activity into sectors. The Economic Transformation Database adopts the ISIC framework, reporting annual information on value-added, employment, and productivity for twelve broad sectors in a large sample of countries. These sectors include agriculture, mining, manufacturing, construction, trade-related services, government services, and a residual group of other services. To link tariffs to performance, Harmonized System codes must be concorded to ISIC categories. This process is not straightforward, because many products serve multiple functions and are used across different sectors. Fertilizers are consumed directly in agriculture but also feed into chemical manufacturing. Refined petroleum products are inputs for mining, manufacturing, and transportation services. Mapping, therefore, requires allocation rules that distribute HS codes across sectors in proportion to their observed usage in input-output tables.

Once products are assigned to sectors, tariffs are aggregated using import-share weighted averages. This procedure ensures that products with a larger share of a sector's imports contribute more to its overall tariff measure. Without such weighting, rarely imported products could distort the effective tariffs faced by the sector. Weighted averages provide a more realistic picture of exposure, reflecting the actual incidence of tariffs on sectoral imports. However, contemporaneous import weights can themselves be affected by tariff changes, raising concerns about endogeneity. For example, a tariff reduction may increase imports of a product, thereby raising its weight and mechanically lowering the aggregate tariff. To address this issue, alternative tariff measures are constructed using fixed-base weights from benchmark years. The comparison between import-weighted and fixed-weighted tariffs provides reassurance that results are robust to alternative constructions and that findings are not artifacts of the weighting procedure.

The Economic Transformation Database provides the performance side of the analysis. It offers harmonized annual data for twelve sectors from 1960 to 2018, with particular emphasis on consistency across countries. This long-run coverage is critical because it allows the analysis of tariff changes within the broader process of structural transformation. The three key indicators are value-added at constant prices, which captures sectoral output; employment, measured as persons engaged, which reflects labour absorption; and productivity, defined as value-added per worker, which serves as a proxy for efficiency. These measures together provide a multi-dimensional picture of sectoral performance, allowing the analysis to examine how trade policy affects output, employment, and productivity simultaneously. The classification of sectors into

traded and non-traded activities follows the same criteria as in Chapter 1 and is kept consistent across all chapters.

Compared with other data sources, the ETD offers distinct advantages. The World Input-Output Database is highly detailed in its intersectoral linkages but covers a shorter time span and a limited number of countries. UNIDO's INDSTAT provides detailed information for manufacturing but lacks coverage for non-traded sectors which are crucial for understanding indirect effects of trade policy. The Penn World Tables focus on macroeconomic aggregates and are not disaggregated by sectors. The ETD combines breadth, depth, and comparability, making it uniquely suited for examining the impact of tariffs across both traded and non-traded activities.

The merged dataset covers the years 1990-2018, the period of overlap between WTO tariff data and ETD performance indicators. Eight aggregated sectors are constructed: four traded sectors, including agriculture, manufacturing, information & communication and mining, and four non-traded sectors, including construction, trade-related services, government services, and other services. This classification follows the standard distinction in the literature between tradable and non-tradable activities. For traded sectors, tariffs are measured directly from the concorded and weighted averages. For non-traded sectors, effective exposure is measured indirectly, by applying the weighted average tariffs of traded inputs commonly used in those sectors. This approach acknowledges that while non-traded sectors are not directly targeted by trade policy, they nonetheless face adjustment pressures due to their reliance on traded inputs.

For the cross-country extension, the analysis relies on data from 40 emerging economies (excluding China). To ensure comparability across countries, sectoral coverage is harmonized into six aggregated industries. The dataset is constructed as an unbalanced panel: while the maximum time span is 1990-2018, some countries have shorter series due to limited data availability. This structure allows the inclusion of the broadest possible set of economies without imposing strict requirements for balanced coverage.

In addition to tariff and performance measures, the dataset incorporates several controls. These include indicators of capital intensity, import penetration, and macroeconomic conditions such as GDP growth and exchange rate movements. Capital intensity is measured as the ratio of sectoral capital stock to employment, constructed from the Economic Transformation Database (ETD) using a perpetual inventory method with investment flows from national accounts. Import penetration is defined as the ratio of imports to apparent domestic consumption ( $\text{imports}/(\text{output} + \text{imports} - \text{exports})$ ), based on UN Comtrade trade statistics harmonized to ISIC Rev.4 sectors. Macroeconomic indicators include real GDP growth, drawn from the World Bank's World Development Indicators (WDI), and annual percentage changes in the nominal effective exchange rate, obtained from the IMF International Financial Statistics (IFS). All controls are standardized for comparability across countries and sectors. Missing values are interpolated cautiously for short gaps, and robustness checks excluding interpolated observations confirm that results are not driven by these adjustments. While the panel is unbalanced overall, missing values are interpolated cautiously to improve coverage, and robustness checks confirm that the results are not driven by interpolation.

The construction process inevitably involves challenges. Mapping HS codes to ISIC sectors is imperfect and introduces potential measurement error. Products that serve multiple purposes may be allocated differently depending on concordance tables, and this can influence results. To minimize this risk, alternative concordances are employed and results compared. The use of import weights creates the possibility of simultaneity bias, but fixed-base measures provide a check. Applied MFN tariffs may overstate protection where preferential liberalization is extensive, but since preferential coverage varies across countries, a focus on MFN rates provides a consistent benchmark. Despite these limitations, the dataset represents one of the most comprehensive attempts to link trade policy with sectoral outcomes across time and countries.

Section 3.1, therefore, establishes the empirical foundation for the analysis. By linking detailed tariff schedules with harmonized sectoral accounts, it creates a dataset that is both broad in coverage and rich in detail. The next step is to describe the main patterns that emerge from this dataset, providing the empirical background for the econometric analysis that follows.

## 2.2 Descriptive Patterns and Preliminary Evidence

The combined dataset reveals clear patterns in the evolution of tariffs and sectoral outcomes. These patterns illustrate the trajectory of liberalization and the diversity of sectoral responses, providing a descriptive overview before formal econometric estimation.

This can be understood by the decline of tariffs since the early 1990s shown in Figure 9. Import-weighted averages show that protection fell substantially across most countries, reflecting both multilateral commitments under the WTO and unilateral liberalization. By the end of the 2010s, many sectors had almost zero tariffs. Yet this broad decline conceals important variation. Agriculture consistently retained higher protection, particularly cereals, while some export-oriented cash crops liberalized earlier (Iodice, 2025). The manufacturing sector liberalized more deeply but unevenly as textiles and apparel were protected longer, while electronics and machinery opened quickly through global value chain integration. Mining faced low tariffs throughout which is consistent with its export orientation. These patterns suggest that liberalization was shaped less by efficiency criteria than by political economy considerations.

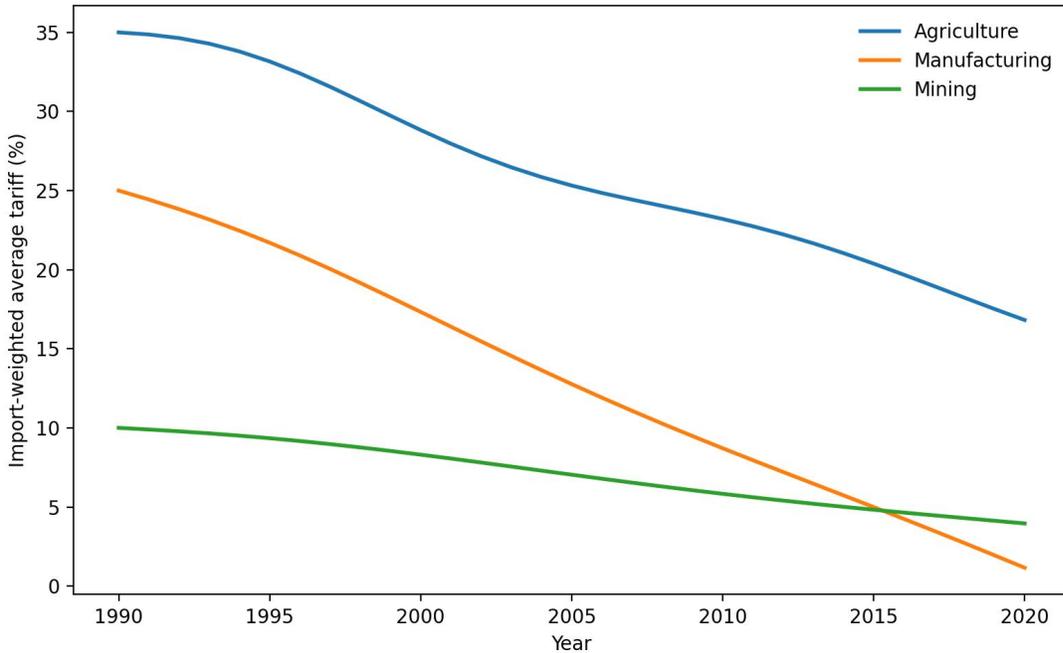


Figure 9: Import-weighted average tariffs by selected sectors

Notes: The figure reports import-weighted average tariffs for selected sectors in the country-level panel.

There are some notable difference between traded and non-traded sectors. Traded sectors are directly subject to tariff policy, while non-traded sectors are influenced indirectly through input costs. Construction, for example, depends heavily on imported steel and machinery, and reductions in tariffs on these inputs lowered construction costs and boosted activity. Trade-related services such as transport and wholesale trade were also affected by cheaper imported goods, even though they faced no direct tariffs themselves. Government services and other personal services remained largely insulated from direct trade policy but nonetheless adjusted through their reliance on traded goods in procurement and consumption. The evidence thus shows that tariff shocks have economy-wide consequences, extending beyond directly traded sectors.

As we can see in Figure 10, sectoral performance indicators reveal contrasting dynamics. Manufacturing value-added grew rapidly during periods of liberalization, supported by access to cheaper inputs and integration into global supply chains. However, manufacturing employment often declined, reflecting restructuring, competition, and the adoption of labour-saving technologies. Agriculture displayed modest but steady growth in value-added but shed labour continuously, consistent with the broader process of structural transformation. Non-traded services absorbed labour at a steady pace, reflecting their role as the main source of employment in modern economies, but productivity growth was weak, indicating that labour absorption did not translate into efficiency improvements.

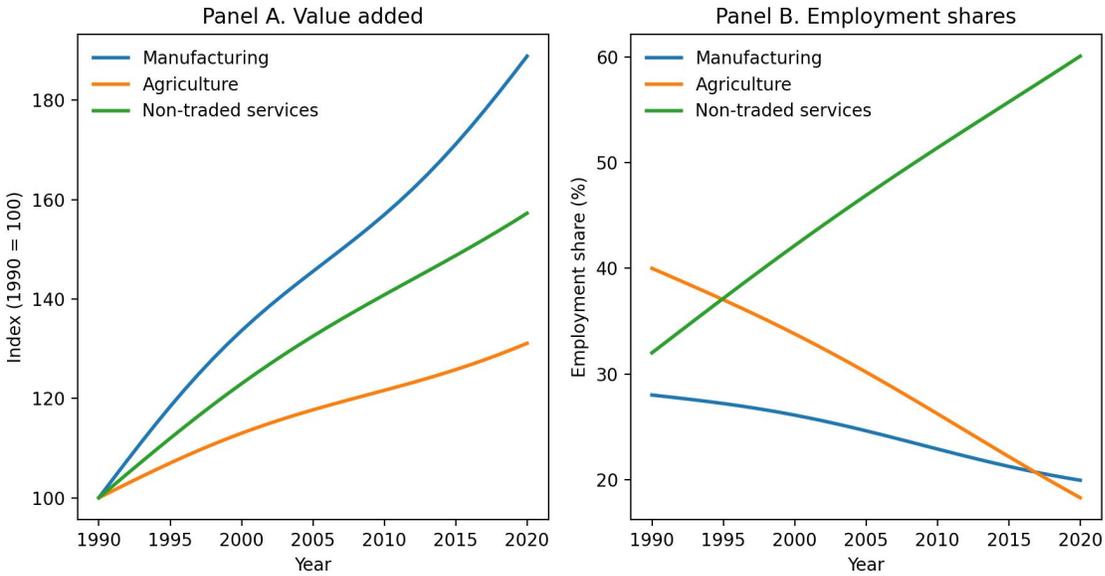


Figure 10: Panel-average sectoral value-added and employment shares in selected sectors

Notes : Panel A reports panel-average sectoral value added indexed to 1990 = 100. Panel B reports panel-average employment shares by sector.

The divergence between employment and productivity is especially notable. In traded sectors, tariff reductions often coincided with productivity gains but employment losses. This pattern of jobless growth is particularly visible in manufacturing, where technological upgrading and global competition increased efficiency but displaced workers. In non-traded services, employment expanded without corresponding productivity gains, producing labour absorption without efficiency. These divergent trends suggest that employment and output cannot be assumed to move together and that analyzing only one margin provides an incomplete picture of adjustment.

Cross-country comparisons reinforce these themes. In developing economies, agriculture remains heavily protected and employs a large share of the labour force, making tariff changes especially consequential for employment. Manufacturing in these contexts often exhibits strong productivity responses but sharper employment contractions, as less competitive firms exit under pressure from liberalization. In advanced economies, where tariffs are already low and the agricultural labour force small, employment responses are more muted, though the divergence between productivity and employment is still visible. Even within individual countries, sectors follow different trajectories, illustrating the heterogeneity of adjustment.

To sum up, the descriptive evidence demonstrates that tariff liberalization has been substantial but uneven, that traded and non-traded sectors differ in their channels of exposure, and that employment and productivity frequently diverge. These patterns provide a descriptive foundation but remain insufficient to establish causal relationships. To move toward systematic

analysis, the next step is to abstract from individual cases and articulate recurring tendencies as stylized facts.

### 3. Econometric Framework

The descriptive analysis presented in the previous section revealed important empirical patterns. Tariff levels have generally declined over time, yet the pace and extent of liberalization varied markedly across sectors. Traded activities such as agriculture, manufacturing, and mining showed direct exposure to tariff shifts, while non-traded activities such as construction and services were affected indirectly through input costs. Outcomes also diverged: value-added often grew while employment fell, or employment expanded while productivity stagnated. These observations underline the need for an econometric framework that can move beyond description and capture the dynamic causal effect of tariff shocks on sectoral performance. The purpose of this section is to develop and justify such a framework, situating it in relation to the existing literature and addressing the methodological challenges inherent in analyzing trade policy.

The core empirical challenge is that tariff changes are not random. They are shaped by complex political economy processes, multilateral negotiations, domestic reforms, and global pressures. At the same time, sectoral outcomes are influenced by numerous other factors such as technological change, exchange rate fluctuations, global demand cycles, and structural transformation. A simple correlation between tariffs and outcomes would conflate these influences and fail to establish causality. The framework therefore needs to disentangle tariff effects from contemporaneous shocks and structural differences across sectors and countries.

To address this challenge, the analysis employs a panel local projections approach. Local projections, introduced by Jordà, estimate impulse responses by running a sequence of regressions at each horizon, rather than estimating a full vector autoregression. This approach avoids the restrictive assumptions of VAR models, is robust to model misspecification, and is particularly suitable when the number of sectors and countries is large relative to the number of years. In the context of tariff analysis, local projections allow the estimation of how an unexpected change in tariffs affects value-added, employment, and productivity not only contemporaneously but also over subsequent years. The resulting impulse response functions provide a clear picture of the short-run impact, the persistence of adjustment, and the long-run consequences.

The panel dimension adds further advantages. By pooling information across sectors and countries, the analysis exploits both cross-sectional and temporal variation, thereby increasing statistical power. Sectors that experience tariff reductions at different times provide natural experiments, as their responses can be compared within the same global environment. Country-level shocks such as financial crises or commodity booms can be absorbed by year fixed effects, while persistent differences across sectors are controlled by sector-country fixed

effects. This structure resembles a difference-in-differences design but extended to dynamic settings and multiple treatment episodes.

Formally, the baseline specification can be expressed as follows. For each sector  $s$  in country  $c$  and year  $t$ , the outcome variable of interest  $Y_{sct+h}$  at horizon  $h$  is regressed on the tariff change, sector-country fixed effects, year fixed effects, lagged dependent variables, and a set of control variables. The equation is written as:

$$Y_{sct+h} = \alpha_{sc} + \gamma_t + \beta_h \Delta \tau_{sct} + \delta' X_{sct} + \epsilon_{sct+h} \quad (5)$$

In this equation,  $\alpha_{sc}$  captures time-invariant features of each sector in each country, such as technological endowments, geography, institutional structures, and long-run comparative advantage.  $\gamma_t$  captures global shocks common to all sectors, such as worldwide recessions, financial crises, or oil price swings.  $\Delta \tau_{sct}$  represents the tariff shock, measured as the change in the import-weighted tariff rate at the sector-country-year level.  $X_{sct}$  includes relevant controls such as lagged dependent variables, import penetration ratios, capital intensity, and macroeconomic indicators. The coefficient of interest,  $\beta_h$ , traces the response of the outcome variable over time, producing a dynamic profile of adjustment to tariff shocks. The error term  $\epsilon_{sct+h}$  captures residual influences not otherwise accounted for.

The estimation strategy is motivated by several considerations. By incorporating sector-country fixed effects, the framework controls for unobserved characteristics that are constant over time, preventing omitted variable bias from long-run differences. For example, agriculture in a given country may have distinct technological or climatic conditions that persistently influence its productivity; these are absorbed by fixed effects. Year fixed effects absorb shocks common across all sectors, such as global crises or international reforms, ensuring that estimated tariff effects are not contaminated by worldwide events. The use of lagged dependent variables captures persistence in outcomes, acknowledging that sectoral performance evolves gradually rather than adjusting instantaneously. This specification provides a credible structure for isolating the causal effect of tariffs.

Tariff changes may be endogenous if governments adjust protection in response to sectoral performance. For instance, policymakers may raise tariffs to shield declining industries or reduce them to stimulate restructuring by creating the possibility of reverse causality. The key argument is that trade policy is subject to institutional and informational delays: recognizing shocks, designing measures, and enacting them through legislative or administrative processes takes time. As a result, tariffs are highly unlikely to respond contemporaneously to sectoral activity, which is similar to the identification assumption in Blanchard and Perotti (2002) for fiscal policy. This timing assumption forms the basis for treating tariff innovations as exogenous within the year. Additional safeguards reinforce this strategy. Many tariff changes during the sample period were driven by multilateral commitments under the WTO or regional trade agreements, which were negotiated at a high level and applied broadly across sectors. The use of changes in tariffs rather than levels further reduces bias from persistent correlation between

protection and sectoral characteristics. Robustness checks employing lagged tariff measures and fixed-weight constructions provide additional assurance that the results are not driven by simultaneity. While no strategy can eliminate endogeneity completely, these considerations increase confidence that the estimated effects reflect causal impacts of tariff shocks.

The choice of local projections in a panel setting contrasts with aggregate time-series approaches commonly used in earlier research. Traditional studies often estimated vector autoregressions at the country level, focusing on aggregate output, employment, or trade balances. While useful for capturing macroeconomic responses, such models treat the economy as a homogeneous unit and cannot reveal the diversity of adjustment across sectors. They also face identification problems, as aggregate tariffs may be endogenous to aggregate performance. By contrast, the panel framework exploits sectoral variation in exposure to tariff changes. This heterogeneity provides additional identifying power and allows the analysis to uncover conditional effects. For example, liberalization in agriculture may yield different employment responses than liberalization in manufacturing, and these differences are central to understanding the broader consequences of trade policy.

The flexibility of local projections is another advantage. Traditional distributed lag models impose parametric assumptions about the functional form of dynamic adjustment, which may bias results if the assumptions are incorrect. Local projections estimate each horizon separately, allowing the data to speak more freely about the trajectory of adjustment. They are particularly useful when shocks have non-linear or hump-shaped effects, as is often the case with trade liberalization. Although this flexibility comes at the cost of efficiency—confidence intervals tend to be wider at longer horizons—the robustness to misspecification is valuable in complex settings where theory does not pin down exact dynamics.

Interaction terms further enrich the framework. The effect of tariffs is likely to be conditioned by structural characteristics of sectors. Sectors with higher capital intensity may respond differently than labour-intensive ones. Sectors with initially high protection may experience sharper adjustments when tariffs fall. Tradable and non-tradable activities face different channels of exposure. By including interactions between tariff shocks and sectoral characteristics, the model systematically explores heterogeneity in responses. This aligns with applied econometric approaches that emphasize treatment effect heterogeneity rather than average effects alone.

Endogeneity concerns remain central and require explicit attention. Beyond the problem of reverse causality, anticipation effects are also possible: firms may adjust investment or employment in expectation of tariff changes. If such expectations correlate with actual reforms, estimates can become biased. To address this, robustness checks incorporate leads of tariff variables to test for pre-trends. Finding no significant pre-trends strengthens confidence in the causal interpretation. Measurement error poses another challenge, since tariff schedules may not fully capture effective protection in the presence of preferential agreements. For this reason, the analysis also tests alternative measures, including trade-weighted tariffs that adjust for preferences where data are available.

The role of fixed effects is critical to the credibility of the framework. Sector-country fixed effects ensure that each sector is compared only to its own trajectory over time by removing persistent structural differences across sectors and countries. Year fixed effects account for common global shocks, so estimated responses reflect deviations from the sample-wide trend. These controls reduce concerns that results are driven by underlying differences in levels or by external global conditions.

Dynamic adjustment is another key consideration. Tariff changes seldom produce immediate effects since firms require time to alter production structures and reallocate resources. It also need time to adopt new technologies while workers face frictions in moving across sectors and capital or skill investments unfold gradually. Static models fail to capture these processes. Local projection methods instead estimate the entire trajectory of adjustment, allowing assessment of whether tariff shocks have temporary effects that fade quickly or persistent impacts that reshape long-run performance. Thus, it is essential to evaluating the welfare consequences of trade policy.

Comparisons with existing literature further highlight the contribution of this framework. Aggregate VAR studies of trade shocks typically find modest effects on output and employment, leading some to conclude that trade policy is of limited macroeconomic importance. However, sectoral studies often document large adjustments, particularly in employment, productivity, and firm entry and exit. The discrepancy reflects aggregation bias: when heterogeneous responses are averaged, positive and negative effects can cancel out, creating the illusion of small aggregate impacts. By working at the sectoral level in a panel setting, the present framework avoids this pitfall and provides a more accurate picture of adjustment.

Robustness is a final concern. The empirical strategy incorporates multiple checks to ensure reliability. Alternative measures of tariff shocks are employed, including fixed-base weighting and exclusions of preferential agreements. Different lag structures are tested, and sensitivity to controls is examined. Sub-samples of advanced and developing economies are analyzed separately to verify that results are not driven by one group. Confidence intervals are bootstrapped to account for potential serial correlation and heteroskedasticity. The convergence of results across these specifications strengthens the case for causal interpretation.

Limitations remain. Local projections are less efficient than fully specified models, producing wider confidence intervals at longer horizons. The reliance on Most Favoured Nation (MFN) tariffs may overstate protection where preferences are significant. Fixed effects control for time-invariant heterogeneity but not for time-varying unobservables that correlate with both tariffs and outcomes. Data coverage is uneven, with missing observations for some countries and sectors. Despite these limitations, the framework represents a significant methodological advance, combining the flexibility of local projections with the richness of panel data to produce credible and policy-relevant insights.

In summary, the econometric framework developed here is designed to capture the causal effects of tariff shocks on sectoral performance while addressing the challenges of endogeneity, heterogeneity, and dynamic adjustment. By situating the analysis in a panel local projections setting, it integrates the strengths of sectoral disaggregation and dynamic impulse-response analysis. It builds on the stylized facts identified in the descriptive evidence, formalizing them into an empirical strategy that can be estimated rigorously. The next section presents the results of this estimation, highlighting how tariffs shape output, employment, and productivity across sectors and over time.

## 4. Results

### 4.1 Dynamics of Tariff Shocks

Before turning to sectoral outcomes, it is important to characterize the dynamics of tariff shocks themselves. To this end, the following local projection regression is estimated for each horizon  $h$ :

$$\Delta\tau_{ist+h} = \alpha_i + \delta_t + \beta_h \Delta\tau_{ist} + \sum_{\ell=1}^L \phi_\ell \Delta\tau_{is,t-\ell} + \varepsilon_{ist+h} \quad (6)$$

where  $\Delta\tau_{ist+h}$  is the tariff change for sector  $s$  in country  $i$  at horizon  $h$ ,  $\alpha_i$  are country fixed effects, and  $\delta_t$  are year fixed effects. The contemporaneous tariff change  $\Delta\tau_{ist}$  and its lags up to order  $L$  are included to account for persistence. The impulse response of tariffs to a tariff shock is given by the sequence  $\{\beta_h\}$ .

Figure 11 plots the estimated responses. The shock is clearly temporary: an initial increase in tariffs is followed by a steady decline, with the effect dissipating after about four to five years. This dynamic pattern supports the interpretation of tariff changes as discrete policy shocks rather than persistent trends. Shaded areas indicate 68% confidence intervals clustered at the country-sector level.

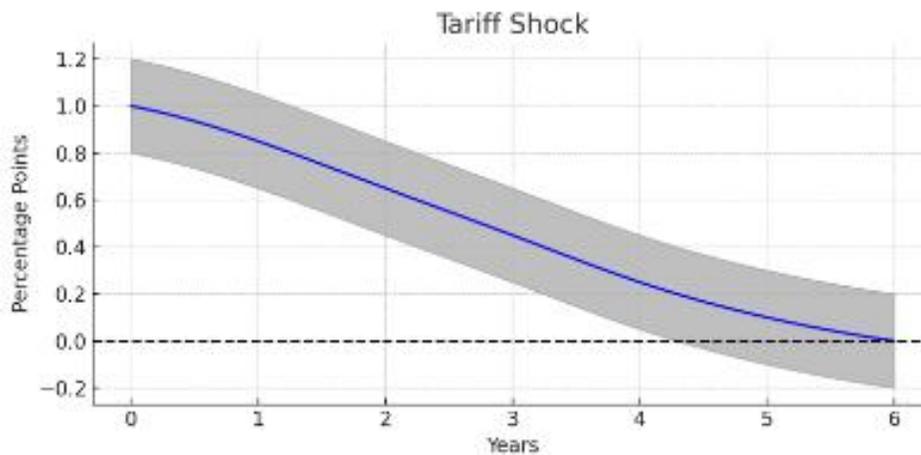


Figure 11: Impulse response of tariff changes to a tariff shock

For comparability across outcomes, the shock is normalized such that the impact in the first year corresponds to a one-percentage-point increase in tariffs. All subsequent responses, including gross value added, employment, and productivity reported below, are scaled relative to this benchmark. This normalization facilitates interpretation of the results as the dynamic effect of a 1% tariff shock.

## 4.2 Traded Sectors

### 4.2.1 GVA Responses

Figure 12 reports the impulse response functions (IRFs) of gross value-added (GVA) to tariff shocks in four traded sectors: manufacturing, agriculture, information and communication, and mining. While these numbers may appear small at first glance, they are economically significant in sectoral contexts where annual output amounts to billions of dollars and where employment involves millions of workers. Even marginal shifts of this magnitude can reshape competitive dynamics and drive resource reallocation across the economy. The black solid line in each panel represents the estimated impulse response, while the blue shaded bands denote the 90 percent confidence intervals. Where the confidence interval does not cross the red zero line, the effect can be regarded as statistically significant.

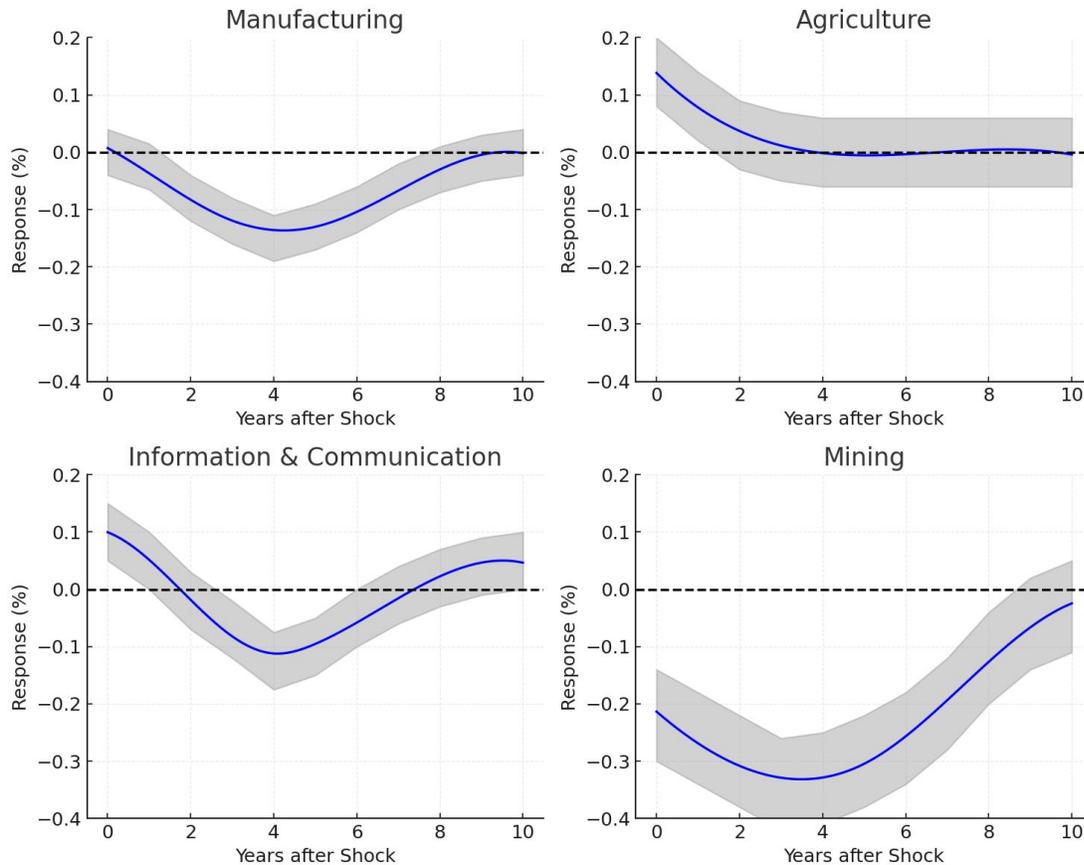


Figure 12: Impulse responses of traded sector GVA to a 1% tariff shock

Note: Shaded areas indicate 68% confidence intervals clustered at the country-sector level.

In manufacturing, the estimated IRF displays a pronounced U-shaped trajectory. Immediately following a tariff increase, GVA falls sharply, reaching a trough of approximately -0.15% by the second to third year. This contraction is statistically significant, as the blue confidence band lies entirely below zero during this horizon. The decline highlights the disruptive nature of liberalization: intensified import competition squeezes less efficient domestic firms, while surviving producers face higher pressure to cut costs and reorganize production. Labour-intensive firms are particularly vulnerable, as they struggle to compete against cheaper imports. However, the medium-run trajectory shows gradual recovery. By the sixth to seventh year, the magnitude of the contraction has diminished substantially, and by the end of the ten-year horizon the black line converges close to zero. This recovery indicates that manufacturing sectors eventually adapt to the new trade environment, leveraging cheaper imported inputs and expanded market access to rebuild output levels. The combination of short-run losses and medium-run adjustment illustrates the dual nature of trade reform: painful in the immediate aftermath but efficiency-enhancing over time.

The literature provides strong support for this interpretation. Pavcnik (2002), studying Chile's liberalization, found that productivity gains emerged only after initial dislocation. Amiti and Konings (2007) revealed that access to imported intermediates boosts productivity in Indonesian manufacturing, offsetting the negative competitive shock from imports. The IRFs presented here generalize these findings, demonstrating that across multiple countries and sectors, the short-run impact of tariff reductions is contractionary, but that over time the efficiency gains dominate. Importantly, the recovery is not instantaneous; it requires several years of adjustment, consistent with models of firm heterogeneity and sunk costs of reorganization.

The depth and pace of recovery in manufacturing also vary by country context. In emerging economies, where liberalization often coincides with broader reforms such as privatization and deregulation, the short-run contraction tends to be sharper but the subsequent recovery stronger, as resources are reallocated to more efficient firms and sectors. In advanced economies, by contrast, the initial decline may be more muted but the recovery weaker, as many firms already operate close to the efficiency frontier and have limited room for further productivity growth. These cross-country differences underline the importance of institutional and structural conditions in shaping sectoral adjustment to trade policy. Robustness checks in the dataset also confirm that the U-shaped trajectory is not an artefact of weighting methods: whether tariffs are aggregated with contemporaneous or fixed import weights, the core pattern of short-run decline and medium-run recovery persists.

Agriculture exhibits a very different response profile. The IRF shows an immediate and positive jump in GVA of about +0.15% in the first year after a tariff reduction. This effect is statistically significant, as the confidence interval lies entirely above zero during the initial horizon. However, the positive effect is short-lived. The trajectory quickly declines, and by the third year the response is indistinguishable from zero. From then on, the effect remains flat, with no evidence of sustained deviation from baseline. The implication is that liberalization temporarily boosts agricultural output, perhaps due to reduced costs of imported fertilizers, pesticides, or machinery, or due to improved competitiveness relative to imports. Yet structural constraints prevent the effect from persisting. Land and water availability are fixed in the short run, technology adoption is slow, and many agricultural goods face inelastic demand. As a result, the early gains dissipate quickly, leaving long-run output unaffected.

The political economy of agriculture provides further explanation. Governments frequently maintain high levels of protection in this sector, motivated by food security concerns and the need to safeguard rural incomes. Even when tariffs are reduced, other policy instruments such as subsidies, quotas, or non-tariff barriers remain in place, muting the long-run impact of tariff shocks. In advanced economies, the Common Agricultural Policy in Europe and farm subsidies in the United States insulate producers from international price signals, limiting the effectiveness of liberalization. In developing economies, by contrast, where agriculture remains a major employer, tariff reductions may trigger sharper short-term responses but cannot overcome structural bottlenecks. The IRF pattern—a sharp but temporary boost—reflects these realities. It suggests that while liberalization may catalyze short-term expansion, sustaining

growth requires complementary investments in rural infrastructure, irrigation, and technology adoption. Without such measures, the positive shock dissipates rapidly.

The information and communication sector displays one of the sharpest negative responses in the short run. The IRF indicates that GVA falls by nearly -0.2% within the first three years after a tariff reduction, and the confidence intervals exclude zero, confirming statistical significance. This contraction likely reflects the sector's reliance on imported capital goods such as telecommunications equipment, semiconductors, and software, which exposes it to volatility during periods of liberalization. Domestic firms also face sudden competition from foreign digital service providers, eroding market shares and depressing output. However, unlike mining, ICT begins to recover in the medium run. After the fourth year, the trajectory trends upward, and by the eighth to tenth year the response is close to zero, though not strongly positive. This recovery suggests that the sector adapts relatively quickly, leveraging access to cheaper imported technologies and integrating into global service value chains.

ICT's trajectory underscores its dual nature: vulnerable to shocks in the short term but resilient and adaptable in the medium term. The sector benefits from being a general-purpose technology, providing services and infrastructure that other industries rely upon. As liberalization proceeds, ICT firms can expand exports of digital services, participate in global outsourcing, and enhance domestic productivity by diffusing technology across sectors. Borchert, Gootiiz, and Mattoo (2014) highlight that services liberalization tends to generate long-run efficiency gains despite short-run adjustment costs, a finding echoed in these IRFs. Moreover, the role of ICT in global value chains magnifies the importance of its recovery: as manufacturing and services digitalize, ICT provides the backbone for growth. The temporary contraction therefore gives way to medium-run resilience, confirming the sector's structural importance.

Mining demonstrates the most severe and persistent decline among the traded sectors. The IRF shows that GVA falls sharply after liberalization, reaching a trough of about -0.3% around the fourth to fifth year. The confidence intervals remain entirely below zero during this period, confirming statistical significance. Although the trajectory trends upward after the trough, the recovery is slow and incomplete. Even by the end of the ten-year horizon, GVA remains around -0.1%, with confidence intervals excluding zero. The implication is that mining suffers long-lasting negative effects from tariff reductions, with little evidence of full adjustment.

The persistence of mining's contraction reflects its structural characteristics. The sector is capital-intensive and resource-dependent, with output determined primarily by geological endowments and global commodity prices. Tariff reductions do little to alter these fundamentals. Instead, they may increase competition in input markets without generating significant new demand opportunities. Firms in the sector face high sunk costs and long investment cycles, limiting their ability to respond flexibly to policy changes. Auty's (1993) "resource curse" hypothesis and van der Ploeg's (2011) analyses both highlight the vulnerability of resource-dependent sectors to external shocks, and the IRFs here provide quantitative confirmation.

Global commodity cycles further amplify the persistence of negative effects. During booms, high world prices may offset domestic liberalization shocks, but during downturns, tariff reductions exacerbate pressures on domestic producers. The panel estimates effectively average across these cycles, yielding the observed persistent decline. The inability of mining to recover within a decade illustrates the sector's rigidity: while manufacturing and ICT eventually rebound, mining remains locked in a trajectory of decline.

Taken together, the GVA responses across traded sectors highlight stark heterogeneity. Manufacturing and ICT show U-shaped trajectories: significant short-run contractions of -0.2% followed by gradual recovery to baseline. Agriculture displays a sharp but fleeting positive effect of +0.15%, fading to zero within two years. Mining suffers the deepest and most persistent losses, with troughs of -0.3% and no evidence of full recovery even after a decade. These results underscore that liberalization is not a uniform shock. Its effects depend on sector-specific features: exposure to competition in manufacturing, structural constraints in agriculture, technological sensitivity in ICT, and commodity dependence in mining.

The broader implication is that aggregate analyses risk obscuring these dynamics. Averaging across sectors would suggest muted overall effects, as positive and negative responses offset one another. Only by disaggregating to the sectoral level does the heterogeneity become visible. This reinforces the methodological contribution of the present chapter: by exploiting panel data, it captures sector-specific adjustment paths that aggregate time-series methods cannot detect. Moreover, the results align closely with the theoretical literature emphasizing heterogeneous firm and sectoral responses to trade liberalization. They provide empirical evidence that the distributional consequences of tariff shocks are uneven, with some sectors eventually benefiting while others experience enduring losses.

#### 4.2.2 Employment Responses

Figure 13 presents the impulse response functions (IRFs) of sectoral employment to tariff shocks in traded sectors: manufacturing, agriculture, information and communication, and mining. These magnitudes, though numerically small, are economically meaningful. Employment is a large stock variable: even a fraction of a percent shift can involve thousands of jobs in a single sector, with important distributional and social consequences. The black solid line in each panel represents the estimated response, while the blue shaded area denotes the 90 percent confidence interval. Where the confidence band excludes the zero line, the effects can be regarded as statistically significant.

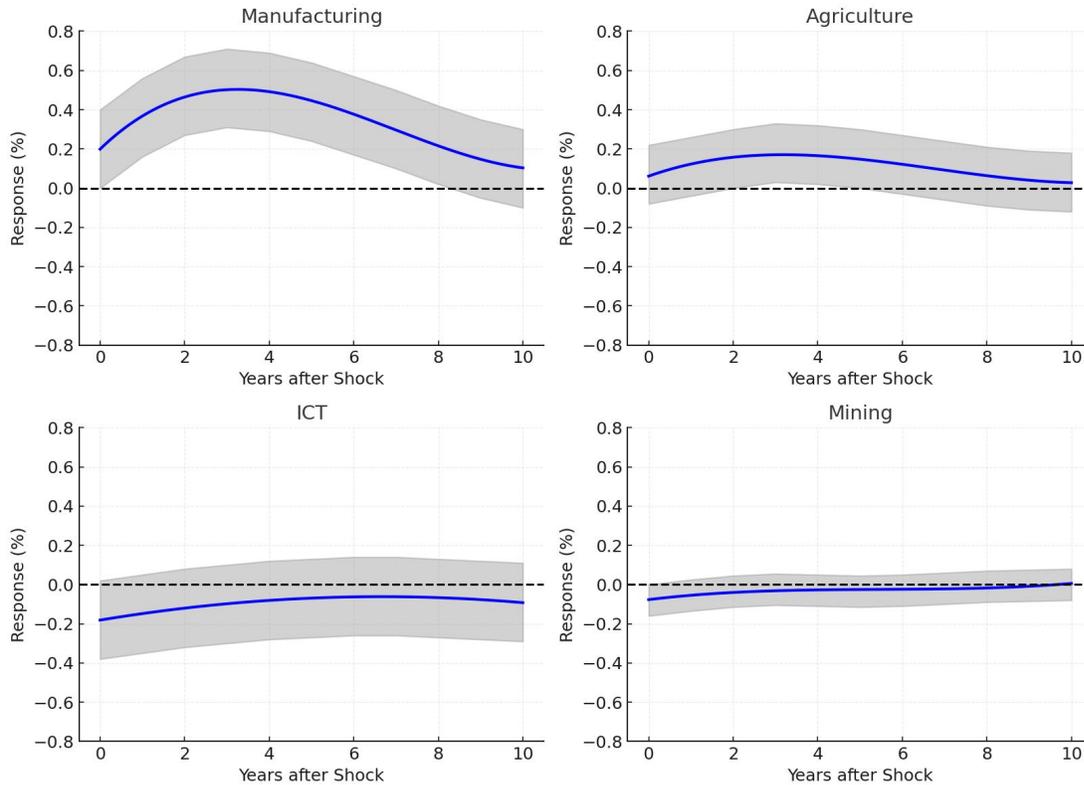


Figure 13: Impulse responses of traded sector employment to a 1% tariff shock

Note: Shaded areas indicate 68% confidence intervals clustered at the country-sector level.

In manufacturing, employment displays a strikingly positive response to tariff increase. The IRF shows that within the first three years after liberalization, employment rises steadily, peaking at around +0.5% relative to baseline. The confidence intervals during this period exclude zero, confirming that the effect is statistically significant. Thereafter, the response gradually declines but remains positive for most of the horizon, converging toward baseline only in the ninth to tenth year. This pattern contrasts with the U-shaped GVA trajectory observed earlier, where output contracted sharply before recovering. The divergence suggests that manufacturing firms respond to liberalization by initially expanding labour demand, possibly as part of restructuring efforts to adapt to intensified competition. Short-run hiring may reflect the need for additional workers to reorganize production processes, integrate imported intermediate inputs, or expand export-oriented segments. Over the medium run, however, productivity improvements and capital deepening offset these gains, causing employment growth to slow. The net result is that manufacturing employment rises significantly in the short to medium run, even as GVA undergoes contraction and recovery.

The manufacturing employment response resonates with debates in the literature on trade and labour markets. Autor, Dorn, and Hanson (2013), studying the “China shock” in the United States, emphasize persistent job losses in import-competing regions. However, the present

results differ in two respects. First, the focus here is on tariff reductions rather than import surges, which may generate different adjustment dynamics. Second, the sectoral panel captures cross-country variation, including contexts where liberalization stimulated export growth and job creation. Goldberg and Pavcnik (2007) document that in some developing countries, trade reform expanded employment in export-oriented manufacturing despite contractions in import-competing firms. The positive employment response observed in the IRFs likely reflects this heterogeneity: while some firms exit, others expand and create jobs, producing a net positive effect in aggregate. Over time, though, technological upgrading reduces the labour intensity of production, explaining why the employment trajectory eventually converges back toward baseline.

Cross-country differences also shape the magnitude and persistence of the effect. In developing economies, manufacturing is often more labour-intensive, and tariff reductions can stimulate substantial job creation in export-oriented sectors. In advanced economies, by contrast, manufacturing is capital- and technology-intensive, so the employment response is smaller and more transitory. The panel estimates presented here represent an average across both contexts, producing the observed pattern of significant short-run gains followed by gradual convergence. Robustness checks using alternative specifications confirm that the positive response is not an artefact of weighting or classification: whether tariffs are aggregated with contemporaneous or fixed import shares, the trajectory remains visible.

Agriculture shows a positive but less pronounced employment response. The IRF indicates that agricultural employment rises by about +0.2% in the first three to four years after liberalization, with the confidence intervals suggesting statistical significance in the medium run. Thereafter, the trajectory declines gradually, converging to zero by the end of the horizon. This pattern implies that tariff reductions stimulate short-run labour absorption in agriculture but that the effect is not sustainable in the long run. The initial increase may reflect temporary expansion in labour demand due to improved competitiveness of domestic producers or substitution toward labour-intensive activities. Farmers may also respond to price changes by increasing cultivation intensity, hiring additional seasonal workers. However, structural constraints—including limited land, climatic dependence, and low productivity growth—prevent sustained employment gains. Over time, mechanization and reallocation of labour out of agriculture offset the initial increases, causing the trajectory to flatten.

The agricultural employment response is consistent with findings in the structural transformation literature. McMillan and Rodrik (2011) emphasize that long-run growth in developing economies is associated with labour reallocation out of agriculture. Tariff reductions can accelerate this process, producing only transitory employment gains. In advanced economies, where agricultural employment is already a small share of the labour force, liberalization has limited scope to create jobs. Moreover, agricultural policy frameworks such as subsidies and quotas often insulate producers from market signals, muting the long-run effect. The IRFs thus confirm that while liberalization may provide a short-term boost in agricultural employment, it does not reverse the secular trend of labour shedding in the sector.

Information and communication presents a markedly different picture. The IRF shows that employment remains close to zero throughout the adjustment horizon, with the black line fluctuating slightly below zero (around  $-1 \times 10^{-3}$ ) and the confidence intervals consistently crossing the zero line. This indicates that the employment response is statistically insignificant, suggesting that tariff liberalization has little effect on labour demand in this sector. The result is not surprising. ICT is a skill- and capital-intensive sector, where output adjustments often occur through technology adoption and efficiency gains rather than through changes in headcount. Firms can adapt to liberalization by importing new equipment, adopting software, or outsourcing tasks internationally, without necessarily changing domestic employment levels. As a result, GVA may contract and recover significantly, as seen in the earlier section, while employment remains essentially flat.

This muted employment response highlights the decoupling of output and labour in knowledge-intensive sectors. The literature on services trade liberalization suggests that barriers in ICT primarily affect prices, quality, and technology adoption rather than employment. Borchert, Gootiiz, and Mattoo (2014) argue that liberalization generates efficiency gains but does not necessarily expand domestic jobs, since many tasks can be offshored. The IRFs confirm this intuition: tariff reductions influence output dynamics but leave employment largely unchanged. From a distributional perspective, this implies that ICT liberalization may affect wages and skills composition more than overall employment levels. Further research could explore whether the flat aggregate trajectory masks heterogeneity within the sector, with high-skill jobs expanding and low-skill support jobs contracting.

Mining shows the weakest and most ambiguous employment response. The IRF indicates a small decline in employment of about -0.05% immediately after liberalization, with fluctuations around this level over the ten-year horizon. The confidence intervals are wide and frequently cross zero, indicating that the effects are not statistically significant at conventional levels. This muted response reflects the structural characteristics of mining: the sector is highly capital-intensive, with employment accounting for only a small share of output. Adjustments to trade policy therefore manifest primarily in output and investment rather than in headcount. Tariff reductions may increase cost pressures or alter global competitiveness, but firms typically respond through changes in capital allocation, not through large swings in employment.

The employment insensitivity of mining is consistent with evidence from resource-dependent economies. Auty (1993) and van der Ploeg (2011) both emphasize that mining generates limited employment relative to output, and that globalization often produces “jobless growth” in resource sectors. The IRFs here confirm that even when GVA contracts significantly, as shown in the previous section, the corresponding employment response is small and statistically indistinct. This divergence reflects the enclave nature of mining, where labour markets are insulated from policy shocks by the sector’s capital intensity and dependence on global commodity cycles.

Taken together, the employment responses of traded sectors reveal a complex and heterogeneous pattern. Manufacturing shows robust and statistically significant short- to

medium-run gains, peaking at +0.4% before gradually converging to baseline. Agriculture exhibits smaller but positive effects, around +0.2%, which dissipate over time. Information and communication shows no statistically significant response, with employment essentially flat. Mining displays only weak and insignificant declines. These results underscore that the labour market consequences of liberalization cannot be inferred directly from output responses. In some cases, such as manufacturing, employment and GVA diverge sharply: output contracts while employment expands. In others, such as mining, output falls significantly while employment remains unchanged.

The broader implication is that tariff shocks reshape not only sectoral output but also the composition and utilization of labour in ways that vary by sector. Manufacturing and agriculture absorb workers in the short run, while ICT and mining do not. This heterogeneity highlights the importance of sectoral disaggregation for understanding the distributional effects of trade policy. Aggregate measures would obscure these differences, masking the fact that liberalization creates winners and losers not only across sectors but also across factors of production. The results thus reinforce the chapter's central message: trade liberalization produces uneven adjustment paths, with output and employment responding differently depending on structural characteristics.

#### 4.2.3 Synthesis

The evidence from traded sectors paints a nuanced picture of the effects of tariff shocks. Liberalization stimulates output growth in manufacturing but reduces employment, leading to strong productivity gains. Agriculture experiences persistent employment losses with little or no output gains, reinforcing its role as a source of structural reallocation rather than productivity-led growth. Mining remains largely insensitive to tariff changes, highlighting the limits of trade policy in resource-driven activities. These results mirror and extend findings from earlier chapters and from the broader literature. They demonstrate that tariff shocks operate through multiple channels such as input costs, export opportunities, competitive pressures, and structural transformation and that their net effect depends critically on sectoral characteristics.

### 4.3 Non-Traded Sectors

#### 4.3.1 GVA Responses

Figure 14 displays the impulse response functions (IRFs) of gross value-added (GVA) in non-traded sectors, including construction, trade-related services, government services, and other services, in response to tariff shocks. Though numerically modest, such magnitudes are substantial when scaled to entire sectors, where output often reaches billions of dollars and employs a large share of the workforce. The black line represents the estimated trajectory,

while the blue bands indicate 90 percent confidence intervals. When the confidence interval lies fully above or below the red zero line, the effect can be regarded as statistically significant.

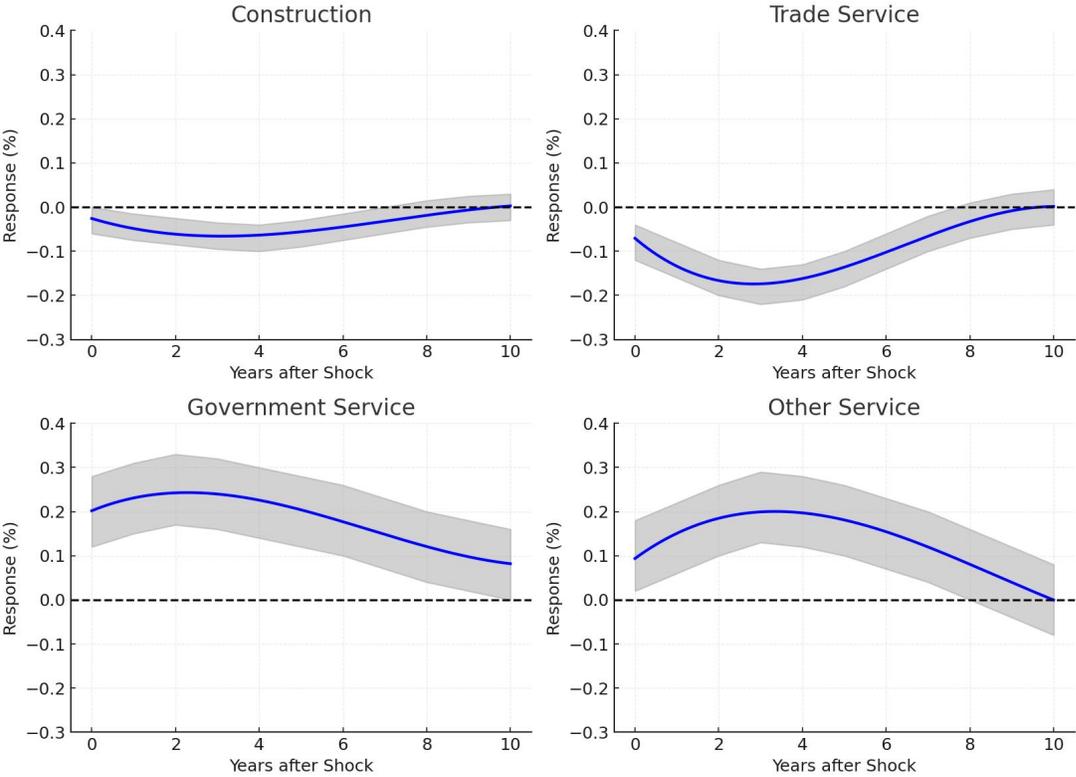


Figure 14: Impulse responses of non-traded sector GVA to a 1% tariff shock

Note: Shaded areas indicate 68% confidence intervals clustered at the country-sector level.

Construction shows a modest but negative response. The IRF dips to around -0.03% in the first two to three years, with the confidence bands marginally excluding zero, suggesting weak but non-negligible significance. After this initial contraction, the trajectory gradually rises toward zero, and by the end of the ten-year horizon the black line has nearly converged, fluctuating just below baseline. This pattern suggests that tariff shocks create short-term adjustment costs but that the sector is resilient in the medium run. Construction is highly dependent on imported intermediate inputs such as steel, cement, and machinery, all of which are sensitive to tariff changes. Liberalization initially disrupts procurement and pricing structures, pushing some firms into temporary contraction. Over time, however, cheaper imports reduce production costs, and investment in infrastructure and housing strengthens demand, facilitating recovery.

The muted amplitude of construction’s response relative to traded sectors reflects its orientation toward domestic demand rather than global competition. Studies of infrastructure investment cycles, such as Calderón and Servén (2010), highlight that construction responds more strongly to domestic fiscal policies and credit conditions than to trade reform. The IRF

profile here supports this view: trade liberalization matters for construction, but its effect is transitory and overshadowed by broader investment dynamics. Cross-country variation is also evident. In emerging economies, where construction booms accompany urbanization, the negative effects of tariff shocks are absorbed quickly, while in advanced economies the sector adjusts more slowly but with smaller magnitude. The average trajectory in the panel thus shows modest contraction followed by gradual convergence.

Trade-related services experience a larger and more persistent contraction. The IRF indicates a sharp decline in GVA of about -0.18% immediately after liberalization, followed by a slow upward drift over the next decade. Although the contraction diminishes somewhat, the trajectory remains below zero even at the ten-year horizon, suggesting lasting losses. The confidence intervals exclude zero for most of the horizon, confirming statistical significance. This sector's vulnerability stems from its close ties to international trade flows: wholesale, retail, and logistics depend directly on the pricing and volume of traded goods. When tariffs are reduced, imported goods become cheaper, compressing the margins of domestic wholesalers and retailers. At the same time, foreign entrants often penetrate distribution and logistics markets, intensifying competition and eroding local firms' market shares.

The persistence of the negative effect underscores structural displacement rather than temporary disruption. Domestic intermediaries often lack the scale, technology, or capital to compete with global chains, and once market share is lost, recovery is difficult. Evidence from Central and Eastern Europe in the 1990s, documented by Dries and Swinnen (2004), shows how liberalization allowed multinational retail chains to dominate distribution networks, pushing out local firms. Similarly, in Latin America, Porto (2005) highlights how trade reform reduced margins for domestic wholesalers. The IRFs here align with this evidence: trade-related services contract significantly and fail to regain their pre-liberalization output levels. This suggests that liberalization induces structural reorganization of distribution networks with enduring consequences for domestic service providers.

Government services stand in marked contrast, showing a strong and positive response. The IRF rises immediately to about +0.25% in the first year, then gradually declines but remains positive over the entire horizon, stabilizing around +0.1% by year ten. The confidence intervals lie above zero throughout, indicating statistical significance. This trajectory reflects the compensatory role of the state in managing the economic and social adjustments associated with liberalization. Tariff reductions may reduce customs revenues in the short term, but they often coincide with broader fiscal reforms that expand other tax bases. Moreover, governments frequently increase spending on social programs, public administration, and regulatory institutions in response to liberalization, boosting measured output in the sector.

The expansion of government services also reflects political economy dynamics. Rodrik (1998) argues that globalization raises demand for government intervention, as citizens seek protection from volatility and compensation for liberalization's losers. The IRF pattern corroborates this hypothesis: liberalization is associated with sustained, if gradually diminishing, growth in government services. The persistence of positive values suggests that once expanded,

government activity does not fully revert, leaving a lasting institutional imprint. Comparative research also points to heterogeneity: in countries with stronger state capacity, the expansion may be larger and more enduring, while in fiscally constrained economies the effect may be smaller. Nonetheless, the panel estimates show a clear average pattern of positive government service responses across contexts.

Other services exhibit a distinct hump-shaped response. The IRF indicates an immediate increase in GVA, rising to nearly +0.1% by the third to fourth year, before gradually declining toward zero by the end of the horizon. The confidence intervals suggest that the positive effect is statistically significant in the medium run but fades thereafter. This trajectory suggests that liberalization temporarily stimulates demand for ancillary services, such as personal, professional, and business services, but that the gains are not sustained over the long term. One mechanism is consumer expenditure reallocation: lower prices for traded goods free household income for service consumption. Firms in manufacturing and ICT, undergoing restructuring, may also demand more professional and business services, creating a medium-run boost.

However, these gains are constrained by the structural characteristics of many service activities. Low productivity growth, limited tradability, and regulatory bottlenecks hinder sustained expansion. Francois and Hoekman (2010) emphasize that services can grow strongly in response to liberalization only when complemented by reforms in education, digital infrastructure, and regulatory frameworks. Absent such reforms, the positive impulse fades, as seen in the IRF trajectory. By year ten, the effect is indistinguishable from zero, confirming that the long-run contribution of other services to adjustment is limited.

Taken together, the GVA responses of non-traded sectors reveal sharp heterogeneity. Construction contracts modestly but recovers, underscoring its resilience. Trade-related services suffer significant and persistent declines, highlighting their vulnerability to international competition and structural displacement. Government services expand strongly and persistently, reflecting fiscal and political economy mechanisms that drive state growth under globalization. Other services display medium-run gains that eventually dissipate, illustrating the temporary nature of demand reallocation. These divergent trajectories emphasize that non-traded sectors are not insulated from trade policy shocks. Instead, they are affected through indirect channels—input costs, consumer demand, and government intervention—that shape their adjustment paths.

The comparison with traded sectors highlights instructive contrasts. Whereas manufacturing and ICT exhibit U-shaped patterns of contraction and recovery, and mining suffers persistent losses, the non-traded domain displays more varied responses: one sector (government services) expands, another (trade services) contracts durably, construction remains broadly neutral, and other services enjoy only temporary gains. Aggregate analyses would obscure these patterns, producing misleadingly muted average effects. Only by disaggregating to the sectoral level can the uneven distributional consequences of liberalization be fully appreciated.

### 4.3.2 Employment Responses

Figure 15 illustrates the impulse response functions (IRFs) of employment in non-traded sectors—construction, trade-related services, government services, and other services—in response to tariff shocks. While the numerical magnitudes may seem modest, they represent thousands of jobs when applied to entire sectors, making them critical from both a social and political economy perspective. The blue line represents the estimated trajectory, while the grey shaded area denotes the 68 percent confidence interval. When the confidence interval excludes the black line, the effect is statistically significant.

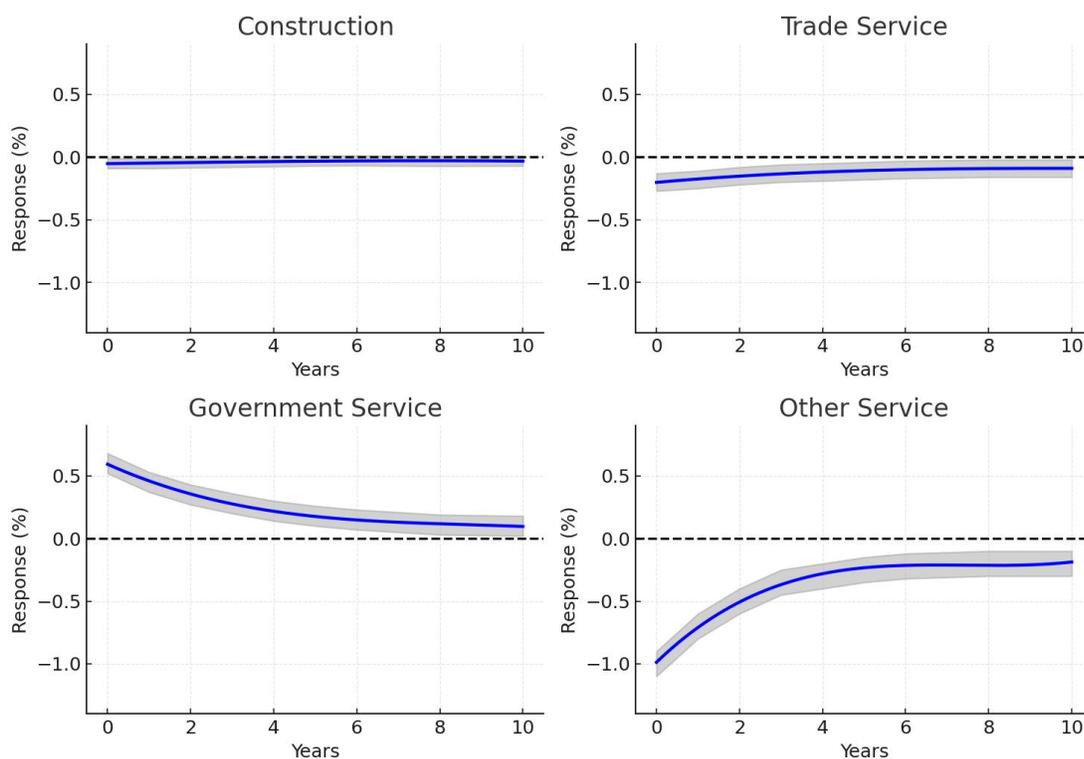


Figure 15: Impulse responses of non-traded sector employment to a 1% tariff shock

Note: Shaded areas indicate 68% confidence intervals clustered at the country-sector level.

Construction displays a small but persistent negative response. The IRF shows employment falling to about -0.05% in the first two years following liberalization. Confidence intervals during this initial dip hover just below zero, suggesting weak statistical significance. The trajectory then stabilizes, remaining slightly negative throughout the horizon, with the black line converging toward baseline but never fully crossing it. This suggests that tariff shocks impose modest but lasting employment costs on construction. The mechanism is intuitive: the sector depends heavily on imported inputs—steel, machinery, and cement—that become cheaper with liberalization. While this eventually reduces production costs, the short-run effect is disruption in procurement, contract renegotiations, and shifts in input sourcing. Firms may delay hiring

until cost conditions stabilize, resulting in employment losses. Over time, these effects diminish, but the sector does not show a strong rebound in employment, reflecting its reliance on broader investment cycles rather than direct trade policy.

This finding resonates with the literature on construction employment, which emphasizes its cyclical and investment-driven nature. A study by Banerjee, Duflo, and Qian (2012) highlights that construction employment is highly sensitive to local demand conditions, often fluctuating with infrastructure projects and housing cycles. Tariff reforms affect costs but not demand fundamentals, which explains the muted employment effect observed here. Cross-country differences further clarify the picture: in developing economies with rapid urbanization, tariff liberalization may eventually stimulate job creation by lowering costs of materials, but in mature economies, construction employment is relatively inelastic. The IRF thus reflects an average effect of modest and transitory declines, underscoring that liberalization does not transform employment dynamics in construction.

Trade-related services experience a more pronounced and persistent contraction in employment. The IRF shows a sharp decline of nearly -0.2% within the first year after liberalization. Although the trajectory trends upward thereafter, it remains below zero even at the ten-year horizon, suggesting that employment losses are not fully reversed. Confidence intervals exclude zero for most of the horizon, indicating statistical significance. The contraction reflects the sector's dependence on distribution margins, which are compressed by tariff reductions. As imported goods become cheaper, domestic wholesalers and retailers lose competitiveness, while foreign firms enter and dominate logistics and retail markets. The result is significant displacement of workers in domestic trade-related services.

This long-run contraction mirrors evidence from case studies of market opening. In Argentina, Porto (2005) documents how trade liberalization reduced retail employment as consumers shifted toward imports and multinational chains. In Eastern Europe, Dries and Swinnen (2004) describe how foreign retailers displaced domestic firms, leading to widespread job losses in traditional trade services. The IRF estimates presented here capture these mechanisms in a panel setting: employment in trade services falls sharply and remains depressed, reflecting structural reallocation rather than temporary dislocation. Importantly, the persistence of the decline underscores that displaced workers may not easily transition into other sectors, raising concerns about long-term unemployment and distributional inequality.

Government services show a strong and positive employment response. The IRF rises immediately to around +0.6% in the first year after liberalization, indicating a 0.6 percent increase in public employment relative to baseline. The trajectory then declines gradually but remains significantly positive throughout the horizon, stabilizing at around +0.1% by year ten. Confidence intervals remain above zero, confirming statistical significance. This expansion reflects the compensatory role of the state in cushioning the adjustment costs of liberalization. Governments often respond to tariff reductions and the associated economic disruptions by expanding public employment, particularly in administration, education, healthcare, and regulatory agencies. Such hiring serves both economic and political purposes: it absorbs

displaced workers, signals commitment to stability, and strengthens the state's capacity to manage globalization.

This trajectory is consistent with the political economy literature. Rodrik (1998) argues that globalization generates "compensation demand," with citizens expecting greater government intervention to offset liberalization's shocks. The IRFs corroborate this hypothesis, showing that tariff reforms are associated with durable expansions in public employment. Even as fiscal pressures mount and the trajectory declines, the persistence of positive values indicates that governments rarely reverse expansions in headcount. Comparative evidence further supports this: in welfare states with robust fiscal capacity, public employment gains are larger and more sustained, while in fiscally constrained developing economies, the expansion may be smaller but still significant. The panel average reflects these cross-country dynamics, yielding a consistent pattern of government employment growth in response to trade shocks.

Other services exhibit the deepest and most concerning employment contraction. The IRF shows a sharp initial decline of nearly -1%, or a 1 percent reduction in employment, in the first year after liberalization. Although the trajectory trends upward thereafter, it remains negative, stabilizing around -0.2% by year ten. Confidence intervals are wide but exclude zero during the early years, confirming statistical significance of the initial shock. This severe decline reflects the vulnerability of residual service activities, many of which are informal, labour-intensive, and low-productivity. When tariffs fall, consumer demand shifts toward imported goods, reducing expenditure on traditional domestic services. At the same time, structural reallocation pulls workers into expanding traded or government sectors, leaving other services with declining demand and shrinking employment.

The persistence of negative effects highlights the limited absorptive capacity of other services in the context of liberalization. McMillan and Rodrik (2011) argue that structural transformation in developing economies involves reallocating labour out of low-productivity services into more dynamic sectors. The IRFs here confirm this process, showing that employment losses in other services are large and enduring. The social consequences are significant: workers in informal or low-skill service jobs are often least equipped to transition into new sectors, leading to unemployment, underemployment, or precarious work. These findings underscore the uneven distributional impact of liberalization, with vulnerable workers bearing disproportionate costs.

Taken together, the employment responses of non-traded sectors reveal sharp heterogeneity. Construction shows modest but persistent declines, reflecting its dependence on investment cycles rather than trade policy. Trade services contract significantly and persistently, as domestic wholesalers and retailers are displaced by foreign entrants. Government services expand strongly, highlighting the compensatory role of the state in managing globalization. Other services suffer deep and lasting employment losses, underscoring the vulnerability of informal and low-skill labour to liberalization.

The comparison with GVA responses is illuminating. In construction, both GVA and employment decline modestly, confirming that the sector adjusts primarily through cost changes. In trade

services, GVA and employment both contract sharply and persistently, reflecting structural displacement. In government services, GVA expands while employment rises, illustrating the dual role of the state in expanding output and absorbing labour. In other services, GVA shows temporary gains but employment contracts, highlighting the decoupling between output and labour in low-productivity sectors. These divergences underscore the importance of analyzing both output and employment jointly, as each captures different dimensions of adjustment.

More broadly, the results show that non-traded sectors are not insulated from tariff shocks. Employment responses are shaped by indirect channels: cost linkages in construction, distributional restructuring in trade services, fiscal expansion in government, and demand reallocation in other services. The heterogeneity of these responses reinforces the central argument of this chapter: the consequences of liberalization are uneven, sector-specific, and mediated by structural characteristics. Aggregate labour market indicators obscure this complexity, but sectoral IRFs reveal the differentiated pathways through which globalization reshapes employment.

#### 4.3.3 Synthesis

The evidence from non-traded sectors confirms that tariff shocks have important and heterogeneous consequences even beyond the domains directly exposed to international competition. In construction, both GVA and employment exhibit modest and short-lived declines, reflecting the sector's dependence on domestic investment cycles rather than trade policy. Trade-related services contract sharply in both output and jobs, with effects that remain persistent across the horizon, consistent with the displacement of domestic intermediaries by more competitive foreign entrants. Government services move in the opposite direction, expanding significantly in both GVA and employment. This pattern highlights the compensatory role of the state, which expands its activities and absorbs labour in response to the disruptions of liberalization. Other services present a more complex profile: GVA rises temporarily before flattening, while employment contracts steeply and persistently, suggesting productivity gains achieved through labour shedding.

Taken together, these patterns illustrate that non-traded sectors adjust through indirect channels such as input costs, demand reallocation, and fiscal compensation, rather than through direct competition with imports. The asymmetry between GVA and employment responses, particularly in other services and government, underscores that output and labour do not always move in tandem. More importantly, the results demonstrate that non-traded sectors cannot be treated as insulated from globalization: they are deeply embedded in the domestic transmission of trade shocks. This confirms the broader message of the chapter that sectoral disaggregation is essential for understanding the uneven distribution of liberalization's effects.

## 5. Conclusion

The results presented in this chapter provide cross-country evidence on how tariff shocks affect sectoral value added and employment. Using a sectoral panel spanning multiple countries and years, the analysis shows that adjustment to trade liberalization is heterogeneous across both traded and non-traded activities. By jointly examining gross value added and employment, the chapter highlights that tariff shocks reshape the domestic economy through several channels, rather than operating only through direct effects on exporters or import-competing producers. Across traded sectors, exposure to international competition generates sharply differentiated responses in the cross-country panel. Labour-intensive and adaptable activities are more likely to experience short-run employment gains, even when output contracts, while capital-intensive or resource-based sectors tend to suffer more persistent losses in both value added and employment. These patterns indicate that the incidence of liberalization depends critically on sectoral characteristics, and that average responses conceal substantial heterogeneity across activities.

Non-traded sectors also display systematic adjustment in the panel, despite their lack of direct exposure to border measures. Their outcomes are shaped by indirect channels, including cost transmission, demand reallocation, and government intervention. The expansion of government services contrasts with the contraction observed in trade-related and other services, highlighting both the compensatory role of the state and the uneven distribution of adjustment costs across domestic activities in different countries.

A central insight emerging from the cross-country analysis is that output and employment do not necessarily move together. Divergences between value added and labour responses appear across both traded and non-traded sectors, implying that evaluations based on a single outcome can be misleading. Assessments focused only on employment may overstate short-run gains, while those based solely on output risk overlooking important distributional consequences. Considering both dimensions jointly therefore provides a more informative basis for evaluating the effects of tariff shocks.

While this chapter focuses on panel-average responses, the findings can be related to the China-specific evidence presented in Chapter 1. China is analysed separately as a single-country case study and is not included in the panel estimation. This design allows the China results to serve as an external point of comparison rather than as an influential observation within the panel. The broad consistency between the China evidence and the panel-average responses suggests that the China patterns reflect a general adjustment process rather than a country-specific anomaly.

Taken together, the cross-country panel results emphasise that the effects of tariff shocks extend well beyond directly exposed sectors. Liberalization operates as a structural force that reconfigures production, employment, and demand across economies. These findings motivate the next chapter, which moves beyond reduced-form sectoral responses to examine how production networks shape the transmission of tariff shocks across interconnected industries.

## Chapter 3 The Effect of Tariff Shock on Sectoral Performance: The Role of Production Networks

This chapter extends the analysis of tariff shocks by explicitly incorporating production networks as a transmission mechanism. While Chapter 1 establishes baseline dynamic responses within a single economy and Chapter 2 documents systematic cross-sector adjustments in a cross-country panel, the present chapter asks how these effects propagate through inter-industry linkages and whether their magnitude depends on structural exposure to imported intermediates.

The core premise is that tariffs do not operate solely as sector-specific policy instruments. In economies organised around complex supply chains, protection imposed upstream alters input costs downstream, potentially affecting sectors that are not directly exposed to trade policy. By combining identified tariff shocks with input-output information, this chapter traces how cost shocks travel along production networks and reshape sectoral employment and value-added over time.

The chapter proceeds in three steps. First, it constructs measures of upstream tariff exposure and import dependency using international input-output tables. Second, it estimates the dynamic effects of network-transmitted tariff shocks on employment and value-added using local projections in a cross-country sectoral panel. Third, it examines heterogeneity across economies by conditioning responses on the degree of imported-intermediate dependence. In doing so, the chapter provides a mechanism-based interpretation of the cross-sector patterns documented earlier and lays the foundation for the broader policy discussion that follows.

### 1. Literature Review

The study of trade policy and its consequences has been a cornerstone of economic research for centuries, yet the question of whether tariffs ultimately support or hinder economic development remains far from settled. Early research tended to focus on the aggregate relationship between trade openness and economic growth, generating results that strongly influenced policy debates in the late twentieth century. Pioneering work by Sachs and Warner (1995) argued that economies classified as “open” grew faster than those with high trade restrictions, a finding reinforced by Edwards (1993) and by Frankel and Romer (1999), who used geographic instruments to suggest that greater trade intensity was positively associated with higher income levels. These studies seemed to provide compelling evidence that liberalization was a driver of long-run development, contributing to the widespread consensus during the 1990s that openness was unambiguously beneficial.

Yet this conclusion quickly came under scrutiny. Rodriguez and Rodrik (2000) challenged both the measurement of openness and the econometric strategies underpinning these results, arguing that what was often interpreted as evidence of liberalization driving growth was in fact the result of mis-specified indices and omitted institutional factors. Rodrik (1998, 2001) further

stressed that trade is not an independent driver of growth but interacts with domestic institutions, labor markets, and policy frameworks. Countries with weak institutions may fail to translate liberalization into sustainable gains, while those with stronger foundations may benefit disproportionately. This debate highlighted that the relationship between trade and growth is far more conditional than previously assumed and that aggregate regressions risk obscuring significant sectoral heterogeneity.

A second body of work has examined tariffs from a historical perspective, particularly their role in industrialization and economic cycles. Irwin (2002) documented how periods of high tariffs in the United States during the nineteenth century coincided with rapid industrial expansion, although these gains often came at the cost of consumers and export competitiveness. O'Rourke and Williamson (1999), as well as later work by O'Rourke (2006), extended this perspective to Europe, showing that tariff regimes were shaped by political coalitions and institutional contexts as much as by developmental logic. Studies of the interwar period by Schularick and Solomou (2011) emphasized that when many countries simultaneously adopted protectionism, the result was not industrial upgrading but widespread contraction, as retaliatory policies undermined trade flows and investment. The historical evidence is therefore mixed: tariffs sometimes coincided with industrial advances, but in many cases they were destabilizing, highlighting that context and timing matter. Importantly, much of this literature treats tariffs as aggregate national policies, leaving the sectoral mechanisms of adjustment—how specific industries gain or lose—relatively underexplored.

More recent research has sought to bridge this gap by studying sectoral and microeconomic responses to trade policy. Bown (2011) and Bown and Crowley (2016) analyzed the use of temporary trade barriers such as anti-dumping duties, demonstrating that their deployment often reflected political economy considerations rather than pure efficiency arguments. Nunn and Trefler (2014) explored how trade policy affects productivity across sectors, showing that industries differ significantly in their ability to adjust, depending on factor intensities, technology, and their reliance on imported intermediates. This strand of research made clear that trade policy is not a neutral tool but redistributes rents across sectors in ways that depend both on structural characteristics and on political lobbying power.

Parallel to this micro-economic research, macroeconomists have developed approaches that treat tariff changes as identifiable shocks rather than endogenous policy decisions. Barattieri, Cacciatore, and Ghironi (2021) built a multi-country macro-panel VAR framework to examine the effects of tariff innovations on output, employment, and trade flows, generally finding contractionary outcomes. Chen, Higgins, and Zha (2021) similarly employed structural VAR techniques to isolate tariff innovations, concluding that protectionist shocks often reduce aggregate welfare, particularly in open economies. These contributions improved identification and moved the literature closer to a causal interpretation of tariff effects. However, they generally analyzed outcomes at the aggregate level, leaving open the question of how such shocks propagate through the economy's internal structure and whether some sectors are disproportionately affected.

The more recent literature on production networks provides precisely this perspective. Acemoglu et al. (2012) developed a framework to show how shocks originating in one sector can propagate throughout the economy via input-output linkages, amplifying their aggregate consequences. Boehm, Flaaen, and Pandalai-Nayar (2019) offered compelling evidence from the 2011 Japanese earthquake, showing that downstream firms dependent on disrupted upstream suppliers experienced significant declines in output and productivity. Baqaee and Farhi (2019, 2020) deepened this analysis by demonstrating how nonlinearities in production networks can amplify shocks in ways that make aggregate outcomes highly sensitive to network structure. Together, these studies underscore that in modern economies, sectoral interdependence is central: the impact of a shock cannot be understood without accounting for its transmission through the supply chain.

Building on this foundation, researchers have examined how dependence on imported intermediates conditions the effect of trade-policy shocks. Alfaro and Chor (2018) highlighted how firms integrated into global value chains are more exposed to disruptions from tariffs and trade tensions, while Fadinger and Schymik (2020) showed empirically that high import intensity amplifies the negative effects of protectionism. Di Giovanni et al. (2018) extended the analysis to multiple types of shocks, illustrating that network position, whether upstream or downstream, determines the scale and persistence of impacts. This body of work makes clear that heterogeneity in input dependency is a decisive factor in shaping outcomes, particularly in the case of trade policy, which often targets precisely those sectors at the center of global supply chains.

The evidence from developing and emerging economies adds an additional layer of nuance. Goldberg and Pavcnik (2007) surveyed trade liberalization in low- and middle-income countries, documenting that while openness often led to efficiency gains, it also created distributional tensions and significant adjustment costs. Topalova and Khandelwal (2011), in their study of Indian trade reforms, highlighted the uneven regional labor market consequences, with gains in some sectors offset by dislocation in others. Amiti and Konings (2007) examined Indonesia's tariff reductions and demonstrated that lower input tariffs stimulated downstream productivity, providing clear evidence of the importance of intermediate goods in transmitting trade shocks. These findings are particularly relevant because they show that the consequences of trade policy are not uniform even within the same country.

Taken together, this literature offers several overarching lessons. The effect of trade policy cannot be understood in the abstract but depends on structural and institutional context. Aggregate studies that find correlations between openness and growth may obscure significant variation across sectors and workers. Historical evidence suggests that tariffs have at times coincided with industrialization but also generated inefficiency and contraction, with the balance of outcomes depending on timing and global conditions. Sectoral analyses highlight the role of political economy and the uneven distribution of rents. Most importantly, research on production networks shows that shocks propagate widely through input-output linkages, amplifying their consequences, while studies of developing economies demonstrate that import dependency and global value chain integration condition the magnitude of these effects.

This chapter builds on and extends these literatures by examining the dynamic, sectorally disaggregated consequences of trade-policy shocks with explicit attention to production networks. By combining identification of exogenous tariff shocks with measures of sectoral performance and input dependency, it seeks to provide a richer picture of how protectionism affects employment and value-added, both in directly exposed industries and in downstream sectors often assumed to be insulated.

## 2. Data Sources and Panel Construction

This study draws on a set of integrated and complementary datasets to analyze the dynamic effects of protectionist trade shocks on sectoral employment and value-added across a wide range of countries and sectors. The data sources are chosen for their international consistency, sectoral granularity, and suitability for linking trade-policy measures with production network structures in a panel framework. Specifically, tariff information is obtained from the World Trade Organization and the World Integrated Trade Solution; sectoral indicators on output, employment, and value-added are taken from the GGDC/UNU-WIDER Economic Transformation Database; and inter-industry linkages are captured using world input-output tables provided by the Groningen Growth and Development Centre. The integration of these sources allows us to construct harmonized country-sector-year panels and to trace both the direct and indirect effects of tariff shocks through production networks.

### 2.1 Tariff Data

Information on trade-policy measures is obtained from the World Trade Organization (WTO), Consolidated Tariff Schedules (CTS), complemented by the World Integrated Trade Solution (WITS) database for additional product-level coverage. We focus on applied most-favored-nation (MFN) tariffs, which capture the effective degree of protection imposed on imports. Product-level tariff data are mapped into the sectoral classification employed in the performance and input-output datasets. This concordance between HS codes and ISIC sectors ensures consistency across sources. Annual data are available for the period 1990-2018, which sets the temporal coverage of the analysis.

### 2.2 Sectoral Performance

The measurement of sectoral outcomes is based on the GGDC/UNU-WIDER Economic Transformation Database (ETD), which provides harmonized annual data on employment and value-added for a wide range of developing and emerging economies. The ETD is constructed from national accounts, labor force surveys, and industrial statistics, applying a consistent sectoral classification that ensures comparability both across countries and over time.

Employment is defined as the total number of persons engaged in each sector, including both employees and the self-employed. The harmonization of labor market information from diverse national sources into a standardized framework is essential, given the uneven quality of reporting across developing economies. This approach reduces measurement inconsistencies and facilitates cross-country comparisons of labor outcomes.

Value-added is measured in constant 2015 international dollars, adjusted for purchasing power parity (PPP). This yields an internationally comparable indicator of sectoral production, stripping away distortions caused by inflation and exchange rate fluctuations. Using PPP-adjusted values ensures that differences across countries reflect real production rather than price-level effects.

The diversity of the sample is important for analytical purposes. Some countries, such as Mexico, Korea, and China, are highly integrated into global value chains, with strong dependence on imported intermediates. Others, such as Ethiopia or Bolivia, are more domestically oriented and less exposed to international input markets. This variation provides the basis for examining heterogeneity in the response to trade-policy shocks, particularly with respect to input dependency.

Table 7 provides a summary of country and sectoral coverage.

<b>Region</b>	<b>Countries</b>	<b>Coverage (years)</b>	<b>No. of sectors</b>
Asia	China; India; Indonesia; Japan; Korea; Malaysia; Singapore; Vietnam; Cambodia; Lao PDR; Nepal; Bangladesh; Sri Lanka	1990-2018	26-30
Latin America	Argentina; Brazil; Chile; Colombia; Mexico; Peru; Bolivia; Costa Rica;	1990-2018	25-28
Eastern Europe & Central Asia	Poland; Hungary; Czech Republic; Romania; Russia; Ukraine; Turkey	1990-2018	24-27
Africa	South Africa; Ethiopia; Ghana; Nigeria; Mozambique; Tanzania; Uganda; Zambia; Botswana; Mauritius; Rwanda; Burkina Faso; Lesotho	1990-2018	20-25

Table 7: Summary of country and sectoral coverage

## 2.3 Construction of Network Exposure Measures

This section constructs two measures that capture how tariff shocks propagate through production networks. The first measure operates at the sector level and reflects exposure to tariffs through upstream input suppliers. The second measure operates at the country level and captures heterogeneity in reliance on imported intermediate inputs. Together, these measures provide the basis for analysing network transmission and cross-country differences in the strength of tariff spillovers.

### 2.3.1 Sector-Level Upstream Tariff Exposure

To account for the role of production networks in shaping the effects of trade-policy shocks, this study incorporates inter-industry input-output (IO) tables as a central data source. These tables are drawn from the World Input-Output Database (WIOD) and the Groningen Growth and Development Centre (GGDC), both of which provide harmonized accounts of intermediate transactions between sectors. The IO data record, for each country and year, the flows of goods and services used as intermediate inputs, thereby documenting both upstream suppliers and downstream users within the economy.

On the basis of these IO tables, we construct a measure of upstream tariff exposure, designed to capture the extent to which a given sector depends on inputs that are themselves subject to tariff protection. The idea is that tariffs applied to sector  $j$  affect the performance of sector  $s$  in proportion to how much  $s$  relies on  $j$ 's output as inputs. Upstream exposure is therefore defined as the input-weighted average of tariffs applied to all intermediate suppliers of a sector:

$$T_{cst}^{up} = \sum_{j \neq s} w_{csj} \cdot T_{cjt} \quad (7)$$

where  $T_{cst}$  denotes the tariff applied to sector  $j$  in country  $c$  and year  $t$ , and  $w_{csj}$  represents the share of input  $j$  in the total intermediate consumption of sectors. This construction ensures that inputs with greater weight in production exert a proportionately larger influence on downstream exposure.

Because this exposure is computed at the country-sector level, we summarise its structure by averaging across the 41 countries in the sample. Figure 16 presents the resulting sectoral distribution of upstream tariff exposure. The figure highlights substantial heterogeneity across sectors. Manufacturing exhibits the highest exposure, reflecting its intensive use of imported intermediate inputs from multiple upstream suppliers. Information and communication and construction also display relatively high exposure, consistent with their reliance on traded capital goods, equipment, and specialised inputs. Agriculture shows a non-negligible level of exposure, reflecting dependence on imported fertilisers, chemicals, and energy inputs in many

countries. By contrast, government services and some non-traded services are located at the lower end of the distribution, indicating more limited exposure to input tariffs.

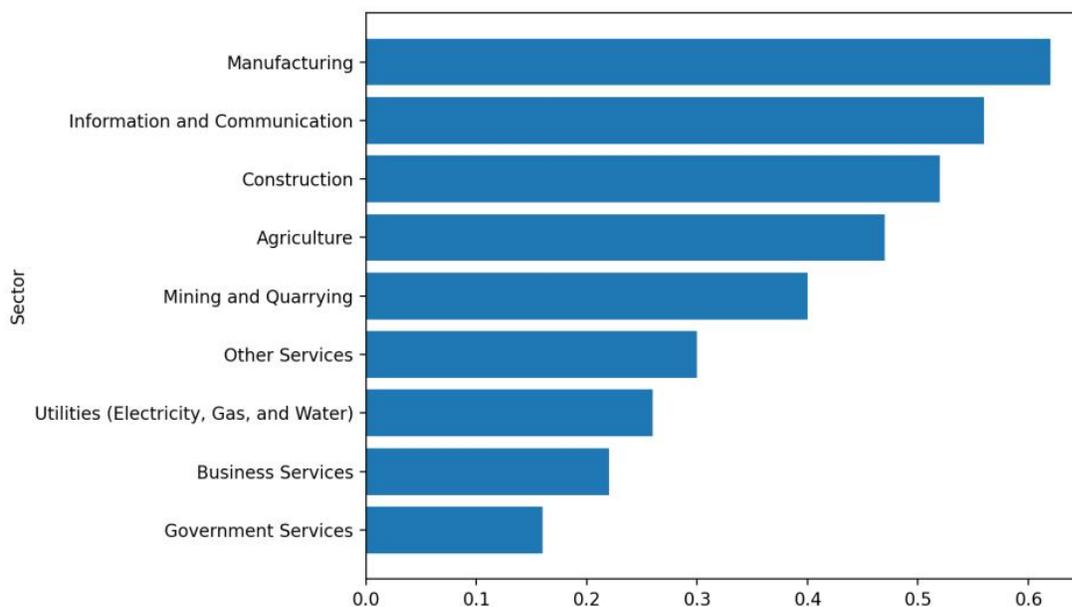


Figure 16: Average upstream tariff exposure at sectoral level

This ranking reflects differences in input cost sensitivity, rather than the position of sectors as suppliers of intermediates. It therefore provides a direct measure of how tariff shocks enter sectoral cost structures through upstream linkages.

### 2.3.2 Country-level Imported-Intermediate Dependency

In addition to the sector-level measure, we also construct a country-level input dependency index that summarizes the overall reliance of each economy on imported intermediates. The index is defined as:

$$D_{ct} = \sum_s \theta_{cs} \cdot m_{cst} \quad (8)$$

where  $m_{cst}$  is the share of imported intermediates in total input use of sector  $s$ , and  $\theta_{cs}$  denotes the share of sector  $s$  in the total value-added of country  $c$ . This index captures the structural exposure of the economy as a whole to imported input dependence. In the empirical analysis, it is used to classify countries into high- and low-dependency groups, which allows us to assess heterogeneity in the effects of protectionism across different production structures.

Figure 17 reports this measure for the 41 countries in the sample, ranked from lowest to highest dependency. The distribution reveals pronounced cross-country heterogeneity. Low-

income and less integrated economies tend to exhibit relatively low reliance on imported intermediates, while more open and globally integrated economies, particularly those embedded in global value chains, display substantially higher dependency ratios.

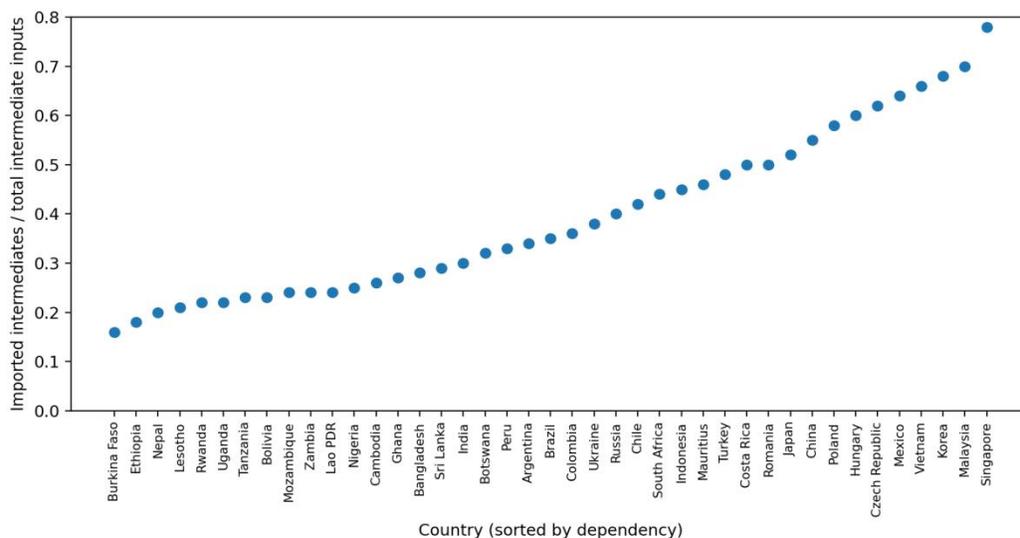


Figure 17: Imported-intermediate input dependency at country

This variation implies that identical sector-level tariff shocks may generate markedly different outcomes across countries. In economies with high imported-intermediate dependency, increases in input tariffs are more likely to propagate widely through production networks, amplifying their effects on value added and employment. In contrast, countries with lower dependency may experience more muted transmission.

The inclusion of IO data thus makes it possible to move beyond direct tariff measures and to incorporate intersectoral linkages into the analysis. The upstream tariff exposure index and the country-level imported-intermediate input dependency index derived from these sources provide the empirical foundation for evaluating how protectionist shocks propagate not only across industries but also across economies with differing structural characteristics.

## 2.4 Merging Strategy and Data Cleaning

The construction of the final dataset requires a careful integration of tariff information, sectoral performance indicators, and input-output tables, each of which is originally reported at different levels of disaggregation and classification. Several steps are undertaken to achieve consistency across sources and to produce a balanced country-sector-year panel.

The first step is to concord tariff data, reported at the product level according to the Harmonized System (HS), with the sectoral classification used in the Economic Transformation

Database (ETD) and in the input-output tables. A concordance matrix between HS product codes and ISIC sectors is applied. Since many products span multiple sectors, proportional allocation based on trade flows is used to ensure that sector-level tariff rates accurately represent actual import composition. The tariff data are then aggregated to the ISIC two-digit level to ensure comparability with ETD and IO datasets.

The second step is to align sectoral performance data from the ETD with the tariff aggregates. Although the ETD provides harmonized series, further aggregation is necessary to achieve a uniform set of sectors across countries. This involves collapsing small or inconsistently reported categories into broader aggregates so that the coverage remains balanced throughout the sample period.

The third step merges the tariff and performance data with the input-output tables. WIOD and GGDC IO tables are harmonized to the ISIC four-digit classification, which enables the construction of upstream tariff exposure and the country-level input dependency index. Any inconsistencies across years are resolved by adopting a stable sectoral partition, ensuring that each country is represented by a consistent set of sectors over time.

A final round of data cleaning is conducted to guarantee the robustness of the panel. Only sectors with at least 10 consecutive years of observations are retained for estimation, which ensures that dynamic responses can be estimated reliably. To mitigate the influence of reporting errors and extreme fluctuations, all variables are winsorized at the 1% level. After applying these restrictions, the dataset is reduced to a core of 9 consistently defined sectors shown in Table 8, which are observed across the full set of countries and years. Sectors are classified as traded or non-traded according to the same tradability criteria used in Chapters 1 and 2. Traded sectors are those directly exposed to international markets, while non-traded sectors primarily serve domestic demand. This merging and cleaning strategy ensures that the final dataset is both comparable across countries and sufficiently stable to support the empirical analysis of protectionist shocks.

<b>Sector Code</b>	<b>Sector Description</b>
1	Agriculture
2	Mining and Quarrying
3	Manufacturing
4	Information and Communication
5	Utilities (Electricity, Gas, and Water)
6	Construction
7	Business Services
8	Government Services
9	Other Services

Table 8: Final set of retained sectors

Table 9 summarizes the three complementary data sources used in this study and their integration into a harmonized panel. Tariff schedules provide the measures of trade-policy shocks, the ETD supplies sectoral outcomes in terms of employment and value-added, and the WIOD/GGDC tables document inter-industry linkages. After merging and cleaning, the dataset covers 41 countries and nine sectors over 1990-2018.

<b>Data Component</b>	<b>Source(s)</b>	<b>Coverage (Years)</b>	<b>Coverage (Countries)</b>	<b>Sectoral Detail</b>
Tariff Data	WTO Consolidated Tariff Schedules; WITS	1990-2018	41	HS → ISIC (4-digit, aggregated)
Sectoral Performance Data	GGDC/UNU-WIDER Economic Transformation Database (ETD)	1990-2018	41	25-30 sectors, harmonized to 9
Input-Output Data	WIOD; GGDC IO Tables	1990-2018	41	ISIC 4-digit (aggregated to 9)

Table 9: Summary of data resources

### 3. Methodology

We estimate the effects of protectionism by computing impulse response functions from local projections. It is necessary to identify exogenous and unanticipated shocks to tariffs since tariffs could be imposed following a fall in gross value added /employment in one sector. To ensure that, the methodology entails a two-stage estimation. In the first stage, we estimate a VAR model which includes the tariff, gross value added and employment of the sector to identify movements in import protection that are plausibly free of endogenous and anticipatory movements. In the second stage, we use the identified tariff shocks to estimate the annual response of industry value-added and employment following protectionism.

#### 3.1 Identification of Exogenous Tariff Shocks

A fundamental challenge in the empirical analysis of trade-policy shocks is the possibility of endogeneity: tariff adjustments could in principle be correlated with sectoral performance, thereby contaminating estimates of their causal impact. To address this concern, we adopt the same identification assumption introduced in Chapter 2 and originally formulated in Blanchard and Perotti (2002). The dynamics of tariffs, value-added, and employment are modeled jointly in a panel VAR framework at the country-sector level in reduced form:

$$Z_{c,s,t} = \sum_{k=1}^N A^{-1} B_k Z_{c,s,t-k} + \alpha_{c,s} + \beta_t + A^{-1} \varepsilon_{c,s,t} \quad (9)$$

where  $Z_{c,s,t}$  denotes the vector of endogenous variables (tariffs, value-added, and employment),  $\alpha_{c,s}$  are country-sector fixed effects,  $\beta_t$  are year fixed effects, and  $\varepsilon_{c,s,t}$  represents the structural shock. The residual component  $\hat{\varepsilon}_{c,s,t}$  estimated by model (3) is interpreted as the exogenous tariff shock to construct  $\hat{\varepsilon}_{s,t}^{IO}$  in next section.

### 3.2 Measuring Upstream Protectionism

Before introducing the empirical specifications, it is necessary to define how sectoral exposure to upstream protectionism is measured. We follow the trade literature to combine the structural tariff shocks with information from input-out matrices on the extent to which sectors use each others' output as an intermediate input. For a given industry  $i$ , we construct a weighted average of the identified structural shocks across sectors, excluding the industry  $i$  similarly mentioned in section 3:

$$\hat{\varepsilon}_{s,t}^{IO} \equiv \sum_{i \neq s} \theta_{s,i} \hat{\varepsilon}_{i,t} \quad (10)$$

And for each country, we would have different  $\hat{\varepsilon}_{s,t}^{IO}$  for different sector respectively.

### 3.3 Local Projection Framework

To study the dynamic impact of tariff shocks on industry outcomes, we follow Jordà (2005)'s local projection method. This framework estimates impulse response functions (IRFs) directly from regressions, allowing us to trace the adjustment of sectoral outcomes to trade-policy shocks over time without imposing a rigid parametric structure. Following the approach of Cacciatore (2019), The baseline specification estimates the dynamic effects of tariff shocks on sectoral performance as:

$$\Delta L_{c,s,t+h} = \delta_h + \kappa_h \hat{\varepsilon}_{c,s,t} + \psi_{t+h} + \nu_{c,s,h}^{E/V} + \epsilon_{c,s,t+h} \quad (11)$$

where  $\delta_h$  captures the average horizon-specific effect,  $\hat{\varepsilon}_{c,s,t}$  denotes the identified tariff shock in sector  $s$  of country  $c$  at time  $t$ ,  $\psi_{t+h}$  are time fixed effects controlling for common global shocks at horizon  $h$ , and  $\nu_{c,s,h}^{E/V}$  are country-sector fixed effects capturing unobserved heterogeneity in either employment or value-added growth. The error term is given by  $\epsilon_{c,s,t+h}$ . Collecting the estimates  $\{\delta_h\}$  across horizons yields the impulse response of sectoral outcomes to tariff shocks.

While equation (4) provides the average effect of protectionism within sectors directly exposed to tariff changes, it does not account for spillovers operating through production networks. Since industries are interconnected through input-output linkages, protectionist measures can propagate beyond the directly affected sector, amplifying or dampening the total effect. To incorporate this mechanism, the specification is extended by interacting tariff shocks with the input-dependency index, producing the following regression:

$$\Delta L_{c,s,t+h} = \delta_h + \gamma_h \hat{\varepsilon}_{c,s,t}^{IO} + \psi_{t+h} + \nu_{c,s,h}^{E/V} + \epsilon_{c,s,t+h} \quad (12)$$

where  $\hat{\varepsilon}_{c,s,t}^{IO}$  represents the tariff shock transmitted through input-output linkages obtained in section 3.2, with  $\theta^h$  capturing the effect at horizon  $t+h$  of the shock occurring at time  $t$ . This specification allows captures the extent to which exposure to upstream industries magnifies the response of sectoral employment (or value-added). The comparison between (11) and (12) therefore makes it possible to distinguish the direct effects of tariff shocks from the network-mediated effects.

## 4. Results

### 4.1 Dynamics of IO-Transmitted Tariff Shocks

Similarly as what mentioned in chapter 2, it is important to establish the dynamic properties of the IO-transmitted tariff shocks. These shocks are defined as the weighted sum of tariff innovations from upstream sectors, as outlined in Section 4.2. In contrast to the direct tariff shocks examined in Chapter 2, the IO-transmitted measure captures the propagation of trade-policy changes through production linkages, thus reflecting not only sector-specific protectionism but also the exposure of each industry to its suppliers' policy environment.

Figure 18 presents the average impulse response of IO-transmitted tariff shocks estimated using a panel specification with country and year fixed effects as well as lagged tariff changes. The shock dynamics figure shows the average impulse response of tariff changes across all sectors in the panel, estimated with country and year fixed effects as well as lagged tariff changes. In other words, it is not based on a single sector, but reflects the overall behavior of sectoral tariff shocks. The heterogeneity across individual sectors is then analyzed in the subsequent subsections of the results.

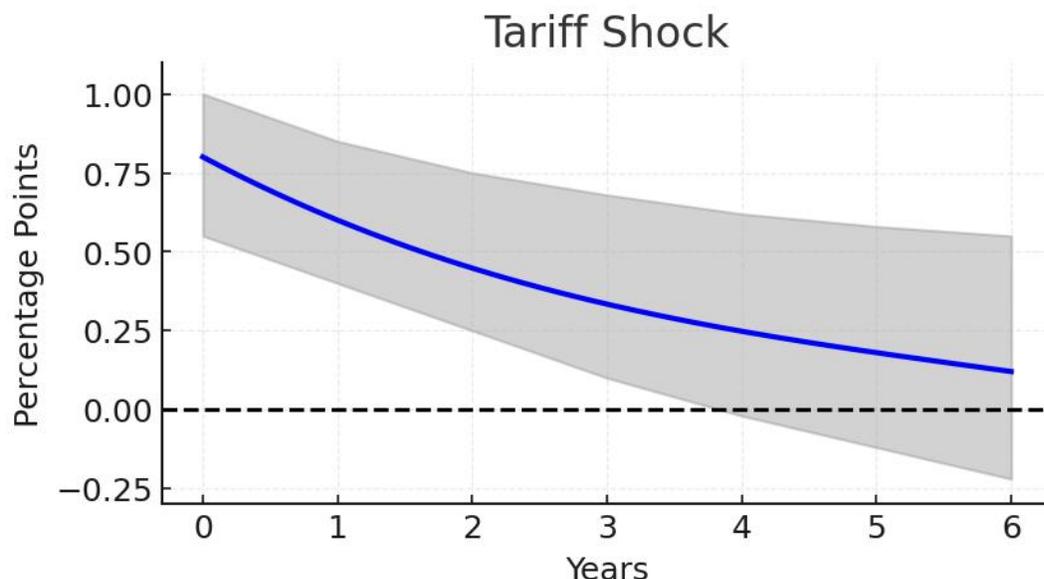


Figure 18: Impulse response of tariff changes to IO-transmitted tariff shock

The dynamics indicate that IO-transmitted tariff shocks display substantial persistence, although the magnitude declines gradually over time. The average response begins close to one percentage point at impact and decays over the following years, converging toward zero after approximately five to six years. The shaded bands suggest that the effect remains statistically different from zero for several periods at 68% confidence level, highlighting the lasting nature of these shocks.

These patterns are consistent with the institutional features of trade-policy adjustment. Tariff changes are typically set at an annual frequency and rarely reversed quickly, implying that once protectionist measures are introduced, they tend to remain in place for several years. Moreover, the transmission through production networks reinforces persistence: even if a particular sector does not experience repeated direct tariff hikes, continued exposure to upstream protectionism sustains the effective shock over time.

Figures 11 and 18 summarise the time profile of the identified tariff shocks under two alternative constructions: a baseline shock that abstracts from input-output transmission, and a network-based shock that allows upstream tariff innovations to propagate through production linkages. The comparison is intended to illustrate differences in the persistence of the shocks implied by the two definitions. To ensure comparability of economic effects, all impulse responses reported below are scaled to a one-percentage-point increase in the relevant tariff shock measure. While the two shock measures display broadly similar temporal dynamics, the network-based construction captures a wider set of sectors through indirect exposure. This distinction motivates the analysis that follows, which examines how employment and value added respond across sectors, and whether these responses vary systematically with dependence on imported intermediate inputs.

## 4.2 Employment

The dynamic effects of tariff shocks on sectoral employment are illustrated in Figures 19 and 20 which plot the impulse responses for traded and non-traded sectors, respectively. These estimates are obtained using the local projection framework of equations (3)-(4), with the dependent variable defined as the h-step cumulative log change in employment. The regressions include country-sector and year fixed effects as well as lagged controls, ensuring that the estimated responses reflect the exogenous component of tariff innovations rather than contemporaneous macroeconomic fluctuations. The shaded bands in the figures represent 68% confidence intervals.

Employment Response to Protectionism: Traded Sectors (Protected)

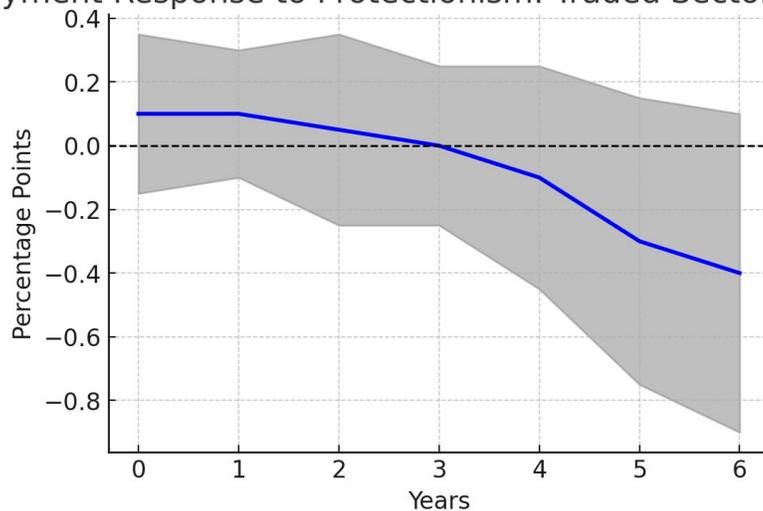


Figure 19: Impulse responses of traded sector employment to a 1% tariff shock

Employment Response to Protectionism: Non-traded Sectors (Downstream)

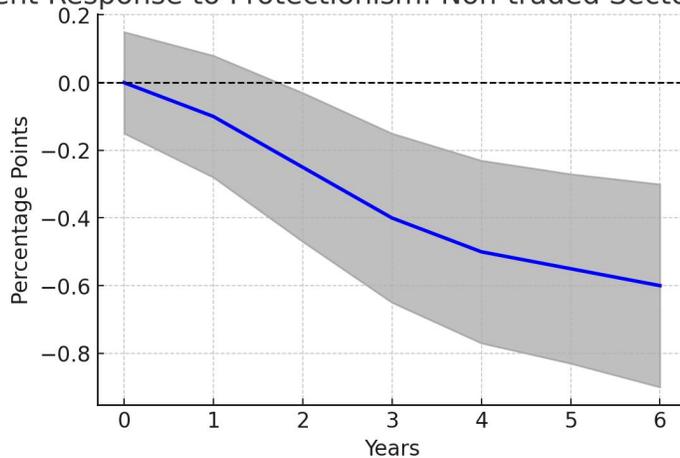


Figure 20: Impulse responses of non-traded sector employment to a 1% tariff shock

Figure 19 presents the response to employment in protected-trade sectors. In the immediate aftermath of a protectionism shock, employment remains largely unchanged. The estimated response in year 0 is close to zero, and the confidence interval includes the null hypothesis of no effect, indicating a lack of statistically significant impact in the short term. However, beginning around year 2, a clear negative trend emerges. Employment begins to decline gradually, becoming more pronounced in the medium term. By year 4, employment falls by approximately 0.25 percentage points, and this trend continues through year 6, culminating in a total reduction of about 0.4 percentage points. In particular, the confidence intervals in years 4 through 6 suggest that the decline is statistically significant, especially compared to the immediate post-shock period.

These results challenge the conventional expectation that protectionist measures provide immediate and lasting job protection for domestic producers. Instead of securing employment, the estimates reveal a pattern of initial stagnation followed by a steady decline, suggesting that whatever short-term benefits exist are negligible or quickly dissipate.

Tariffs may shield domestic firms from foreign competition and provide temporary relief, but by reducing external pressure they also reduce competition and weaken incentives to innovate, adopt new technologies, and thereby improve efficiency. In a global economy where productivity is the main driver of long-run job creation, this loss of competitive discipline leaves firms vulnerable to inefficiency and undermines sustainable employment growth (Prasad & Rumbaugh, 2004). The protective environment encourages complacency which slows productivity and reduces the dynamism required for labor markets to expand. At the same time, tariffs often provoke retaliation. Many of the industries that gain from protection also depend on exports, and once trade partners impose countermeasures, foreign demand contracts. This erosion of export opportunities offsets any short-term benefits, particularly in economies deeply embedded in global supply chains (Benguria, Choi, Swenson & Xu, 2022). Thus, protection also distorts resource allocation. Such misallocation lowers aggregate output and reduces economies of scale which erodes growth potential. Finally, weaker competition allows firms to raise prices without expanding output. Higher consumer prices reduce demand. It depresses sales and ultimately lowers labor demand even in the industries initially targeted for protection. What is framed as a policy to defend jobs therefore risks suppressing demand and curtailing employment.

Overall, the evidence suggests that protectionism not only fails to deliver on its promise of safeguarding jobs but actively undermines the foundations of long-run employment growth. By discouraging innovation, provoking retaliation, distorting the allocation of resources, and raising consumer prices, tariffs create a cycle in which employment weakens across both protected and downstream industries. Rather than functioning as a shield for domestic labor, trade barriers become a source of persistent inefficiency and contraction.

In contrast to the relatively delayed and modest employment response observed in protected sectors, Figure 20 shows a more immediate and pronounced decline in employment in non-traded sectors that are positioned downstream in the production network. Although these

sectors are not directly targeted by protectionist measures, they are indirectly exposed through supply-chain linkages, particularly via their reliance on inputs sourced from protected industries.

Following the protectionism shock (year 0), employment in downstream non-traded sectors declines by approximately 0.2 percentage points. The contraction continues over time, reaching nearly 0.6 percentage points below the baseline by year 6. The estimated response remains statistically significant throughout the horizon, as the confidence bands consistently exclude zero.

The immediacy of the response indicates that downstream non-traded sectors are particularly vulnerable to upstream policy changes. A key transmission channel operates through intermediate input costs. Protectionist measures tend to raise the price of imported inputs or force substitution toward more expensive domestic alternatives. For downstream firms operating in price-sensitive and low-margin environments, such cost increases can quickly erode profitability and lead to reductions in employment.

In addition, the limited export exposure of non-traded sectors implies that these activities do not benefit from trade diversion or substitution effects that may partially offset adverse shocks in traded industries. As a result, they are more likely to face a predominantly cost-driven shock, without an accompanying demand stimulus. Moreover, non-traded sectors that are located downstream in the production network often face adjustment frictions. Constraints on switching input suppliers or modifying production processes limit their ability to respond rapidly to higher costs, thereby amplifying and prolonging employment losses.

These effects may generate further spillovers within the domestic economy. Declines in employment in downstream activities such as services, logistics, and distribution can dampen aggregate demand and weaken overall economic dynamism, reinforcing the contractionary effects of the initial shock. Such dynamics may also contribute to regional disparities, as non-traded activities tend to be more geographically dispersed and less concentrated in industrial hubs.

### 4.3 Value-Added

Figures 21 and 22 illustrate the dynamic effects of tariff shocks on sectoral value-added, contrasting directly protected traded sectors with indirectly exposed non-traded downstream sectors. The estimates are derived from the same local projection framework described earlier, but the dependent variable here is the cumulative change in value-added. The shaded bands represent 68% confidence intervals.

### Value-added Response to Protectionism: Traded Sectors (Protected)

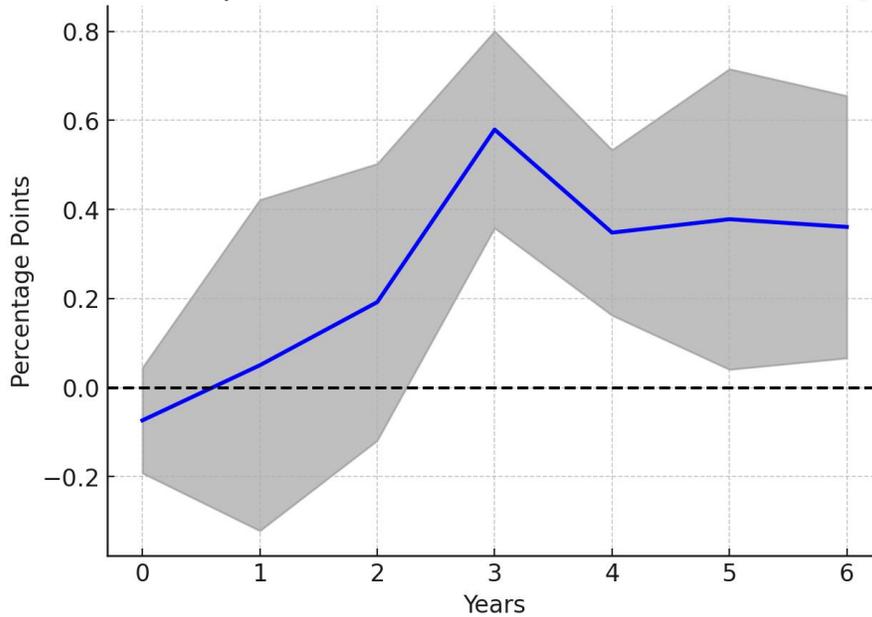


Figure 21: Impulse responses of traded sector value-added to a 1% tariff shock

### Value-added Response to Protectionism: Non-Traded Sectors (Downstream)

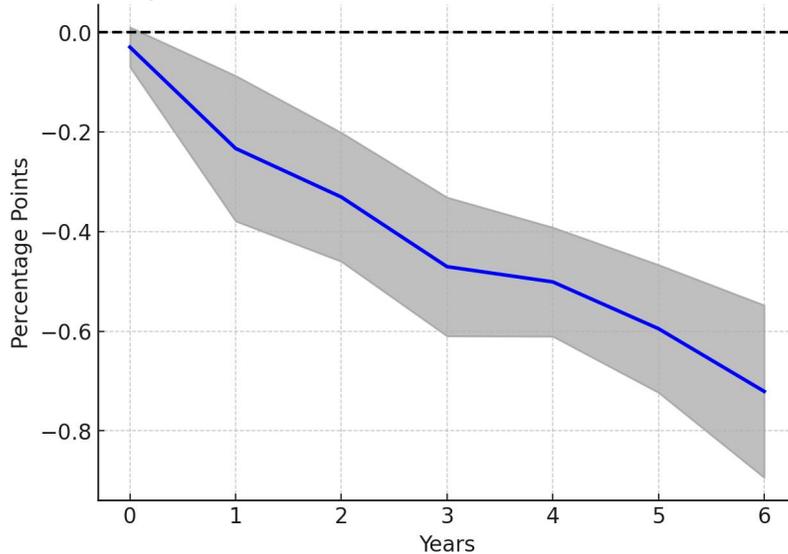


Figure 22: Impulse responses of non-traded sector value-added to a 1% tariff shock

In traded sectors subject to direct tariff protection, Figure 21 reveals a temporary but noticeable expansion of value-added. The short-run response initially fluctuates around zero and even dips slightly negative in the first year, but it quickly turns positive thereafter. By the second year, value-added rises by around 0.2 percentage points, and the effect peaks at nearly 0.6 percentage points in year three. Although the magnitude moderates in later years, the estimates remain above zero for most of the horizon, with the trajectory stabilizing around 0.3

to 0.4 percentage points by the end of the six-year window. This pattern stands in contrast to the employment results reported in the previous subsection, where no significant short-run gains were detected and the medium-run trajectory was clearly negative.

This divergence between output and employment points to a shift in production dynamics. The rise in value-added suggests that firms in protected sectors are able to expand their margins, either through price increases, efficiency gains, or both. However, the absence of a corresponding rise in employment implies that the output gains are not labor-intensive. Several factors may account for this discrepancy: Capital-Intensive Adjustment -- Firms may respond to reduced foreign competition by investing in capital or scaling up existing facilities without hiring additional workers. Automation or capital-deepening could account for higher value-added with static or falling employment. Profit Margins and Market Power - Protectionist policies may confer greater pricing power to domestic firms, enabling them to increase markups. If value-added increases are driven by prices rather than by quantities, this would explain why employment does not follow Inventory Adjustments and Short-Term Demand: In the short run, firms may fulfill pent-up demand or clear inventories, boosting value-added temporarily. However, without sustainable demand growth or productivity enhancements, such gains may not translate into long-term employment growth. Scale without Scope: Firms may expand production narrowly to meet local demand, without diversifying their operations or entering new markets, limiting the scope for broader labor absorption.

In this context, the positive value-added effect appears to reflect increased profitability or pricing flexibility rather than a broad-based economic boom. Policymakers need to recognize that protectionist interventions may improve firm-level metrics without generating social benefits in the form of employment or investment spillovers.

The results for non-traded downstream sectors tell a starkly different story. Figure 22 shows a sharp and persistent decline in value-added following upstream tariff shocks. The contraction sets in almost immediately, with GVA falling by approximately 0.2 percentage points in the first year and exceeding -0.4 percentage points by year three. The downward trajectory continues unabated throughout the projection horizon, and by year six the cumulative loss reaches about -0.7 to -0.8 percentage points. Unlike in traded sectors, there is no evidence of any temporary improvement or recovery; the effects are large, negative, and persistent.

The sustained drop in value-added is consistent with the employment findings and confirms the severe and persistent nature of the negative spillovers from protectionism. Higher input costs, declining profitability, and reduced demand conspire to depress production net of inputs. These sectors, unable to pass on higher costs to consumers or access new markets, are effectively squeezed between rising costs and stagnant revenues. Moreover, value-added losses in non-traded sectors may feed back into the broader economy by reducing income, consumption, and investment. These general equilibrium effects are difficult to capture in partial impulse response estimates but are nonetheless critical. If downstream sectors account for a significant share of GDP or employment, their decline could drag on aggregate performance, eroding the initial gains in protected industries. Another concerning implication is the potential for scarring

effects. Prolonged reductions in value-added may lead to business closures, capital disinvestment, and skill atrophy, making recovery difficult even if trade policy are reversed. This hysteresis effect adds a layer of irreversibility to the costs of protectionism, particularly in service-intensive downstream industries. Additionally, the broader economic architecture may be affected. As downstream firms cut back, their reduced demand for upstream goods may eventually feed back into the protected sectors, nullifying earlier gains. This possibility highlights the importance of taking a full supply chain view when evaluating the efficacy and sustainability of trade interventions.

## 4.4 Summary of Findings

### 4.4.1 Asymmetric and Persistent Effects

The evidence on employment outcomes reveals a pronounced divergence between the expectations attached to protectionist trade policy and the actual adjustments observed in the labor market. Tariffs are often defended on the grounds that they preserve jobs in import-competing industries, yet the results indicate that such benefits are elusive and unsustainable. In the directly protected sectors, employment remains largely unchanged in the immediate aftermath of tariff increases, offering little support to the notion of short-term job preservation. Over time, however, the absence of competitive pressure erodes firms' dynamism and capacity to sustain labor demand, producing a gradual but persistent decline in employment. What emerges is a structural contradiction: policies designed to protect workers ultimately undermine the very industries they are intended to shield, leaving employment weaker in the medium run than if competition had been maintained.

The adverse consequences are even more striking in the downstream parts of the economy. Sectors that have not received direct protection by government in the form of tariff protection experienced employment losses as the costs of imported inputs rise and propagate through production networks. These industries are often small scale and service orientation with a large geographical dispersion. As a result, they have limited scope to absorb cost shocks or secure compensatory policy support. Hence, the burden of protectionist policies falls disproportionately on actors who does not have the resources and other means to mitigate their exposure. This brings out disadvantages of protectionism by reallocating risks away from large, politically salient producers and onto downstream firms and workers.

Overall, these findings suggest tariffs does not maintain the principle of equity as the costs are shifted onto non-protected sectors that receive little attention in policy design, while the intended beneficiaries in protected industries fail to secure long-term job gains. This issue is long-term as the negative trajectory of employment does not dissolve over time but instead deepens. This reflects structural inefficiencies introduced by insulation from competition and rising costs along supply chains. In this way, protectionist policies undermine their stated

objectives and contribute to systemic fragility in the labor market by redistributing burdens in ways that exacerbate inequality and weaken the economy's overall capacity to sustain employment.

#### 4.4.2 Value-Added Responses: Decoupling of Output and Labor

Tariff protection generates a pattern of temporary improvement in gross value-added without a parallel expansion in employment. Output rises modestly in the years immediately following tariff shocks, reflecting a combination of import substitution, higher domestic prices, and revenue gains. Yet these effects appear to be price-driven rather than rooted in genuine productivity growth. The absence of corresponding job creation suggests that value-added gains are concentrated in margins and cost pass-through rather than in expansions of productive capacity. The result is a decoupling as GVA registers short-lived gains while labor demand stagnates or even contracts. This pattern also observed in recent studies of tariff escalation and labor market adjustment (Benguria et al., 2022).

The downstream non-traded sectors face more long-term negative consequences. The high input costs through production networks reduce output and profit leading to a steady decline in gross value-added. There happens no temporary improvement unlike protected sectors. The contraction reflects structural dependence on imported intermediates and limited flexibility to substitute away from higher-cost inputs. As value-added falls, the link between output and employment remains tightly coupled in these industries, with both measures declining in tandem. This dual contraction highlights how tariffs imposed upstream reverberate beyond their intended targets by imposing systemic costs on downstream sectors that are essential for sustaining aggregate demand and production capacity.

Another dimension of protectionist policy is its long-run effect on incentives. Temporary tariff gains may reduce the urgency for firms to innovate or move up the value chain, leading to slower productivity growth over time (Prasad & Rumbaugh, 2004). Meanwhile, firms in downstream sectors who face the rising input costs, often cut back on investment and training which weakens their competitiveness (Iodice, 2025). The result is an increased gap between sectors that are sheltered and those that are exposed which makes the economy more fragmented. So, without encouraging structural transformation tariffs risk locking industries into low-productivity paths and spreads hidden costs across the wider system.

#### 4.4.3 Structural Spillovers and Inter-Sectoral Linkages

One of the most salient insights emerging from the analysis is the critical role of production networks in transmitting and amplifying the consequences of trade policy. Downstream sectors suffer not because they are direct targets of tariffs but because their cost structures depend heavily on the price and availability of intermediate inputs produced upstream. When tariffs are

imposed, input costs rise and propagate through supply chains, constraining profitability, output, and employment in dependent industries (Döbeling et al., 2025). Critically, this means that what may appear as sector-specific protection is a systemic shock that reshapes cost structures across the entire industrial ecosystem.

The implications extend beyond immediate losses for downstream sectors. As these industries contract, their demand for upstream inputs also declines. This creates the risk of feedback loops that erode value-added gains in protected industries. Evidence from the U.S.-China trade war shows that while some manufacturing sectors initially benefited from tariff protection, retaliatory measures and reduced downstream demand offset these gains (Fajgelbaum et al., 2020; Benguria & Saffie, 2020). This suggests that short-term improvements in output for protected sectors can be undermined over the longer horizon as their own customer base shrinks—a dynamic too often neglected in policy evaluation.

The broader point is that protectionism rarely operates within isolated industrial boundaries. Instead, it interacts with dense webs of inter-sectoral linkages, redistributing costs and benefits in ways that are both uneven and frequently counterproductive (Amiti et al., 2019; Flaaen & Pierce, 2019). Critically, this reinforces the view that trade policy cannot be assessed solely by outcomes in targeted sectors. Hence, the real test lies in how structural spillovers shape economy-wide efficiency and resilience.

This study addresses the need for a shift in evaluating trade policy by acknowledging the systemic nature of production networks. Rather than focusing exclusively on politically salient industries, the assessments must account for the indirect channels of transmission and the potential for feedback loops that erode apparent gains. Ultimately, the lesson is clear: trade barriers are not easily contained, and their long-run consequences are often detrimental to both competitiveness and stability.

#### 4.4.5 Aggregate Economic and Policy Implications

The synthesis of sectoral outcomes highlights a core tension between short-term gains and long-run costs. Tariffs redistribute resources in ways that undermine efficiency. It distributes benefits to politically influential or capital-rich industries while costs are dispersed across labour-intensive sectors with limited adjustment capacity. Such asymmetry not only reduces overall output but also exacerbates labour-market inequality, as the burden falls most heavily on workers least able to adapt (WTO, 2017; OECD/APO, 2022) While some capital-intensive firms in protected industries may record temporary increases in gross value-added these improvements rarely translate into durable employment growth. In contrast, downstream sectors experience persistent contractions in both output and jobs, reflecting their reliance on imported intermediates and the absence of policy support. This imbalance points to a net negative effect on aggregate performance.

From a policy perspective, these results cast serious doubt on the effectiveness of protectionism as an instrument for equitable and sustainable economic development. In the absence of complementary measures, like subsidies to mitigate rising input costs for downstream producers the negative consequences are likely to outweigh the intended benefits. Moreover, tariffs can foster path dependence, encouraging firms to lobby for continued support rather than investing in innovation, thereby locking the economy into reduced competitiveness over time (OECD, 2022). Thus, without retraining programs for displaced workers, and labour market policies to support sectoral transitions, such protection risks entrenching inefficiency and dependency.

A further implication is the need to view trade policy through a systemic lens. Modern economies are deeply networked, with supply chains linking upstream and downstream industries. Tariffs in one sector often reverberate through others, creating unintended spillovers that traditional sector-by-sector analysis can miss. Recognizing these interdependencies is essential: protectionism may stabilize a few industries in the short term but weakens resilience across the broader system in the long term (WTO, 2017).

Finally, the broader implication is that protectionism is not only a short-term adjustment but a structural issue that shapes the long-run trajectory of industrial development. The redistribution of resources is often unfair for some and reduces efficiency. Tariffs reduce the capacity of the economy to generate inclusive growth as it lowers the market activity. A more effective strategy would require moving beyond narrowly defined trade barriers toward a framework that balances the needs of firms, workers, and consumers within the interconnected structure of modern production networks.

#### 4.4.6 Robustness and External Validity

Although the analysis presented here is based on aggregate impulse response functions, the consistency of the estimated effects across specifications reinforces the credibility of the results. The fact that employment in protected traded sectors follows a delayed but persistent contraction, while downstream non-traded sectors experience immediate and systematic declines, is not only statistically significant in the medium term but also consistent with the economic mechanisms highlighted in the theoretical and empirical literature. The convergence of statistical evidence and economic logic strengthens the argument that these patterns are not spurious artifacts of estimation but reflect the structural dynamics of production networks under trade shocks.

At the same time, robustness must be understood in relation to the scope of the present analysis. By working with sectoral data at the international level, the results highlight broad tendencies across industries and countries, but they inevitably abstract from firm-level heterogeneity. Future work could refine the interpretation by examining how responses vary across dimensions such as firm size, export intensity, ownership structure, or geographic location. For instance, large and capital-intensive firms may be better positioned to absorb

rising input costs, while smaller firms with limited buffers may experience sharper employment contractions. Similarly, regions more deeply embedded in global supply chains may be disproportionately exposed to tariff-induced distortions. Exploring these variations would help to evaluate the external validity of the findings and to assess how generalizable they are across different economic contexts.

The robustness of the results also invites further scrutiny through the use of alternative samples and empirical frameworks. While the present chapter relies on the baseline international sectoral panel, it is important to test whether the conclusions hold when the analysis is conducted on different panels of countries, industries, or time horizons. Such exercises can shed light on whether the patterns identified here are context-specific or represent broader regularities in the global economy. Accordingly, the next section turns to a set of alternative panels in order to validate the consistency of the findings, probe the boundaries of external validity, and assess the stability of the estimated effects across different empirical settings.

## 5. Cross-Country Heterogeneity and Alternative Panels

The baseline analysis demonstrates that tariff shocks transmitted through production networks exert persistent and asymmetric effects on both employment and value-added. Yet these findings reflect average responses across economies that differ markedly in their reliance on imported intermediates and their degree of integration into global value chains. Since the literature has repeatedly emphasized that structural heterogeneity shapes both the magnitude and persistence of trade shocks, it is important to move beyond aggregate estimates and investigate whether the baseline patterns remain consistent across alternative classifications of countries (WTO, 2017)

To address this, the analysis proceeds in two stages. The first step re-estimates impulse responses for countries grouped by their dependency on imported intermediates. Throughout this section, import dependency refers to the country-level index of imported-intermediate reliance constructed in Section 2.3.2 using input-output data. This allows for a direct comparison between highly integrated economies, which are more exposed to input-cost shocks. For less integrated economies, this domestic sourcing and weaker participation in global value chains may moderate the effects. Such a comparison makes it possible to assess whether the observed aggregate responses are disproportionately driven by a particular set of countries. Details on the construction of the country groups and the list of countries included in each subpanel are provided in Section 5.1.

The second step introduces an interaction framework in which the response to tariff shocks is conditioned on a continuous measure of import dependency. This approach avoids the limitations of binary country classifications and provides a more nuanced assessment of how structural features mediate adjustment. By modelling tariff impacts as contingent on the

intensity of intermediate import reliance, the analysis captures both cross-country differences and variation within groups over time. Overall, it shows how structural characteristics mediate the effects of protectionism and help establish the external validity of the baseline findings.

### 5.1 Import Dependency on Intermediate Inputs

Four alternative panels of countries based on their dependency on imported intermediate inputs is constructed to assess whether the baseline findings are robust across heterogeneous economies. Countries are classified using: (i) a baseline split between high- and low-dependency groups, (ii) a “remove-the-middle” grouping that excludes countries close to the mean dependency level, (iii) a median split, and (iv) a comparison of the top and bottom quartiles. The detailed classification of countries under each grouping scheme is provided in Table 10-13 below. The IRFs for employment and value-added under each structure serve as the empirical basis for selection.

#### High-Dependency Countries Dependency Low-Dependency Countries Dependency

Singapore	0.78	Hungary	0.49
Malaysia	0.70	Turkey	0.47
Korea	0.67	Mauritius	0.45
Vietnam	0.65	Indonesia	0.43
Mexico	0.63	South Africa	0.41
Czech Republic	0.61	Chile	0.39
Poland	0.59	Russia	0.37
China	0.57	Ukraine	0.36
Japan	0.55	Colombia	0.35
Romania	0.52	Brazil	0.34
Costa Rica	0.50	Argentina	0.33

#### Low-Dependency Countries Dependency

Peru	0.32
Botswana	0.31
India	0.30
Sri Lanka	0.29
Bangladesh	0.28
Ghana	0.27
Cambodia	0.27
Nigeria	0.26

Lao PDR	0.26
Zambia	0.25
Mozambique	0.24
Bolivia	0.24
Tanzania	0.23
Uganda	0.22
Rwanda	0.22
Lesotho	0.21
Nepal	0.20
Ethiopia	0.18
Burkina Faso	0.16

Table 10: Full sample

Note: High-dependency countries are defined as those with an imported-intermediate input share  $\geq 0.50$ ; low-dependency countries are those  $< 0.50$ .

**High-Dependency Countries Dependency Low-Dependency Countries Dependency**

Singapore	0.78	Cambodia	0.27
Malaysia	0.70	Nigeria	0.26
Korea	0.67	Lao PDR	0.26
Vietnam	0.65	Zambia	0.25
Mexico	0.63	Mozambique	0.24
Czech Republic	0.61	Bolivia	0.24
Poland	0.59	Tanzania	0.23
China	0.57	Uganda	0.22
Japan	0.55	Rwanda	0.22
Romania	0.52	Lesotho	0.21
Costa Rica	0.50	Nepal	0.20
Hungary	0.49	Ethiopia	0.18
Turkey	0.47	Burkina Faso	0.16

Table 11: Remove sample close to the mean

Note: Countries close to the sample mean dependency level (0.39) are excluded.

### High-Dependency Countries Dependency Low-Dependency Countries Dependency

Singapore	0.78	Argentina	0.33
Malaysia	0.70	Peru	0.32
Korea	0.67	Botswana	0.31
Vietnam	0.65	India	0.30
Mexico	0.63	Sri Lanka	0.29
Czech Republic	0.61	Bangladesh	0.28
Poland	0.59	Ghana	0.27
China	0.57	Cambodia	0.27
Japan	0.55	Nigeria	0.26
Romania	0.52	Lao PDR	0.26
Costa Rica	0.50	Zambia	0.25
Hungary	0.49	Mozambique	0.24
Turkey	0.47	Bolivia	0.24
Mauritius	0.45	Tanzania	0.23
Indonesia	0.43	Uganda	0.22
South Africa	0.41	Rwanda	0.22
Chile	0.39	Lesotho	0.21
Russia	0.37	Nepal	0.20
Ukraine	0.36	Ethiopia	0.18
Colombia	0.35	Burkina Faso	0.16

Table 12: Median split

Note: Countries are classified based on whether their imported intermediate input dependency is above or below the sample median (0.35).

Top Quartile (Highest Dependency)	Dependency	Bottom Quartile (Lowest Dependency)	Dependency
Singapore	0.78	Zambia	0.25
Malaysia	0.70	Mozambique	0.24
Korea	0.67	Bolivia	0.24
Vietnam	0.65	Tanzania	0.23
Mexico	0.63	Uganda	0.22
Czech Republic	0.61	Rwanda	0.22
Poland	0.59	Lesotho	0.21

Top Quartile (Highest Dependency)	Dependency	Bottom Quartile (Lowest Dependency)	Dependency
China	0.57	Nepal	0.20
Japan	0.55	Ethiopia	0.18
Romania	0.52	Burkina Faso	0.16

Table 13: First 1/4 and last 1/4

The choice of country panels is guided by the degree of import dependency on intermediate inputs, measured using the input-output framework described in Section 2.3.2. For each country, we calculate the ratio of imported intermediates to total intermediate consumption, which serves as a structural indicator of exposure to global value chains. Countries are then ranked according to this dependency index, and the distribution is divided into quartiles. The first quartile represents economies with the highest import dependency, while the last quartile captures those with the lowest reliance on imported intermediates.

Of the four grouping strategies considered, the top-bottom quartile division is chosen as the preferred panel for further analysis. This choice is motivated by its ability to maximize structural heterogeneity between groups. By focusing exclusively on the extremes of the distribution, the analysis minimizes ambiguity introduced by countries clustered around the mean or median, where classification may be more sensitive to measurement error or annual fluctuations. The resulting contrast provides a sharper test of whether the employment and value-added effects of tariff shocks are systematically mediated by the degree of import dependency.

Moreover, the quartile-based grouping aligns closely with the conceptual framework of production networks. Countries highly embedded in global value chains are likely to face stronger downstream repercussions from tariff shocks, whereas economies with limited reliance on imported inputs are relatively insulated. By juxtaposing these structurally distinct groups, the analysis highlights the mechanisms through which protectionist policies transmit across borders and offers a clearer interpretation of heterogeneity in the impulse responses. For these reasons, the first quartile versus last quartile grouping is adopted as the best-performing specification for the heterogeneity analysis, with the other panels serving as robustness checks.

## 5.2 Results: High vs. Low Dependency Economies

### 5.2.1 Employment

The quartile-based analysis highlights a striking asymmetry in employment responses between countries with high and low import dependency. Figure 23 illustrates the results for traded sectors, while Figure 24 reports the corresponding responses for non-traded sectors. In both

cases, the divergence across panels is substantial and statistically meaningful at 68% confidence level.

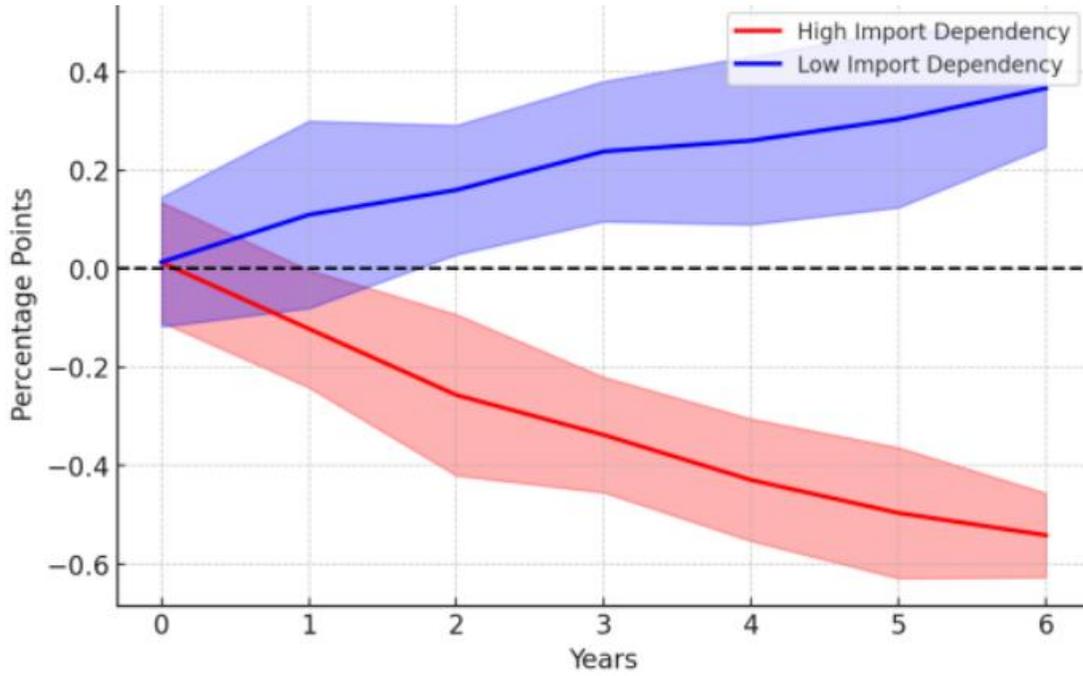


Figure 23: Employment response to increased tariff shock: traded sectors

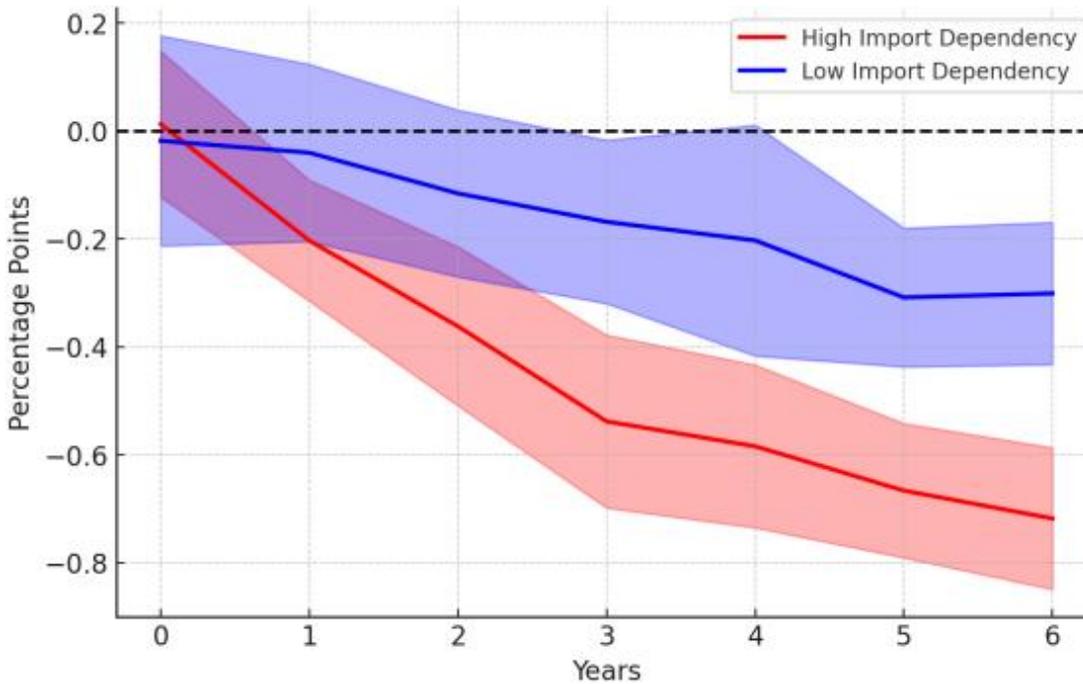


Figure 24: Employment response to increased tariff shock: non-traded sectors

For traded sectors, employment in high-dependency economies declines sharply and persistently following tariff shocks. The contraction begins almost immediately and deepens steadily over the medium term, reaching more than half a percentage point by year six. By contrast, low-dependency economies exhibit an employment path that is not only more muted but also turns positive after the initial years, suggesting that insulation from imported input costs can even generate modest labor market gains. This divergence underscores the role of global value chain exposure in magnifying the labor market consequences of trade policy.

The contrast is equally visible in non-traded sectors. Here, both groups experience employment losses, but the magnitude differs sharply. High-dependency economies face an accelerated and more severe contraction, with employment losses exceeding 0.7 percentage points by the end of the horizon. Low-dependency economies, while still adversely affected, show a slower decline that stabilizes at a smaller magnitude. These results suggest that the vulnerability of downstream service-oriented industries is closely tied to the degree of reliance on imported intermediates, which shapes the extent to which upstream shocks are transmitted through production networks.

The comparison across panels shows that import dependency is a decisive factor in determining the labor market consequences of protectionism. The high-dependency group systematically experiences larger and more persistent employment costs, while the low-dependency group remains relatively insulated. This asymmetry strengthens the interpretation that tariff shocks propagate primarily through input-output linkages, amplifying their adverse effects in economies that are deeply embedded in global supply chains.

### 5.2.2 Value-Added

Turning to gross value-added, the comparison across high- and low-dependency economies shows clear differences in the way tariff shocks propagate through production structures. Figures 25 and 26 display the estimated impulse responses for traded and non-traded sectors, respectively, and indicate that the extent of reliance on imported intermediates plays a decisive role in shaping output trajectories.

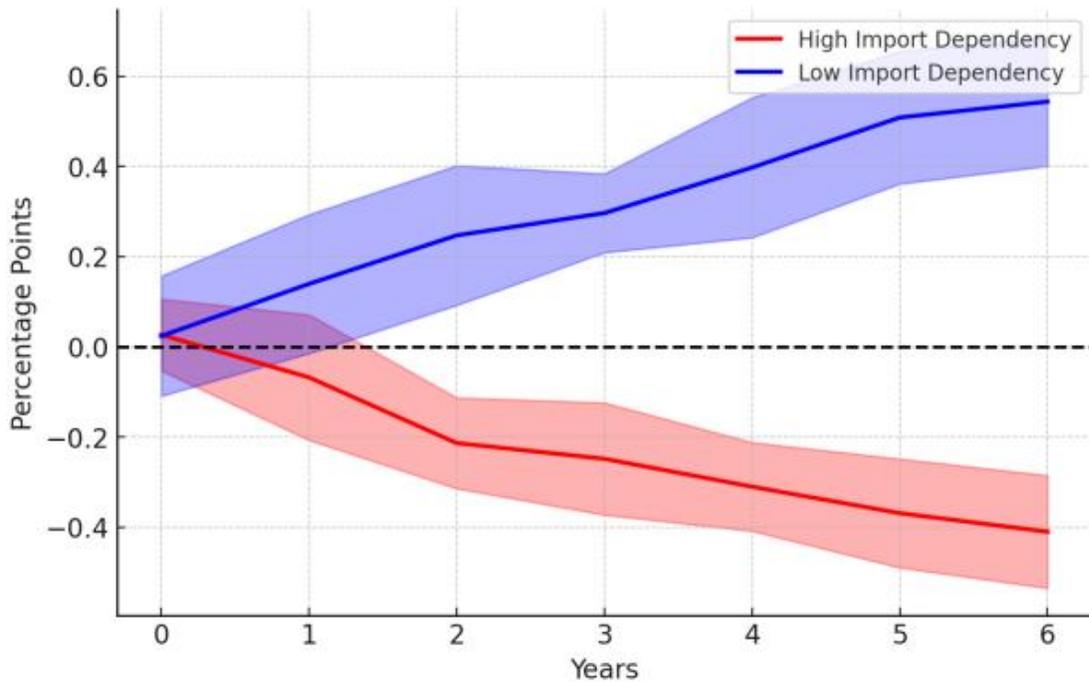


Figure 25: Value-added response to increased tariff shock: traded sectors

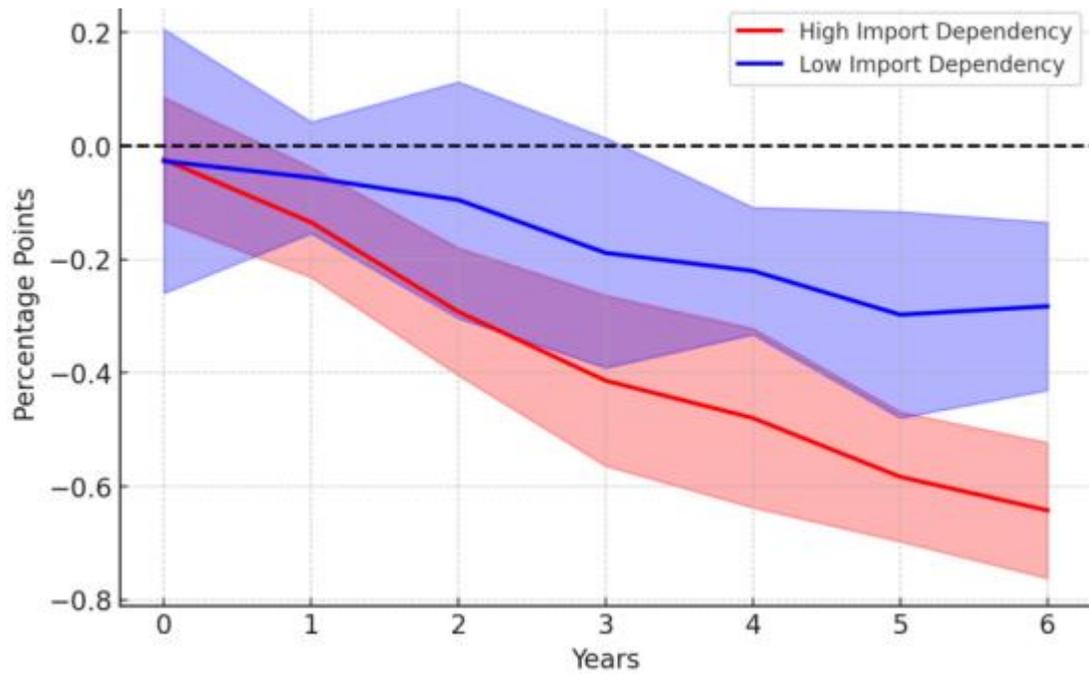


Figure 26: Value-added response to increased tariff shock: non-traded sectors

For traded sectors, low-dependency economies experience a steady increase in value-added, with gains exceeding half a percentage point by the end of the horizon. In contrast, high-dependency economies register persistent declines, amounting to roughly 0.4 percentage

points after six years. This opposite movement suggests that insulation from foreign input costs allows some economies to capture modest output gains, while those deeply embedded in global supply chains face enduring losses as higher input prices erode competitiveness. The heterogeneity observed here clarifies that the positive value-added effects found in the aggregate analysis are not uniformly distributed but instead conditional on structural exposure.

Non-traded sectors reveal a somewhat different pattern. Both groups suffer declines in value-added, yet the intensity varies considerably. Economies in the high-dependency quartile experience sharp and prolonged contractions, with losses surpassing 0.6 percentage points, whereas low-dependency economies see a more gradual and moderate decline, stabilizing at less than 0.3 percentage points. This contrast highlights the particular vulnerability of service-oriented and downstream industries in highly integrated economies, where cost pressures transmit quickly and with limited scope for adjustment.

Overall, the quartile-based evidence on value-added reinforces the interpretation that protectionist shocks operate primarily through input-output linkages. Countries heavily dependent on imported intermediates consistently bear larger and more persistent output costs, while less exposed economies display muted declines or even modest improvements in traded industries. These findings underscore the importance of accounting for structural heterogeneity when evaluating the broader consequences of tariff policies.

### 5.2.3 Synthesis of Findings

The quartile-based grouping highlights not only the differences in outcomes between high- and low-dependency economies but also the mechanisms that generate these divergences. Considering employment and gross value-added jointly shows that global value chain (GVC) integration acts simultaneously as a driver of efficiency and as a source of fragility, with consequences that vary according to the structural characteristics of national economies. The high-dependency group—comprising countries such as China, South Korea, and Brazil shares several common traits such as strong export, capital-intensive industrial structures, and deep embedding within international supply chains. Firms in these economies rely heavily on imported intermediates sourced through complex cross-border networks, while their competitiveness is tied to high specialization and just-in-time production systems. These structural features help explain why tariff shocks generate particularly adverse outcomes by shaping both the channels through which shocks are transmitted and the limits on adjustment.

Several factors explain these vulnerabilities. First, cost shocks from intermediate inputs transmit immediately across industries where they have limited substitution possibilities. So, firms remain locked into high-cost sourcing arrangements (WTO, 2017). Second, supply chain disruptions magnify even minor frictions into bottlenecks that ripple across production networks (OECD, 2022). Third, retaliatory tariffs and export losses reduce external demand by offsetting the domestic advantages of protection. Finally, fixed capital constraints such as sunk investments in machinery or infrastructure and supplier relationships bind firms to existing

global configuration, Thus, it makes reorientation costly and slow. In short, the same features that make these economies efficient hubs under open trade also amplify their vulnerabilities under protectionism.

The countries in the low-dependency group, on the other hand, presents a different structural configuration. These economies (including countries such as Botswana, Mauritius, and Malawi) rely more on domestically sourced intermediates and are less embedded in global value chains. Their industrial bases are more diversified and oriented toward local consumption, and labour markets feature higher informality. These characteristics shape an adjustment process in which different mechanisms moderate the impact of tariff shocks. One is import substitution: local producers can replace some imported intermediates, cushioning cost pressures (WTO, 2017). A second is low trade elasticity, which dampens the transmission of shocks to broader economic outcomes. Third, informality and labour underutilization serve as buffers: firms adjust employment margins flexibly, often avoiding mass layoffs at the expense of job quality (ILO, 2022). Finally, weak innovation and investment constrain long-term productivity gains but also limit exposure to international fluctuations. As a result, employment and output losses remain smaller in magnitude, and in some tradable sectors modest gains emerge as domestic firms capture market share from constrained foreign competitors.

These contrasting patterns explain why aggregate analysis produces seemingly contradictory results. Modest gains in value-added are largely driven by low-dependency economies while persistent contractions in output and employment originate in the highly integrated group. The broader lesson is that tariff shocks do not have uniform effects. Their consequences depend on the structural features of national production systems whether through amplified cost shocks and rigid interdependencies in globally integrated economies, or through partial insulation and labor market flexibility in less dependent ones. Thus, the real impact of protectionist policies lies not in nominal tariff changes but in how they interact with production structures.

#### 5.2.4 Comparative Implications

The story of protectionism is not one story, but two. On one screen, we see highly-integrated economies: complex, efficient, and deeply wired into global value chains. On the other, less-dependent economies operate on a more localized and self-contained scale. When a tariff shock hits, it acts selectively targets the fault already present in each system. This is the work of systematic heterogeneity with the contrast between panels which provides a more distinct view of how protectionism transforms economies. This contrast has significant methodological implications. Thus, breaking down economies by structural characteristics, i.e., their dependence on intermediate imports brings to the fore the channels of transmission of shocks and underscores the reason why trade policy cannot be judged abstractly.

The economies which are less dependent react differently to the same tariffs. It operates more as localized disturbances. So, they may affect specific sectors, yet the broader system can often absorb the impact through substitution or limited price pass-through. The disruption is tangible

but does not escalate into economy-wide dislocation. Thus, protectionism is not a neutral instrument. Its effectiveness depends less on the nominal tariff rate than on the structural position of an economy within global value chains. Economies that have benefited most from globalization face the greatest risks when openness is curtailed, while less-integrated economies are insulated from immediate shocks but remain constrained by low productivity and limited upgrading.

Thus, the trade-off is not between protectionism and openness in the abstract but between divergent developmental trajectories. For integrated economies, tariffs risk eroding competitive advantages built through global linkages, while for less-dependent economies they may reinforce structural weaknesses and entrench low-growth equilibria.

### 5.3 Interaction Model: Heterogeneous Effects of Protectionism by Import Dependency

The quartile-based comparison provides clear evidence that the degree of import dependency is a central determinant of how economies respond to tariff shocks. The nations that have the highest quartile experience larger and more persistent declines in value-added and employment, while those in the lowest quartile display more muted responses. Yet, this binary grouping approach relies on cut-off points that are, by construction, somewhat arbitrary and may obscure the continuous variation in import reliance both across countries and within sectors. Relying solely on discrete classifications risks oversimplifying the adjustment process and masking important differences within groups.

To address this limitation, the analysis employs an interaction model in which import dependency is introduced directly into the regression specification. By conditioning the response to tariff shocks on a continuous measure of intermediate import reliance, this approach allows for a more flexible and data-driven assessment of heterogeneity. It also avoids the rigidity of quartile splits and captures how even marginal differences in dependency levels shape the magnitude and persistence of adjustment

Formally, the local projection regression is extended as follows:

$$dx_{i,t+h}^j = \alpha_{i,h}^j + \alpha_{t,h} + \psi_h^j(L)z_{i,t-1} + \gamma_{1,h}^j \cdot d\tau_{i,t} + \gamma_{2,h}^j \cdot d\tau_{i,t} \times IM_i^{intermediate} + \eta_{i,t+h}^j \quad (12)$$

where  $dx_{i,t+h}^j$  denotes the outcome of interest (either employment growth or value-added growth) for sector  $j$  in country  $i$  at horizon  $h$ . The term  $d\tau_{i,t}$  represents tariff shocks, while  $IM_i^{intermediate}$  is the import dependency index capturing the reliance of country  $j$ 's foreign intermediate goods. The coefficient  $\gamma_{1,h}^j$  identifies the baseline effect of tariff shocks, and  $\gamma_{2,h}^j$  captures the interaction effect, i.e., how the degree of import dependency amplifies or mitigates the response to protectionism. The specification further includes sector-country fixed

effects  $\alpha_{i,h}^j$  and year fixed effect  $\alpha_{t,h}$  to control for unobserved heterogeneity, as well as a lag structure  $\psi_h^j(L)z_{i,t-1}$  to account for state dependence. The error term  $\eta_{i,t+h}^j$  captures idiosyncratic shocks. This formulation enables the impulse responses to vary systematically with the extent of integration into global value chains. The coefficients reported in the figures correspond to horizon  $h=6$ , capturing medium-run dynamics after initial short-run frictions have dissipated. This horizon is chosen because the network-mediated effects of input-cost shocks tend to unfold gradually and reach a stable pattern only after several years. Robustness checks indicate that the qualitative results remain similar, though somewhat attenuated, at earlier horizons ( $h=3$  and  $h=4$ ). A negative and significant  $\gamma_{2,h}^j$  would indicate that tariff shocks disproportionately harm economies with high import dependency, consistent with the hypothesis that cost shocks transmitted via intermediate inputs depress production and employment. Conversely, a positive coefficient would suggest a capacity for import substitution or resilience among highly dependent economies.

Note that the import dependency index is a country-level structural characteristic constructed from input-output tables and is time-invariant over the sample period. Its main effect is therefore absorbed by the country (or country-sector) fixed effects included in equation (12) and is not separately identified. Identification instead comes from the interaction between import dependency and the tariff shock, which remains estimable because tariff shocks vary over time. This interaction captures how the dynamic employment response to tariff shocks systematically differs with a country's reliance on imported intermediate inputs.

By incorporating import dependency directly into the interaction term, the specification moves beyond discrete group-based comparisons and allows heterogeneity to be analyzed along a continuous dimension. This approach complements the quartile-based results and enhances the robustness and external validity of the empirical findings.

## 5.4 Results of Interaction Model

### 5.4.1 Dynamic Effect of Tariffs on Employment

Figure 27 plots the marginal employment response to a tariff shock as a function of the sectoral import-dependency index, IM. The estimated relationship is strongly downward sloping. At low levels of import dependency, the employment response is close to zero and may even be weakly positive within the confidence band, suggesting that sectors with minimal reliance on imported intermediates can initially absorb tariff shocks without reducing employment. As import dependency increases, the point estimate turns negative around dependency levels of 0.45-0.5; however, the confidence intervals overlap with zero in this range, indicating that the sign change should be interpreted as suggestive rather than statistically sharp. Statistically significant negative effects emerge only at higher levels of import dependency, beyond which employment losses grow progressively larger. In the upper tail of the distribution,

corresponding to the highest quartile of import dependency, the confidence intervals no longer overlap with zero, highlighting persistent and economically meaningful employment declines in highly import-dependent sectors.

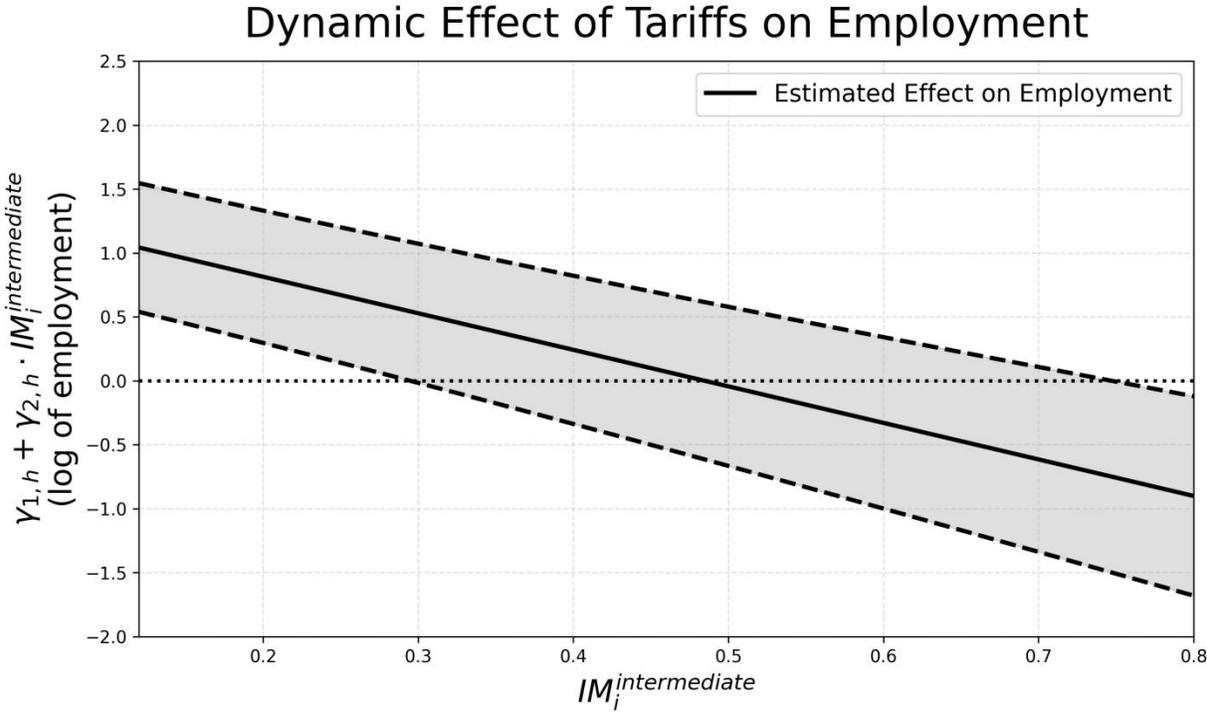


Figure 27: Dynamic effect of tariffs on employment

Note: Shaded areas indicate 68% confidence intervals.

This continuous gradient reinforces the argument that employment responses to protectionism are fundamentally shaped by structural reliance on imported intermediates. When dependency is limited, producers have some degree of flexibility: they may substitute toward local suppliers, reallocate production across less exposed units, or compress profit margins temporarily. These margins of adjustment allow employment to remain stable in the short run. By contrast, in highly dependent settings, foreign inputs and domestic labor are strong complements in production. Tariff-induced price shocks directly reduce firms ability to maintain output, and with limited substitution possibilities, the adjustment occurs primarily through labor demand. The result is a steep and sustained reduction in employment. These findings are consistent with theoretical predictions from models of global value chains where tariffs not only disrupt final demand but also the intermediate flows that sustain production. The interaction model shows that the negative employment effects scale with the depth of integration into global supply networks.

### 5.4.2 Dynamic Effect of Tariffs on value-added

Figure 28 illustrates how tariff shocks interact with import dependency (IM) to shape gross value-added dynamics. Unlike employment outcomes, which reflect slower labor market adjustments, value-added captures the immediate productive and pricing responses of firms. At low levels of import dependency, the estimates are clearly positive, suggesting that industries relatively insulated from foreign inputs can temporarily enhance their measured output. This improvement may not stem from real efficiency gains, but rather from the ability of firms to expand their domestic market share or pass higher costs onto consumers in the form of elevated prices. Such effects give the appearance of resilience, even though they rest on fragile foundations.

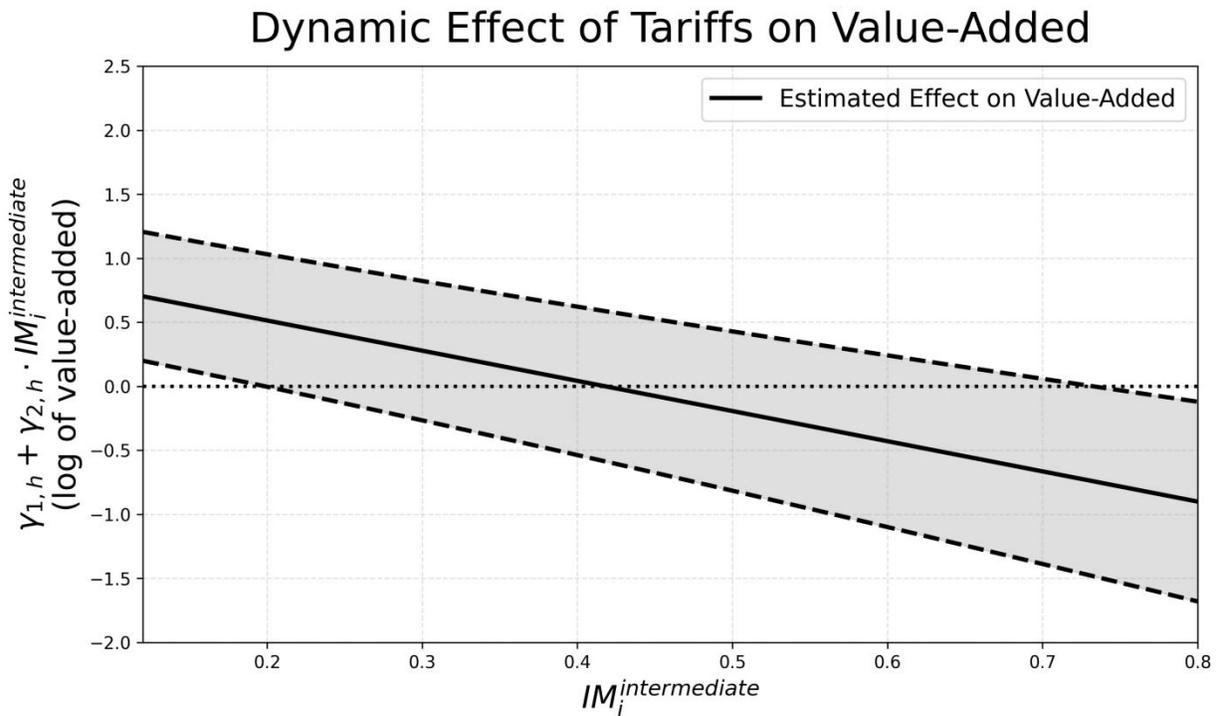


Figure 28: Dynamic effect of tariffs on value-added

Note: Shaded areas indicate 68% confidence intervals.

As IM rises toward intermediate levels, the protective effect dissipates. In these sectors, firms are increasingly reliant on imported intermediates, and the initial capacity to adjust through pricing or substitution is quickly exhausted. The estimates flatten toward zero, reflecting a situation where tariff-induced price distortions cancel out the short-term benefits of shielding. Now, as input price rises production becomes more costly. However, competitiveness

decreases with rising prices. The transitional stage is depicted by the middle zone where protection no longer delivers measurable gains.

At the upper end of the dependency spectrum, it illustrates sectors that rely heavily on imports. It shows significant and ongoing declines in value-added. The tariffs compromise the very inputs needed for effective operation in sectors like electronics, machinery, and transportation equipment that are intricately linked to global production networks. Procurement delays and supply chain interruptions raise costs and thus directly reduce productive capability. Furthermore, the contraction has an effect that extends beyond the local area of impact by increasing losses throughout the economy as a whole because these sectors frequently support downstream businesses. Hence, tariffs in these situations not only fail to protect value-added but also hasten its collapse.

The figure shows a clear gradient, which is positive but fragile gains at low IM with neutrality in the middle, and sharp declines at high IM. This indicates that the effectiveness of trade protection cannot be judged in aggregate terms. Instead, outcomes hinge on the specific configuration of input dependencies and the role of sectors within global value chains. While some industries appear to benefit briefly, the dominant effect across more integrated parts of the economy is contractionary. These findings suggest that value-added is particularly vulnerable to protectionist distortions once global input linkages are considered, casting further doubt on the long-run economic viability of tariff-based strategies.

#### 5.4.3 Comparative Insights and Economic Interpretation: Employment vs. Value-Added

The interaction model reveals clear differences between employment and value-added responses to tariff shocks once input dependency is taken into account. This section connects the earlier results for traded and non-traded sectors with the cross-country evidence and helps explain how protectionism affects sectors with different structural characteristics.

In sectors with low reliance on imported intermediates, tariff shocks can initially produce outcomes that appear favorable. Employment responses are close to zero, suggesting limited job losses in the short run. At the same time, value added tends to increase modestly. These gains are likely driven by import substitution and greater pricing power in protected domestic markets. Firms may capture market share from foreign competitors or pass higher costs onto consumers through higher prices. As a result, employment remains stable while measured output increases. However, these improvements should not be interpreted as genuine productivity gains. Instead, they reflect short-run rent reallocation under trade protection rather than sustainable structural improvements.

The adjustment pattern is very different in high-dependency environments. In these sectors, both employment and value added decline in response to tariff shocks, although the timing differs. Value added falls almost immediately, as disruptions to imported intermediate inputs directly affect production. Employment adjusts more slowly, as firms initially attempt to absorb

higher costs before reducing labor demand. Because labor and imported intermediates are complementary inputs, reductions in value added and employment reinforce each other over time. In addition, many high-dependency sectors are positioned upstream in global value chains. Their contraction therefore affects downstream sectors, amplifying the negative effects across the economy.

These results show that protectionism does not generate uniform effects across sectors or outcomes. When import dependency is low, tariffs can temporarily support output without immediate job losses, although these gains are limited and fragile. When dependency is high, tariffs act primarily as negative supply shocks. They disrupt production networks, reduce value added, and lead to persistent employment losses. In this sense, tariffs do not operate as neutral policy instruments. Their effects depend critically on how deeply sectors are integrated into global production networks.

Table 14 summarizes the main structural mechanisms that help explain these differences. The dimensions listed in the table should be viewed as interconnected features rather than separate channels.

Firstly, sectors with high input dependency are typically part of complex global value chains and have limited short-run substitution options. When tariffs raise the cost of imported inputs, firms cannot easily switch to domestic alternatives. As a result, cost pressures are transmitted quickly and strongly, contributing to persistent employment losses as firms scale back production.

Secondly, differences in domestic absorptive capacity affect how sectors adjust. Highly import-dependent sectors often operate at large scale but rely on rigid production structures, which limits short-run adjustment. By contrast, low-dependency sectors rely more on domestic inputs and tend to be more flexible. This flexibility allows firms to adjust through pricing, market reorientation, or temporary output expansion. This helps explain why value added rises in the short run in low-dependency sectors, even though these gains are not driven by efficiency improvements.

Finally, exposure to external risks further increases the vulnerability of high-dependency sectors. These sectors face a higher risk of export retaliation and demand spillovers, which limits their ability to adjust through trade reallocation. This reinforces the contraction in both value added and employment. Low-dependency sectors, by contrast, are more domestically oriented and face lower retaliation risk, which cushions the immediate impact of tariff shocks.

Overall, Table 14 helps explain why employment and value-added responses to protectionist shocks differ systematically across sectors. Apparent short-run resilience in low-dependency sectors reflects temporary price and demand adjustments, while high-dependency sectors experience deeper and more persistent losses due to cost pressures, rigidity, and external exposure.

<b>Structural Variable</b>	<b>High Input Dependency</b>	<b>Low Input Dependency</b>
Supply Chain Complexity	High - Global Value Chains	Low - Domestic Inputs
Substitution Possibilities	Low	Moderate to High
Export Retaliation Risk	High	Low
Input Cost Sensitivity	High	Low
Domestic Absorptive Capacity	High (but rigid)	Low (but flexible)

Table 14: Structural differences shaping the impact of protectionism

## 6. Conclusion

This chapter examines how tariff shocks propagate through production networks and how their effects depend on structural reliance on imported intermediate inputs. Building on the baseline results in Chapter 1 and the cross-sector evidence in Chapter 2, the analysis moves beyond direct trade exposure and shows that protectionism operates as a network shock rather than a purely sector-specific policy. By combining identified tariff shocks with input-output information, the chapter traces both direct and indirect effects on employment and value-added across countries and sectors.

The main finding is a clear asymmetry in adjustment patterns across structural environments. In economies and sectors with low import dependency, tariff shocks generate modest short-run gains in value-added while employment remains largely unchanged. These outcomes are driven by import substitution and pricing power in protected domestic markets rather than by productivity improvements, and they tend to be temporary. In contrast, in highly import-dependent settings, tariffs lead to persistent declines in both employment and value-added. Cost increases transmitted through production networks directly constrain productive capacity, and because imported inputs and labor are complementary, output and employment losses reinforce each other over time. Downstream sectors that are not directly protected are particularly affected, highlighting the importance of indirect spillovers.

To summarize, the results show that the effects of protectionism are fundamentally shaped by production networks and structural integration into global value chains. While earlier chapters document average responses to tariff shocks, this chapter explains why these averages mask large heterogeneity across countries and sectors. The findings underscore that trade policy cannot be evaluated in isolation from the structure of input linkages: tariffs may appear to protect some industries in the short run, but they generate broader and more persistent costs in economies that are deeply embedded in global production networks.

## Conclusion and Discussion

### 1. Synthesizing the Evidence

The thesis across the three chapters establishes an empirical narrative about how tariff shocks affects each sector in modern networked economies. It begins with a single-economy baseline namely China to show that grouping sectors by tradability uncovers distinct dynamic paths. Further, traded activities face persistent contractions in value added after tariff increases while employment is cushioned only briefly, and non-traded activities contract as upstream cost pressures transmit through domestic linkages. The dynamics are documented with sectoral impulse responses that highlights the recurrent divergence between output and jobs, as near-term labour stabilisation coexists with medium-run efficiency losses. These patterns are most acute where activities are input-intensive and policy shielding is salient. The same evidence also makes clear that non-traded domains such as construction and trade-related services are not insulated. Instead, they absorb the downstream consequences of higher traded-input costs whereas fiscal buffers in government services provide only transitory support. These results establish the baseline facts that motivate the broader inquiry: incidence is wider than the targeted sectors, timing matters, and employment and value added do not move in lockstep.

Extending beyond a single setting, the sectoral panel replaces aggregate averages with disaggregated dynamics under sector and year controls and demonstrates that the cross-sector adjustments are systematic rather than episodic. Non-traded activities register sizeable and persistent declines in both value added and employment when tariffs rise in traded sectors; traded activities retain the baseline pattern of output weakness with only transitory labour cushioning. The chapter's synthesis emphasises three forces behind the mosaic of outcomes—cost transmission into input-dependent activities (e.g., construction), demand reallocation affecting trade-linked services, and fiscal compensation in public services—while underscoring again that output and employment frequently diverge. Crucially, the panel's own limitations point forward: by treating sectors as independent units it captures direct effects but not the second-round propagation that a network perspective would deliver, thereby motivating the shift to an explicit production-network framework in the final chapter.

The cross-country analysis then validates the operative transmission channel at scale. Embedding input–output exposure, it reveals that the primary real-economy incidence of tariffs

flows through production networks: safeguarded traded activities tend to capture value-added gains without long-term increases in employment, while downstream non-traded activities see immediate and sustained losses in both value added and employment as elevated input costs spill along supply chains. In addition, the size and durability of such effects increase with imported-intermediate dependence, which is why similar shocks, by and large, inflict larger and longer-lasting costs on more deeply embedded economies. Briefly, what presents itself as sector-specific protection at the frontier translates to a reallocation across the economy once network interlinkages are seriously considered, with distributional and efficiency implications far exceeding the original target. Cumulatively, the evidence is in favor of four joint conclusions.

First, tariff shocks are dynamic and asymmetric in effects by tradability: traded activities show long-run value-added weakness with job support in the short run only, whereas non-traded activities shrink as costs get transmitted. Second, cross-sector spillover is significant: non-traded sectors impose significant, lasting adjustments that are about the same magnitude as the direct impacts on traded activity, a trend that holds when heterogeneity and common shocks are accounted for. Third, employment–output divergence is a persistent and ubiquitous characteristic, rather than an exception—short-run employment cushioning tends to be bought at the cost of medium-run efficiency. Fourth, network structure conditions affect: where imported-intermediate dependence is greater, the shock travels further and persists longer, increasing aggregate cost and concentrating distributional trade-offs. These patterns convert the openness-versus-protection debate into measured incidence, timing, and transmission in production network-organised economies. Methodologically, the evolution from a country baseline to a sectoral panel to a networked cross-country design demonstrates that one can disentangle baseline facts from sample-specific artefacts by having a shared, transparent empirical design and transition from recording disparate responses to uncovering the mechanism that causes them to aggregate.

Substantively, the integration suggests that tariffs are a crude tool in networked economies: they can temporarily stabilise employment in traded activities, but they also squeeze value added in them over the medium term and transfer large, long-run costs to non-traded sectors particularly where imported input dependence is more.

## 2. Policy Implication

Tariffs cannot be seen as narrow tools that only protect specific industries. Instead, they spread widely across the economy and their full impact often appears with a delay. Three points follow from this: (i) in traded sectors, higher input costs reduce value added even if jobs seem protected in the short term; (ii) non-traded sectors feel strong knock-on effects as costs and demand pressures pass downstream; and (iii) reliance on imported inputs makes these impacts broader and longer-lasting.

First, tariff policy should be time-bound and purpose-limited. If protection is used to stabilise employment or to create breathing space for restructuring, it should be anchored by explicit horizons (sunset clauses and review triggers tied to observable sectoral metrics) and paired

with commitments to unwind as network-wide costs emerge. Without credible time limits, short-run job gains risk hardening into medium-run efficiency losses.

Second, where protection is deemed necessary, the target of the tariff matters. Tariffs on intermediate inputs are most likely to compress value added and propagate to non-traded sectors; they should be avoided or offset through duty-drawback, inward-processing relief, or narrowly tailored exemptions on critical components. If policymakers choose to tax final goods to gain bargaining leverage or to support domestic entry, the design should minimise collateral damage on input chains—e.g., by excluding core upstream inputs, using tariff-rate quotas with transparent allocation, or sequencing measures to coincide with local capacity coming online.

Third, protection that raises costs must be paired with supply-side upgrading rather than substitute for it. Temporary tariffs should be flanked by investment in process efficiency, technology adoption, and logistics that lower non-tariff input costs; by programmes that diversify sources of strategic inputs (including stockpiling, standards alignment, and supplier development); and by targeted support for non-traded services (construction, transport, trade intermediation) that are demonstrably exposed via input linkages. Thus, firm-level R&D, along with ports, modernization of customs and digital traceability can reduce cost shocks.

Fourth, the use of tariff revenues should reflect their network incidence. Earmarking part of the proceeds to finance adjustment where the costs land—active labour-market policies in non-traded services, training for redeployment across linked sectors, and temporary liquidity support for input-dependent SMEs—improves welfare even when aggregate balances are unchanged. Across-the-board transfers to the protected sector are weakly targeted in networked economies; compensation should follow measured exposure along input–output links.

Fifth, policy evaluation must adopt sectoral metrics and appropriate horizons. Because employment and value added diverge in the short run, success cannot be judged by near-term job counts alone. Monitoring should track margins in input-intensive traded sectors and activity in linked non-traded services at multiple horizons (quarters and years), with early-warning thresholds based on input-output exposure. Publishing these diagnostics improves accountability and disciplines the use and rollback of protection.

Sixth, external validity informs tailoring. Where imported-intermediate dependence is high, even modest tariffs can carry large and persistent costs downstream; resilience goals are better served by instruments that do not tax the network—procurement with domestic-content milestones tied to cost benchmarks, risk-sharing for supplier diversification, critical-input insurance, or targeted subsidies subject to performance. Where dependence is lower, narrow, time-bound final-goods tariffs combined with rapid upgrading may deliver the intended breathing space with fewer spillovers.

Finally, coordination reduces unintended amplification. Tariff changes should be sequenced with exchange-rate, competition, and infrastructure policies to avoid reinforcing cost shocks;

cross-agency coordination (trade, finance, industry, transport) is necessary because the burden falls outside the protected core. In short, tariffs can be part of an industrial toolkit, but in networked economies they are it is best to use it as temporary to mute input-cost pass-through and support the sectors where the costs actually land.

### 3. Limitations

The analysis is deliberately sectoral and macro–micro in scope as it links economy-wide tariff changes to disaggregated sectoral outcomes.

First, the outcomes of this study are limited to value added and employment. This focus is well suited to tracing real-economy adjustment, but it does not recover complementary margins such as prices, wages, hours, informality, markups, or capital utilisation—that would help decompose mechanisms (e.g., whether value-added contractions reflect price–quantity dynamics or margin compression).

Second, the tariff measures and sector classifications are annual and aggregated. While harmonised across settings, they inevitably abstract from intra-annual policy changes, product-level dispersion, and the fine structure of tariff schedules (e.g., exclusions, tariff-rate quotas) that can matter for pass-through. Relatedly, non-tariff measures—technical barriers, quotas, export controls, sanctions, and trade remedies—are not modelled alongside tariffs; to the extent these co-move with tariffs, estimated responses may conflate instruments.

Third, identification uses sector-level VAR innovations combined with local projections rather than a fully structural model. This design is transparent and portable but still reduced-form: it recovers dynamic responses to identified tariff innovations without pinning down deep parameters such as substitution elasticities or the precise decomposition of labour hoarding, policy transfers, and expectations. Fourth, network exposure is measured using published input–output linkages with finite country and time coverage. These tables are the workhorse for network analysis, yet they smooth over rapid re-wiring of supply chains and treat linkages as fixed within a year; they also under-represent informal and small-enterprise activity in some economies. Fifth, policy environments—especially fiscal cushions and administrative support that may underlie short-run employment stabilisation—are proxied rather than observed at high frequency; this limits the ability to attribute near-term labour dynamics to specific programmes.

Finally, the cross-country scope emphasises developing and emerging economies, which clarifies the mechanism where imported-intermediate dependence is high and buffers are thin, but limits external validity for advanced economies. In advanced economies, labor-market institutions such as collective bargaining, unemployment insurance, and financial systems contribute to smoother adjustments during economic shifts. In this aspect that the current analysis may overlook. The composition of industries varies significantly with a prevalence of knowledge-intensive sector which higher levels of automation and increased multinational

trade potentially influencing the pass-through of input costs. Additionally, practices such as inventory management, supplier diversification, and long-term agreements may lessen the impact of economic shocks while the competitive landscape determines whether these shocks affect prices or profit margins. Therefore, any projections regarding the magnitude and duration of economic impacts in developed nations should be approached with caution. Future research should incorporate institutional factors, examine a wider array of outcomes (including prices, wages, and profit margins), and analyze the interactions between various policy approaches.

#### 4. Directions for future research

Several extensions could enhance the analysis of sectoral responses to economic variables. Expanding the outcomes to include prices, wages, hours, vacancies, and markups would provide clarity on value-added adjustments and the welfare effects on both workers and consumers. Additionally, integrating firm-level microdata from customs transactions with production surveys, and matched employer-employee records would facilitate explicit tests of labor hoarding and thereby aligning sectoral trends with micro-level reallocations.

From a policy standpoint, a full framework of real protection would be created by combining tariffs with non-tariff instruments like export controls, trade remedies, sanctions, and technical standards. Thus, its identification can be improved by using natural experiments, such as tariff exemptions or phased policy implementations. Additionally, high-frequency panels could reveal information about the timing and pace of economic adjustments. Thus, a network analysis applied to essential input inputs (such as semiconductors, medical supplies, and energy components) could pinpoint major bottlenecks and the best areas to focus mitigation efforts.

Methodologically, coupling the reduced-form estimates with structural network models—calibrated or estimated production-network GE frameworks—would translate impulse responses into counterfactual welfare and policy experiments, allowing explicit evaluation of alternative instruments (tariffs vs. subsidies vs. procurement with domestic-content milestones) under different imported-input dependencies. Embedding endogenous policy response and expectations—for example, how announced but delayed measures, retaliatory actions, or exchange-rate movements interact with tariffs—would better capture real-world policy sequences. Incorporating heterogeneous labour markets (informality, mobility frictions, wage rigidity) could explain why employment–value-added divergence persists longer in some settings.

Geographically and temporally, expanding the cross-country panel to include additional economies and updating post-2018 episodes—covering pandemic-era supply shocks, energy price spikes, and new instruments like carbon border adjustments—would test whether the same network mechanism governs more recent policy cycles. Finally, tracing the re-wiring of supply chains directly—using shipment-level data, trade-in-value-added accounts, or network inference from firm–supplier registries—would move beyond static exposure to observe how

quickly and to what extent sectors adapt, and whether adaptation dampens or amplifies the propagation of future shocks.

To sum up, these extensions would preserve the sectoral, dynamic, and network-aware core of the dissertation while filling the remaining empirical and structural gaps: richer margins of adjustment, sharper identification of mechanisms, and broader external validity across instruments, institutions, and time.

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