5

Industrial Policy in a Strategically Contested Global Economy

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5. 1 Introduction – Industrial Policy In An Evolving Global Economy

Governments across a wide range of economies have returned to industrial policy in recent years as a central feature of their economic strategies. Unlike the interventionist policies of earlier decades, which were often justified by developmental concerns or framed around infant industry protection, today's industrial policies are being deployed in response to a broader set of structural and strategic challenges. These include decarbonization, concerns over technological dependence, supply chain resilience and the rising role of economic security in shaping international economic relations.

This renewed interest in state-led economic interventions is unfolding within a global economy that is deeply integrated through cross-border production networks. China's expanding use of industrial subsidies – accelerating after the launch of "Made in China 2025" plan in 2015, and the 2018 trade conflict with the United States (US) – illustrates how domestic support policies now shape global production and export structures. Modern global value chains (GVCs) link firms, suppliers and buyers across national boundaries, often with strong interdependence in inputs and technologies.

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In this context, policies aimed at domestic restructuring or sectoral support can influence trade and investment patterns well beyond national borders. While the instruments may look familiar – subsidies, tax incentives, investment screening mechanisms – their operation within these tightly connected systems creates new analytical and governance challenges.

The IMF (2024b) and the OECD (2023) note that contemporary industrial policy is increasingly anchored within national fiscal and financial frameworks. Instruments once managed by sectoral ministries, such as targeted credit, procurement or research and development (R&D) incentives, are now more systematically coordinated with macro-stabilization, climate investment and technology finance agendas. This institutionalization marks a transition from episodic, project-based intervention towards sustained policy coordination across industrial, financial and environmental domains (Baquie et al., 2025; Benitez and Bisbey, 2021). As a result, industrial policy functions simultaneously as a mechanism of structural transformation and as a core element of fiscal architecture, linking production upgrading with long-term investment and climate objectives.

Recent work by Evenett and colleagues (2024) helps clarify the character of the current wave of industrial policy. Drawing on a database of policy announcements since early 2023, they document a notable increase in targeted measures across more than 75 jurisdictions. These measures span clean energy technologies, semiconductors, digital infrastructure and the upstream inputs needed to support them, such as critical minerals. The stated objectives of these policies go beyond traditional economic upgrading and increasingly emphasize security, resilience and climate transition. Their analysis also reveals clear variation across income levels. Advanced economies tend to rely on direct financial transfers, R&D support and public procurement, while emerging markets and developing economies (EMDIs) more often use tax incentives, trade-related measures and state-directed finance. These differences likely reflect variation in fiscal space and administrative capacity but also highlight a broader shift in the policy landscape.

Although attention has often focused on the number of industrial policy interventions being introduced, some analysts have cautioned against assuming that simple counts correlate with significance. Dadush (2022) notes that many interventions are modest in financial scale and unlikely to meaningfully distort trade. He points to cases such as development bank lending or small-scale state aid programmes where the grant-equivalent value is negligible relative to broader macroeconomic aggregates. While he acknowledges the importance of monitoring industrial policy for transparency and dialogue, he warns that relying on numerical tallies of interventions may exaggerate their systemic effects (see Table 5.1). This perspective highlights the importance of distinguishing between large-scale strategic interventions and routine support measures that may have limited cross-border relevance.

Table 5.1: Harmful Interventions by Country – Economic Impact vs. Reported Numbers				
Country/ Region	**Period**	**GTA reported interventions**	**Actual economic impact**	**Key Dadush findings**
China	2009-2023	Increased number nearly every year since 2009; largest presence in Global Trade Alert (GTA) database listings	**Substantial but overstated:** ~1.73% of GDP (2019), ~$300bn annually	• Only substantive case of large-scale trade-distorting subsidies • However, aggregate welfare impact on trading partners uncertain • State-owned enterprises (SOEs) account for only ~7% of China's exports • Many subsidies may benefit trading partners through lower prices
France	2019	79 harmful interventions (55 subsidies); majority from European Investment Bank (EIB)	**Minimal:** Grant element ~€140m (~0.02% of gross fixed investment)	• EIB source of 46/55 subsidies • EIB loans have market-rate conditions • Real grant element "equivalent to measurement error" • Explosion in reported numbers masks trivial economic impact
US	Pre-2019	Declining subsidy interventions after Global Financial Crisis through 2019	**Minimal:** SBA assets <$17bn; Ex-Im Bank loans ~$8bn (2019)	• Portfolios "minuscule compared to US trade flows" • Two main agencies have very modest budgets • Declining trend contradicts perception of increasing interventions
US	Post-2021	Massive increase in industrial subsidies	**Substantial:** $805bn across the Infrastructure Act, the Inflation Reduction Act (IRA), and the CHIPS Act	• EV subsidies with discriminatory local content provisions • "Single most important signal" of US retreat from rules-based system • Subsidies may exceed China's as share of GDP
EU	2009-2019	Large and increasing numbers reported by GTA	**Limited:** Mostly development/environmental loans through EIB	• Despite strict state aid rules, appears as major subsidy user in GTA • Most interventions are EIB development finance • Grant elements minimal due to market-rate lending conditions
All Countries	2018-2023	Subsidies rose to ~80% of harmful interventions (2020-21), fell to 64.4% (2023)	**Context-dependent:** Pandemic crisis interventions vs. normal industrial policy	• Pandemic subsidies were "necessary policy response in crisis" • Should be "targeted and temporary" • Normal-times industrial subsidies historically small as % of GDP

Note: Scale and scope of recent industrial policy interventions are unprecedented in both advanced and emerging economies, reflecting not only competitiveness concerns but also geopolitical, climate, and security imperatives (see Box 5.1).
Source: Based on data and analysis in Dadush (2022).

As this new generation of industrial policy gains traction, the implications for global production are not yet fully understood. Most existing analytical frameworks were developed in earlier periods, when production was organized more nationally and spillovers were easier to isolate. Evaluating the effectiveness and consequences of industrial policy today requires analytical approaches that are better attuned to inter-sectoral linkages, firm-level heterogeneity and international feedback effects within globally integrated value chains. Several recent empirical and modelling contributions, discussed in later sections of this chapter, help address these gaps. They provide evidence on how industrial policy affects productivity convergence, supply chain reconfiguration and cross-border investment dynamics across strategically significant sectors.

These developments also raise questions about the adequacy of existing multilateral rules and institutional mechanisms. The World Trade Organization's (WTO) framework for managing subsidies and countervailing measures remains in place, but enforcement limitations, notification gaps and the broader breakdown in dispute settlement have reduced its effectiveness. At the same time, efforts by institutions such as the International Monetary Fund (IMF), the Organisation for Economic Co-operation and Development (OECD), the World Bank and the WTO to improve data and transparency – through mechanisms like the Joint Subsidy Platform – are emerging as important complementary tools. Some academic and policy proposals, including the idea of a modular transparency platform (Koopman, 2025), have sought to address these challenges by offering alternative frameworks for monitoring and dialogue.

This chapter sets out to provide a structured, evidence-based and neutral review of the emerging landscape. It draws together empirical findings, modelling insights and institutional developments to help clarify how industrial policy is evolving, how it interacts with GVCs, and how researchers and policymakers are responding. The sections that follow examine the conceptual foundations of industrial policy in an open economy, survey recent trends in its design and implementation, and assess available evidence on its economic and strategic effects. The chapter concludes with a discussion of current efforts to improve transparency and coordination, without making normative judgments about the legitimacy or desirability of specific policy approaches.

5. 2 Conceptual Background and Analytical Considerations

Industrial policy has long been a contested concept in both economic theory and applied policy (Rodrik, 1995; Juhász et al., 2024). While definitions vary (Aiginger and Rodrik, 2020), a common understanding refers to targeted government efforts to influence the allocation of resources across sectors to support specific developmental, strategic or social objectives. Historically, the focus was on promoting industrialization through infant industry protection or through policies designed to encourage the accumulation of capital, learning and scale economies in manufacturing. Over time, as global trade became more liberalized and integrated, enthusiasm for active industrial policy diminished, in part due to concerns over inefficiency, rent seeking and poor targeting.

As production has become globally fragmented, the classical frameworks of industrial policy have come under renewed scrutiny. Recent cross-country studies drawing on newly compiled datasets tracking industrial policy measures, such as Evenett et al. (2004) and Baquie et al. (2025) show that governments are using a far wider mix of instruments ranging from R&D subsidies and carbon-related incentives, to strategic public procurement to steer structural change. More generally, building on earlier second-best logic (Rodrik, Grossman, and Norman, 1995; Baldwin and Krugman, 1988), recent empirical and theoretical studies apply it to globally networked production

systems in which spillovers cross borders through trade, investment and knowledge flows. As a result, modern industrial policy is understood less as a national corrective and more as a coordination process operating within complex value chain ecosystems.

The analytical frameworks that shaped the earlier consensus on industrial policy were built on models of domestic distortions and welfare optimization. The seminal contributions of Bhagwati and Ramaswami (1963) and Corden (1957) fundamentally transformed the understanding of optimal policy interventions by establishing the principle that the most efficient remedy for a specific market distortion is a targeted instrument – typically a production or consumption subsidy – rather than a trade barrier. These frameworks also emphasized that protectionist measures, including tariffs and quotas, generally impose efficiency costs that exceed their potential benefits, except in very specific cases when addressing distortion precisely at its source.

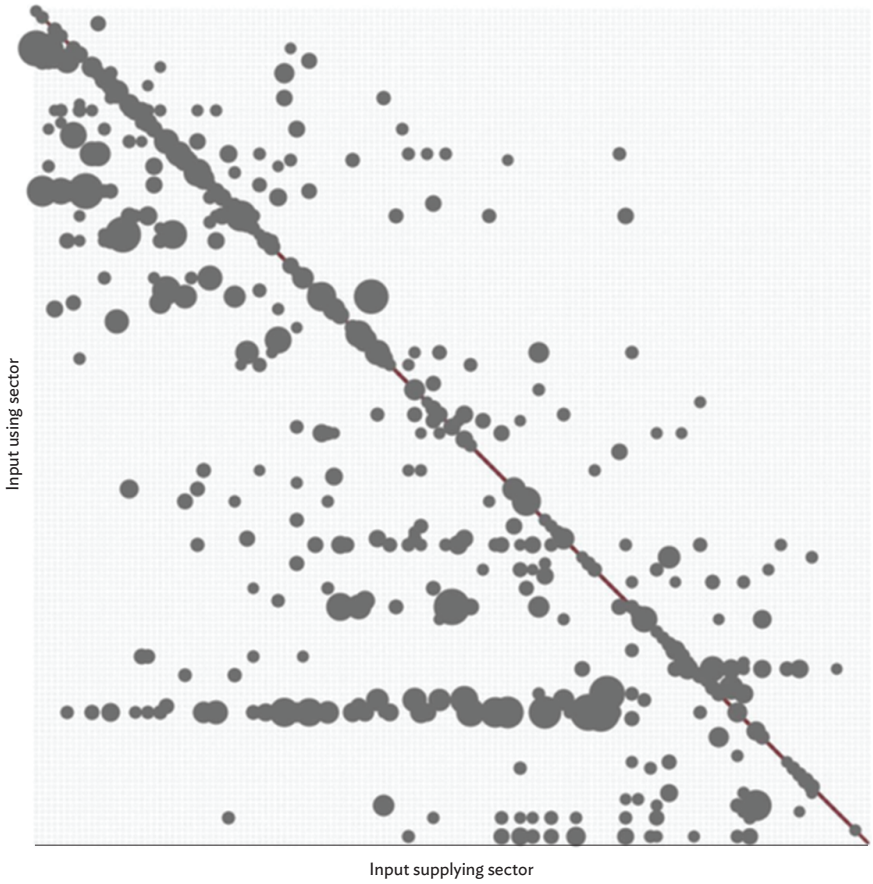
However, much of this work was developed under conditions that abstracted from international production fragmentation, cross-border investment flows and knowledge spillovers. With the rise of GVCs over the past three decades, the analytical environment in which industrial policy operates has changed considerably. Today, trade in intermediate goods accounts for more than half of world trade, with firms regularly sourcing inputs and organizing production across multiple jurisdictions. In such a setting, the effects of industrial policy depend not only on the internal conditions of the targeted sector, but also on its position and connectivity within broader production networks.

Recent empirical and theoretical work has responded to this shift. One relevant contribution is Liu (2019), who shows how industrial policies can generate cascading spillovers when targeted at sectors with extensive upstream and downstream linkages. Liu (2019) demonstrates that subsidies directed at upstream sectors amplify productivity and competitiveness throughout production chains (see Figure 5.1), a result confirmed by Zhang et al. (2024) and Rotunno (2024), who trace similar spillover effects across domestic and cross-border networks. Ma et al. (2024) show that participation in GVCs through imported inputs raises firm productivity by fostering learning and supplier upgrading, suggesting that industrial policy can indirectly strengthen these channels.

Together, these studies contribute to an emerging strand of literature that grounds industrial policy evaluation in firm-level and network-based metrics, moving beyond traditional partial equilibrium analysis and illuminating how policy interventions ripple through production networks. This suggests that the effectiveness of industrial policy cannot be evaluated without reference to inter-sectoral and international linkages.

In related work, Lashkaripour and Lugovskyy (2023) develop a general equilibrium model with scale economies and monopolistic competition, showing that well-targeted industrial policy can yield global efficiency gains and transformative welfare

Figure 5.1: The Input-Output Demand Matrices of China in 2007



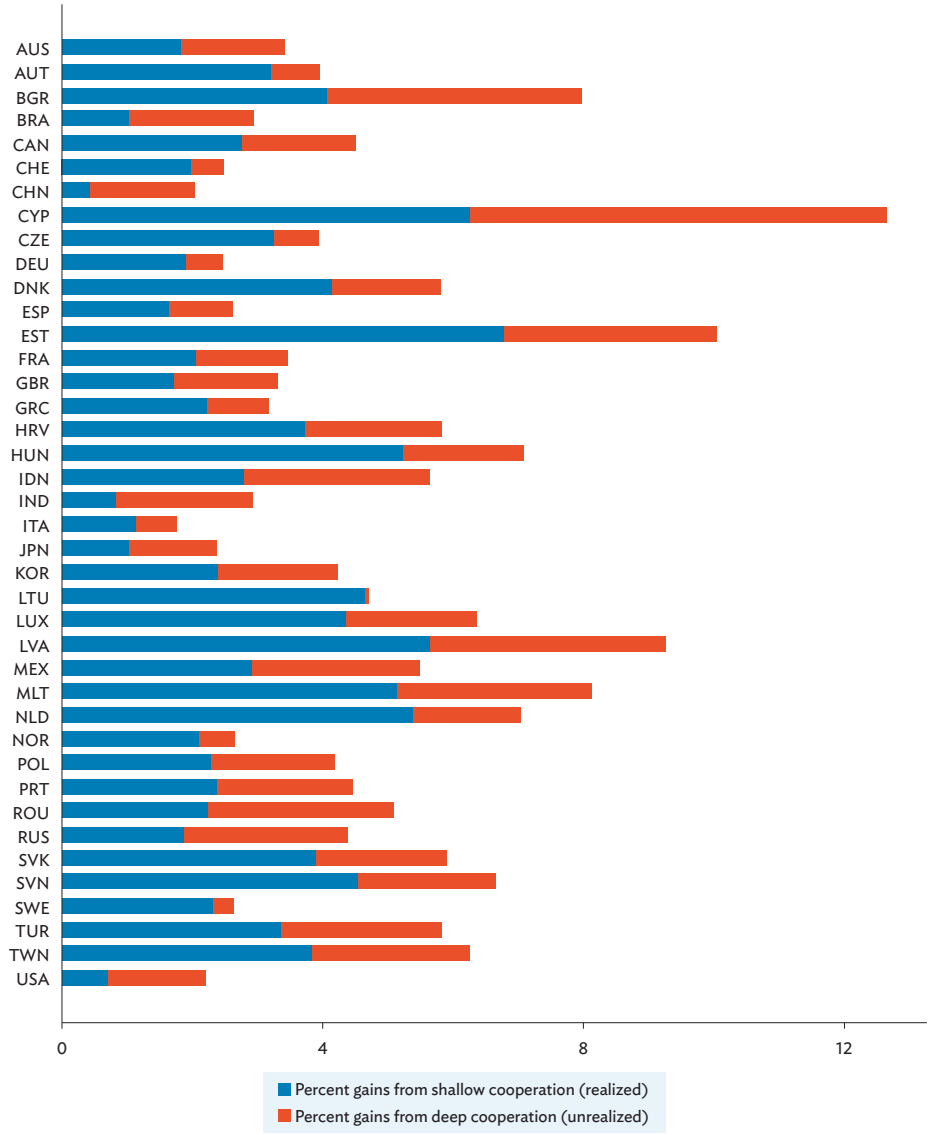
Note: The figure visualizes China's 2007 input-output demand matrix, with rows denoting input-using industries, and columns denoting input-supplying industries. The size of *i j*-th entry in the figure reflects the share of industry *j*'s output supplied to industry *i*, with only linkages of 5% or more shown. Industries are ranked by the sector's distortion centrality, placing the upstream sectors towards the top. The dense area below the diagonal indicates a hierarchical production structure in which inputs flow primarily from upstream to downstream sectors. This pattern underscores Liu's finding that in such hierarchical networks, distortions and policy effects accumulate through backward demand linkages so that subsidies to upstream sectors can generate amplified spillovers throughout the value chain.

Source: Figure III, right panel ("The IO Demand Matrices of China Are Hierarchical") in Liu (2019).

improvements under certain conditions, particularly when subsidies are coordinated internationally in sectors characterized by technological complementarity and underinvestment (see Figure 5.2).

Other recent work has turned to the political economy and institutional dimensions of industrial policy. Juhász and Lane (2024) argue that industrial policy outcomes often hinge less on economic fundamentals than on institutional design and coalition dynamics. They emphasize that the ability to sustain effective industrial strategies depends on the presence of bureaucratic competence, clear accountability mechanisms and durable political coalitions. Their historical survey, and related scholarship, contrasts cases where these conditions were met, such as postwar France or contemporary South Korea, with others where fragmentation or political capture led to limited results (see Table 5.2).

Figure 5.2: Welfare Gains from Deep and Shallow Cooperation



Note: This figure illustrates how international coordination magnifies the welfare effects of industrial policy in economies characterized by scale economies and profit-generating markups. Using data from the 2014 World Input-Output Database, the authors compute welfare changes under three benchmark scenarios: (i) the status quo; (ii) shallow cooperation, in which countries refrain from overt protectionism but act unilaterally; and (iii) deep cooperation, in which governments coordinate corrective Pigouvian subsidies across sectors. The figure reports the percentage change in real income relative to the status quo equilibrium for various economies. The results highlight that unilateral or shallow forms of policy coordination yield limited or even negative welfare effects once terms-of-trade tensions are considered, whereas deep cooperation – mutual alignment of industrial subsidies – produces transformative global gains. The figure suggests that the welfare consequences of modern industrial policy depend less on its scale than on the degree of cross-country coordination. Effective governance of industrial policy therefore requires "deep" agreements capable of internalizing cross-border spillovers and mitigating subsidy races, rather than isolated national interventions.

Source: Figure 5 ("Welfare Gains from Industrial Policy under Increasing Returns") in Lashkaripour and Lugovskyy (2023)

These institutional considerations are particularly relevant in evaluating the capacity of countries to design, monitor, adjust or phase out industrial policy instruments over time. The ability to implement industrial policy effectively may depend less on the theoretical merits of the intervention than on its institutional coherence, consistent oversight and the operational autonomy of implementing agencies.

Table 5.2: Comparisons of Industrial Policy Cases from Various Studies						
Economies	Period	Institutional context	Sector(s)	Policy tools	Outcome	Source(s)
South Korea	1960s-1980s	Strong bureaucratic competence, clear accountability, stable political coalitions	Steel, shipbuilding, electronics	Targeted credit, export discipline, SOEs, performance monitoring	Successful industrial upgrading and export dominance	Rodrik (2008); Juhász, Lane & Rodrik (2024)
Chinese Taipei	1970s-1990s	Flexible bureaucratic institutions, coordinated industrial planning	ICT, machinery, semiconductors	R&D subsidies, SME support, flexible industrial planning	Sustained tech upgrading and diversified manufacturing base	Rodrik (2007)
Brazil	1970s-1980s	Fragmented implementation, weak bureaucratic control, vulnerability to capture	Manufacturing (general)	State-owned enterprises (SOEs), protective tariffs, subsidized investment	Initial capability gains followed by inefficiency and stagnation	Rodrik (2008); Juhász, Lane and Rodrik (2024)
India	1950s-1980s	Fragmented institutions, weak coherence, frequent political capture	Heavy industry, general manufacturing	Licence system, SOEs, import substitution	Low productivity growth, limited export orientation	Rodrik (2008); Juhász, Lane and Rodrik (2024)
Argentina	1950s-1970s	Highly protectionist, politically driven state interventions	Consumer goods, general import substitution industries (ISI)	Protectionist tariffs, state-led development	Chronic macro instability, limited industrial deepening	Rodrik (2007, 2008); Juhász, Lane and Rodrik (2024)
France	Post-WWII-1980s	Not specified	Not specified	Centralized planning ('Plan Calcul'), elite-driven policy	Limited success due to weak feedback and rigid structures	Estrin and Holme (1983); Cohen (2007); Klebaner and Voy-Gillis (2023)

Note: Authors' compilation from cited sources, drawing on Rodrik's (2007, 2008) synthesis of works by Evans (1995), Amsden (2001), Wade (1990) and related works.

Multilateral institutions have begun to integrate some of these evolving considerations into their own policy frameworks. Recent IMF and OECD initiatives have begun to incorporate industrial policy within broader fiscal and governance frameworks. Section 6 discusses these institutional responses and the emerging transparency and coordination tools in greater depth.

The analytical challenge going forward is to bring these strands of research and institutional practice into a more coherent evaluative framework. The rise of GVCs and the heightened geopoliticization of technology and security policy have altered the assumptions that underpinned earlier analyses. Modern industrial policies are increasingly justified on grounds that they transcend conventional economic rationales and often produce both positive and negative spillovers across borders. Understanding when and how these effects arise requires tools capable of capturing intricate cross-sector linkages, firm-level heterogeneity and state-capacity constraints. Equally critical is enhancing transparency and fostering shared understanding across jurisdictions, particularly where overlapping industrial support from multiple governments coexists in the same sectors, which heightens the risk of friction and inefficiency in global markets.

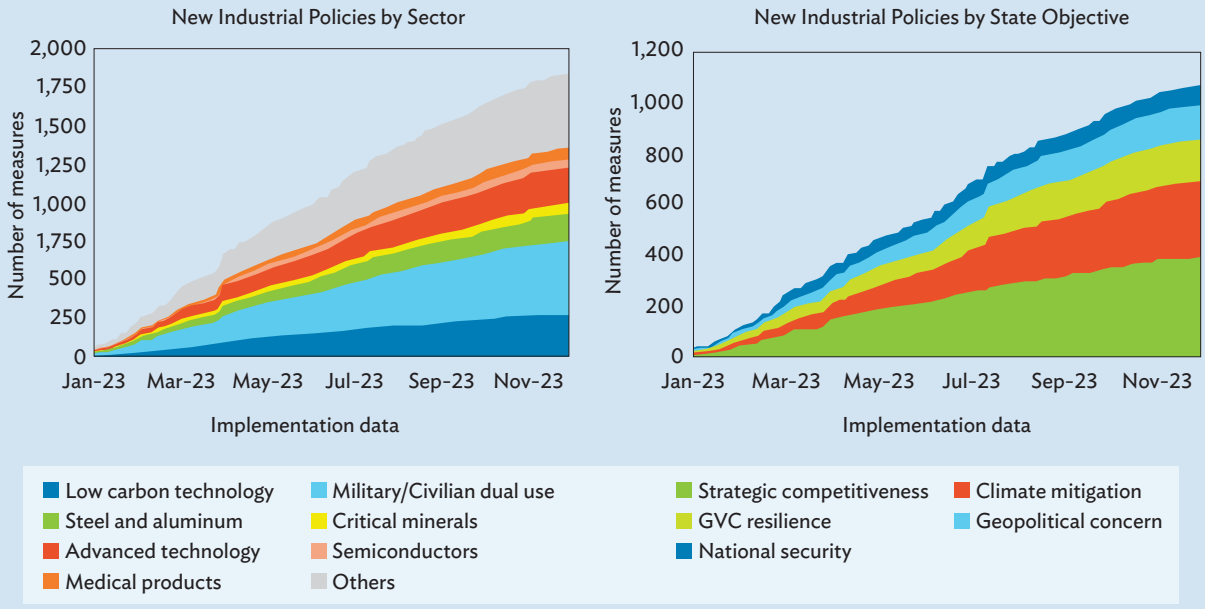
The sections that follow draw on empirical and theoretical work aimed at clarifying these intricate dynamics. While the effectiveness of industrial policy remains context-specific, the available evidence helps identify the conditions under which particular types of interventions are more likely to generate learning, technological upgrading, productivity growth or resilience. At the same time, recent research has warned of the potential pitfalls, subsidy races, retaliatory measures and unintended distortions – especially when transparency is low and policy coordination is weak. These issues are developed further in subsequent sections.

Box 5.1: The Rise of New Industrial Policies

The resurgence of industrial policy reflects a shift in government strategies to address economic and non-economic challenges, including climate change and geopolitical tensions, often through subsidies and trade restrictions. While industrial policy can help address market failures to promote structural transformation and resilience, overall economic impacts remain mixed, and its effectiveness depends on sectoral dynamics and policy design. This note summarizes recent developments and policy lessons from the analysis of industrial policy, the IMF's approach to covering industrial policy in surveillance and international collaboration on data gaps and policy coordination.

Industrial policy (IP) refers to government efforts to shape the structure of the economy through targeted measures on specific domestic industries, firms or economic activities to achieve certain economic or non-economic objectives. Challenges related to climate change and increased geopolitical rivalry have contributed to governments taking a more active role in guiding the structural transformation in the recent wave of IP. This is evidenced by governments' stated motives and the sectors targeted. Besides economic motives like competitiveness, new motives such as climate mitigation, geopolitical and national security concerns, and supply chain resilience have emerged. Sectors targeted include low-carbon technologies, military/civilian dual use products and other advanced technologies, as well as their upstream inputs, such as critical minerals (Figure B 5.1.1).

Figure B 5.1.1: New Industrial Policy Measures
(Cumulative, based on announcements since Jan 2023; sample of 75 jurisdictions)



Source: Evenett, Jakubik, Martin and Ruta (2024)

Policy tools deployed in pursuit of industrial policy objectives vary, depending on countries' fiscal, institutional and administrative capacity, and often discriminate between domestic and foreign producers. Most of the recent IPs have been implemented through different types of subsidies – advanced economies (AEs) tend to rely on direct financial grants, state loans, and other forms of state aid, while emerging markets and developing economies (EMDEs) opt for state loans, tax relief and capital injections. Trade restrictions on

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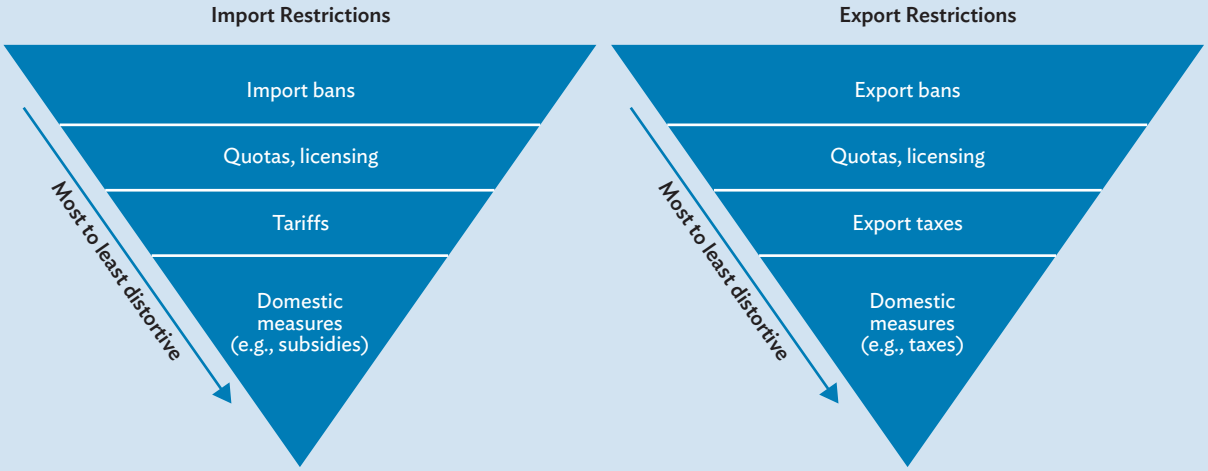
Box 5.1: continued

imports and exports are also more frequently used by EMDEs, possibly reflecting their more limited fiscal or administrative capacity. Over the past decades, the use of subsidies has been more prevalent in EMDEs, contributing to the sizable stock of "legacy" measures that are still in place. Discriminatory policies feed trade tensions and sometimes run counter to trade rules.

By steering resource reallocation to certain sectors, industrial policy can have significant domestic and cross-border economic impacts (spillovers); but empirical evidence of net economic benefits is mixed. Overall, economic gains from IP are moderate and uneven, and they are more effective when addressing highly distorted upstream sectors with suitable tools (Baquie et al., 2025). Case studies point to certain broad enabling factors behind IP successes, including targeting sophisticated sectors with export orientation and ex ante competitive products (Huang et al., 2025) or sectors with high network linkages to other sectors (Liu, 2019), as well as resource-intensive activities (Lebdioui, Lee, and Pietrobelli, 2020), while enforcing competition and accountability (Cherif and Hasanov, 2019).

The bar to get industrial policy right is high even when market forces fail to provide a socially efficient outcome. Government intervention under "real-world" conditions of market imperfections are rarely if ever non-distortionary, leading at best to what is termed a "second best" allocation in terms of welfare. In general, the most efficient policy instruments to correct for domestic price distortions due to market failure are domestic taxes and subsidies rather than trade policy and protection (Bhagwati and Ramaswami, 1963; Lashkaripour and Lugovskyy, 2023). Addressing non-economic objectives such as defence (production targets), self-sufficiency (import targets), sectoral employment (factor use targets) or climate change (carbon emissions targets), implies efficiency is no longer a primary consideration and requires different combinations of instruments (Bhagwati, 1969; Corden, 1957). Nevertheless, there are significant practical hurdles such as fiscal constraints, administrative capacity, rent seeking and corruption to attain net positive welfare outcomes and desired non-economic objectives.

Figure B 5.1.2: A General Hierarchy of Trade Restrictive Policies



Note: These are intended as general guidance; the size of the distortion of an individual measure will vary depending on scope and implementation.

The IMF covers industrial policy in its surveillance and policy advice when it is macro-critical or can generate significant cross-border spillovers. Key considerations in staff's advice are whether (i) a well-established case for IP exists, i.e., addressing a well-identified market failure that cannot be addressed through horizontal policies, (ii) effective design which considers economy-wide complementary policies and governance capability, (iii) benefits outweigh costs and (iv) implementation compatible with fiscal sustainability, external and domestic stability, and a country's WTO commitments. The IMF's advice on trade-related aspects of industrial policy is grounded in Article I of its Articles of Agreement, "to facilitate the expansion and balanced growth of international trade.." This entails favouring less distortionary implementation of IP, with due consideration to trade and investment spillovers, and advising against discriminatory features, which are almost always unnecessarily costly and encourage retaliation (Figure B 5.1.2).

As more countries resort to industrial policy to manage structural transformation and the green transition, there is a need for deeper collaboration among international organizations on IP issues. Data gaps remain a key challenge to improve tracking of IP measures, benchmarking countries, assessing IP effectiveness and facilitating fact-based policy coordination to mitigate harmful IP interventions. Some work is ongoing to improve the availability of cross-country data, such as the Joint Subsidy Platform jointly developed by the IMF, the OECD, the World Bank and the WTO, and further joint work is under way (IMF, OECD, WBG, and WTO, 2022). Staff at the IMF have also initiated a collaboration with the Global Trade Alert on a New Industrial Policy Observatory (NIPO) to monitor developments in 75 jurisdictions (Evenett et al., 2024; Evenett et al., 2025). Drawing on their respective expertise, international organizations can coordinate data collection efforts on critical IP issues (e.g., green subsidies) and identify further actions to increase transparency and availability of information on IP measures adopted by countries.

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Box 5.1: continued

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Note: The author of this box is Adam Jakubik. This box draws from material in Evenett et al. (2024) and IMF (2024). The views expressed herein are those of the author and should not be attributed to the IMF, its Executive Board, or its management.

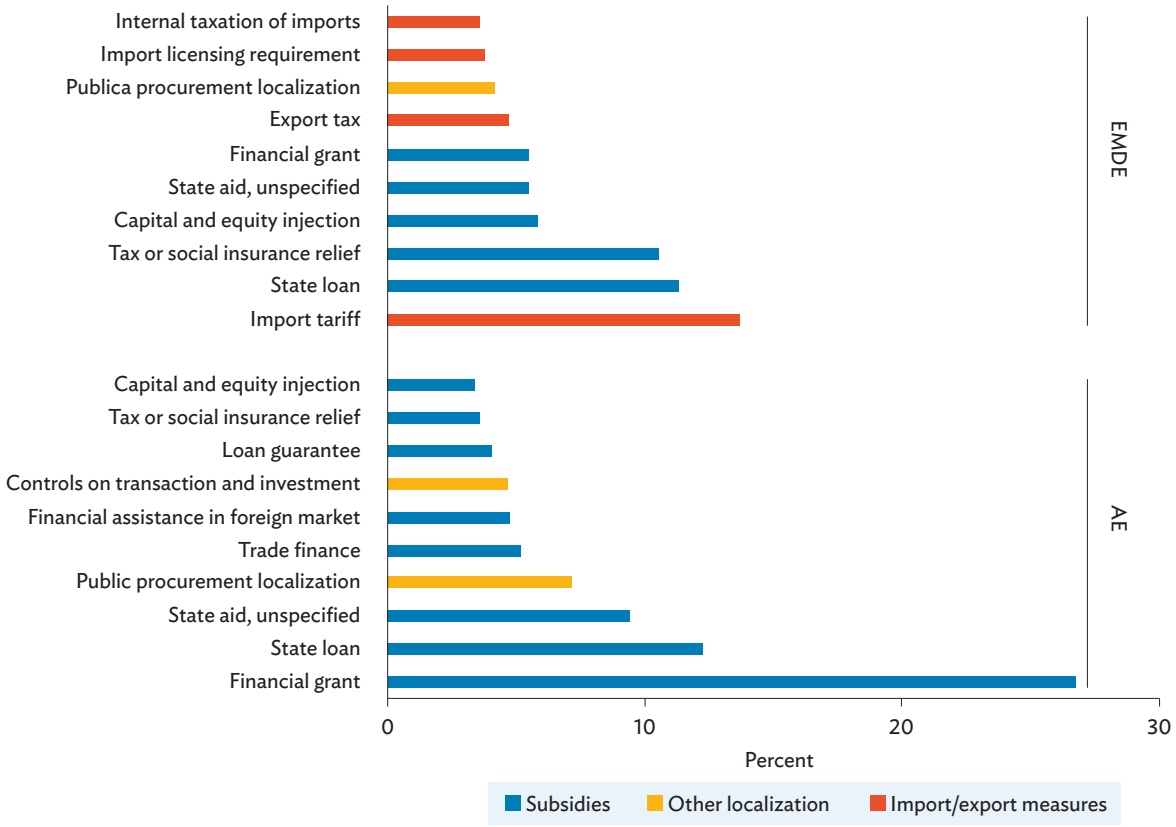
5. 3 Evolving Practices in Industrial Policy: Recent Developments and Key Insights

The last several years have witnessed a resurgence in the use of industrial policy instruments (Irwin, 2023; Evenett et al., 2024), with governments across income levels implementing measures that range from direct fiscal support to regulatory incentives and trade-related restrictions. While some of these interventions respond to immediate shocks such as the COVID-19 pandemic, others reflect longer-term shifts in economic strategy driven by techno-nationalist ambitions, especially as countries seek to strengthen domestic capabilities in technologies foundational to their resilience, competitiveness, sustainability or security. The scope and pace of these interventions are documented in a growing set of databases and policy surveys (Millot and Rawdanowicz, 2023; EBRD, 2024; Evenett et al,. 2024; Juhász et al., 2025).

Of the various efforts to track and document the resurgence of industrial policy measures, the most comprehensive one is that by Evenett and colleagues (2024), who assembled a database (the New Industrial Policy Observatory dataset, NIPO) of industrial policy announcements across 75 jurisdictions between January 2023 and early 2024. Their analysis focuses on measures targeting clean energy, semiconductors, digital infrastructure and upstream sectors such as critical minerals. The database reveals substantial variation in both the instruments deployed and the sectors targeted.

Advanced economies tend to rely more on direct grants, equity stakes and public procurement, while EDMEs often use tax-based incentives, trade-related restrictions and subsidized lending (see Figure 5.3). As discussed in Section 1, China's expanding subsidy programmes have become central to its industrial strategy (see Figures 5.4 and 5.5). Firm-level evidence (Zhang et al., 2024) shows how these measures, especially upstream subsidies, shape export behaviour and sectoral upgrading.

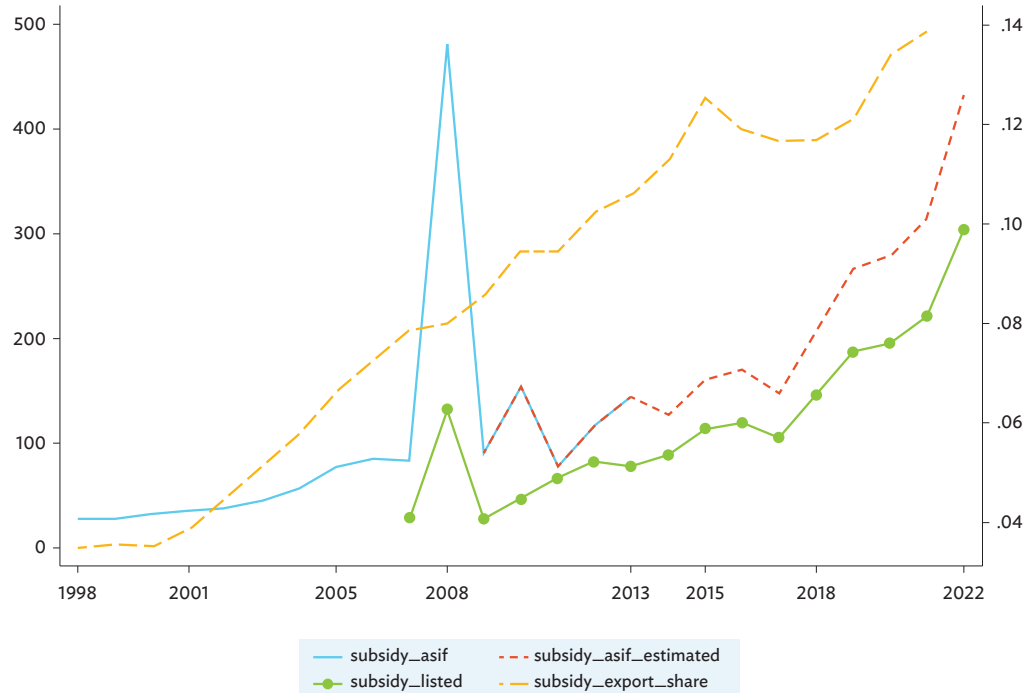
Figure 5.3: Trade Distortive Industrial Policy in 2023 by Income Group



Note: AE = Advanced economies; EMDE = Emerging markets and developing economies.
Source: Figure 3 ("Trade distortive industrial policy tools in 2023 by income group") in Evenett et al. (2024).

The research by Zhang et al. (2024) also examines how the impacts of industrial subsidies in China reverberate through domestic supply chains, reshaping trade and firm behaviour. Using firm-level and industry-level data, they estimate how subsidies provided to one segment of a value chain alter input costs and demand conditions for firms in related sectors. Their findings show that direct subsidies boost export activity at both extensive (participation) and intensive (volume) margins. More strikingly, indirect subsidies, especially those channelled through first-tier upstream sectors, have even stronger impacts on the export outcomes than direct subsidies. Overall, upstream subsidies, channelled through supply chains, emerge as powerful levers of export growth. The study also reveals heterogeneous effects by firm ownership: while both domestic and foreign-invested firms benefit from direct subsidies, upstream indirect

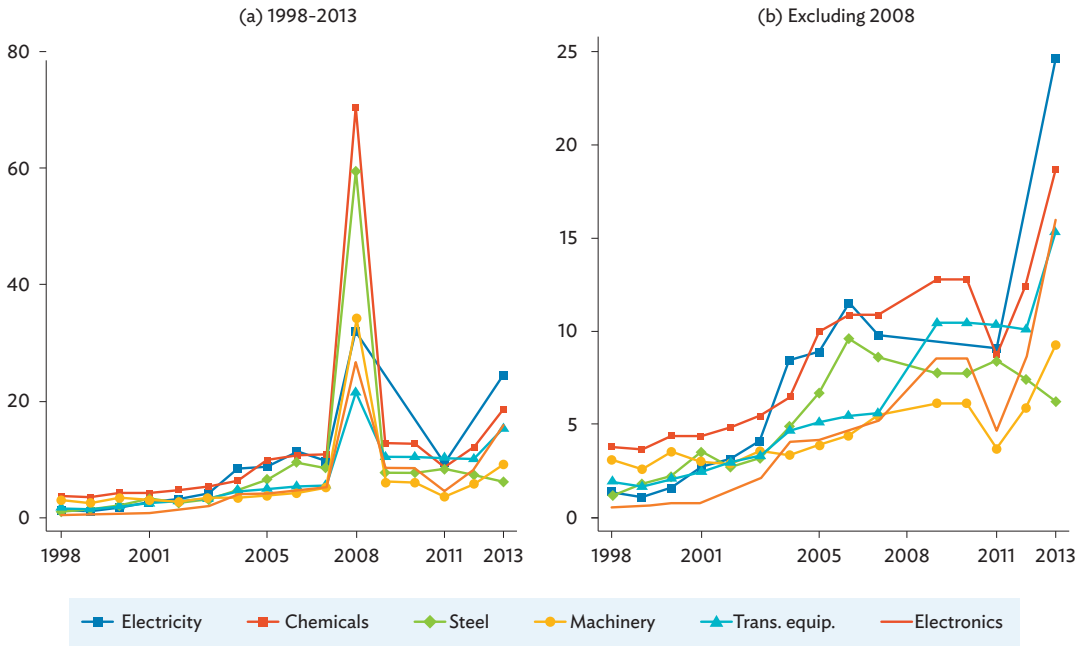
Figure 5.4: The Rise of Industrial Subsidies in China



Note: Subsidies are defined as direct government payments (billion RMB) to manufacturing, mining and utilities sectors. *subsidy_asif* captures subsidies directly reported by above-scale industrial firms in China's *Annual Survey of Industrial Firms (ASIF)*; *subsidy_asif_estimated* denotes econometrically estimated total subsidies based on ASIF data, accounting for unreported or missing subsidies; *subsidy_listed* draws on WIND data for listed firms, capturing government support disclosed in annual financial reports, such as R&D grants, tax rebates and special funds; *China_export_share* shows China's share in global exports, indicating export orientation and competitiveness. The figure reveals that China's subsidy disbursements rose sharply after 2008, serving first as counter-cyclical stimulus and later as instruments for upgrading, green transition, and resilience, reaching about RMB430 billion ($60 billion) by 2022.

Source: Compiled by Zhang et al. (2024) based on ASIF, WIND, and WITS databases, as in Figure 1 ("The rise of industrial subsidies in China") in Zhang et al. (2024).

Figure 5.5: Industrial Subsidies in Major Chinese industries



Note: Classification of industry is based on 2002 China Input-Output Tables.

Source: Compiled by Zhang et al.(2024) based on the ASIF, as in Figure 2 ("Industrial subsidies in major industries") in Zhang et al.(2024)

subsidies disproportionately favour domestic firms, which benefit from both first and second-tier subsidies, whereas foreign firms benefit primarily from second-tier only.

Indeed, international variations in industrial policy practices reflect more than just fiscal capacity. They also reveal divergent philosophies on how best to address structural constraints and enhance long-term competitiveness. In many cases, the design and delivery of industrial policy are shaped by the institutional features of the state (Juhász et al., 2025; OECD, 2025), including the administrative quality of public agencies, the availability of sector-specific information and the existence of mechanisms to evaluate and adjust interventions over time. The economic consequence of these policies has become an important area of inquiry, particularly with respect to their effects on trade and investment flows. Some of the strongest insights to date come from model-based analysis, including recent work by Bekkers and Jhunjhunwala (2024), who use a global computable general equilibrium (CGE) model to simulate the effects of unilateral and multilateral production subsidies in sectors with high input-output linkages.

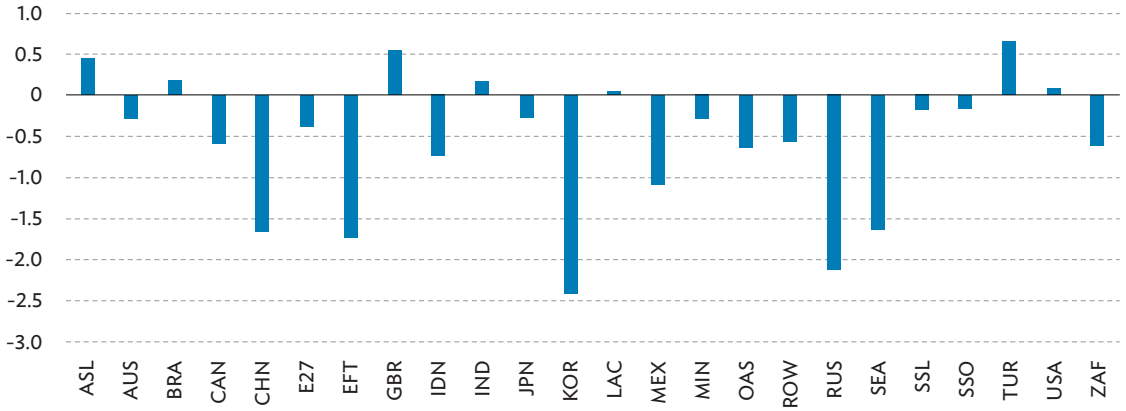
Their simulations show that unilateral subsidies can not only boost domestic output and exports in the targeted sector but also generate substantial positive spillovers for third countries, particularly when those countries are embedded in the same production networks. Moreover, the results suggest that coordinated subsidy schemes may achieve larger global welfare gains while mitigating distortions. These findings help clarify the conditions under which subsidies generate not just substitution effects but also productive complementarities, potentially supporting Dadush's view that subsidy concerns may be overstated in some contexts. However, this finding applies primarily to large-scale interventions in sectors with distinct structural characteristics, not to the modest development finance or small and medium-sized enterprise (SME) support programmes that comprise much of the Global Trade Alert (GTA) database.

A key contribution of the work lies in quantifying the magnitude and direction of cross-border spillovers, as well as identifying sectors that are most susceptible to international feedback effects. Sectors such as semiconductors and electric vehicle components – characterized by intensive network linkages, dense international sourcing patterns and capital-intensive production – appear particularly sensitive to changes in cost structures induced by subsidies. Their simulations illustrate the estimated output and welfare effects across regions under different subsidy scenarios (see Figure 5.6).

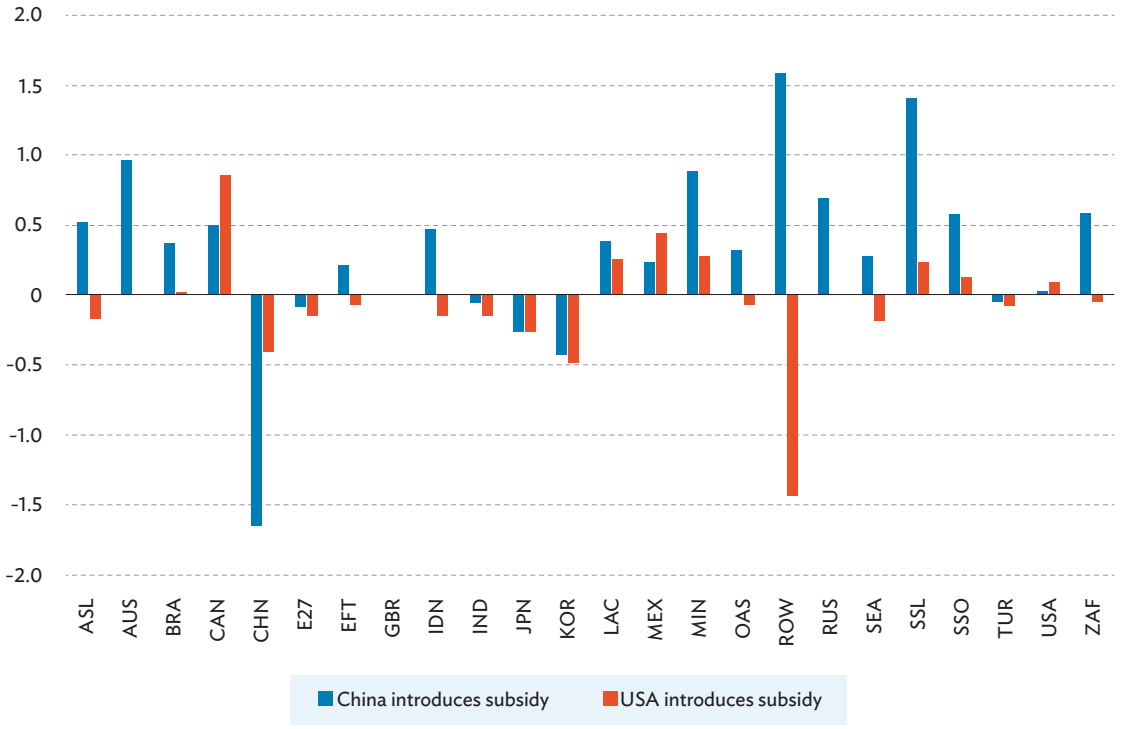
While CGE models provide a structured way to simulate subsidy effects under a range of assumptions, complementary empirical work, such as that by Zhang et al. (2024), which directly measures how subsidies affect input costs, demand conditions and export outcomes, is needed to assess how policies operate in practice. Their findings show that both upstream and downstream subsidies contribute significantly to sectoral export outcomes, with the strength of these effects contingent upon the sector's technological structure and market concentration.

Figure 5.6: Simulated Welfare and Output Effects of Subsidies

A. Simulated real income effects from unilateral introduction of a 10% output subsidy in the manufacturing sector (% change)



B. Projected changes in real income when China and the US would introduce a 10% manufacturing subsidy (% change)



Note: Using the WTO Global Trade Model, Bekkers and Jhunjhunwala (2024) simulate how industrial-subsidy shocks spread across economies with intermediate linkages. Panel A shows the real-income effects of a unilateral 10% output subsidy in manufacturing. Most subsidizing regions experience small welfare losses due to fiscal costs and terms-of-trade deterioration, while third-country effects are generally positive because of lower import prices and stronger upstream demand. Panel B shows the case where both China and the US introduce a 10% manufacturing subsidy: coordinated action moderates own-country losses and yields broader, more balanced global gains. Together, the simulations indicate that subsidy spillovers are often positive in general equilibrium and that coordinated industrial policies can raise global welfare more than isolated national programmes.
asl = Asia, Low Income; aus = Australia; bra = Brazil; can = Canada; chn = China; e27 = European Union (27); eft = EFTA (Norway, Switzerland, Iceland, Liechtenstein); gbr = United Kingdom; idn = Indonesia; ind = India; jpn = Japan; kor = Korea; lac = Latin America; mex = Mexico; min = Middle East and North Africa; oas = Other Asia (e.g., Malaysia, Philippines, Thailand); row = Rest of the World; rus = Russia; sea = Southeast Asia; ssl = Sub-Saharan Africa, Low Income; sso = Sub-Saharan Africa, Other; tur = Türkiye; usa = United States; zaf = South Africa.

Source: Figure 3 ("Simulated Real Income Effects from Unilateral Introduction of a 10% Output Subsidy in the Manufacturing Sector, % Change") and Figure 5 ("Projected Changes in Real Income when China and the USA would Introduce a 10% Manufacturing Subsidy, % Change") in Bekker and Jhunjhunwala (2024).

Indeed, this type of analysis complements macro-modelling work by offering granular, firm-level evidence of how subsidy measures operate through real production linkages. It also reinforces the view that the impact of a subsidy is not limited to the targeted firm or sector but depends on how that firm connects to others within and across borders. As Zhang and colleagues argue, the observed effects may also be amplified in policy environments where multiple instruments – subsidies, public procurement and trade regulation – are used in tandem and layered together.

Both the Bekkers and Zhang papers suggest that identifying the type of industrial policy instrument in use is only a starting point. Equally important is understanding how that instrument interacts with supply networks, competitive dynamics and the institutional architecture in which it is embedded. For instance, a production subsidy to an upstream input supplier may have minimal effects in a fragmented, low-margin sector. But in sectors featuring strong economies of scale and tight linkages to export markets, such upstream subsidies can trigger substantial downstream spillovers. These empirical and model-based contributions point to the need for a typology-driven approach to industrial policy monitoring. The variety and diversity of policy interventions reported in databases like the Global Trade Alert or the Joint Subsidy Platform suggest that simple classification by instrument or sector may be insufficient. Instead, several recent contributions have proposed more structured typologies based on risk profile, scale and network centrality. Reed (2024), for example, offers a three-tiered framework to classify industrial policy by ex-ante success probability, linking policy ambition to sectoral capabilities and market growth trajectories. This type of framework, though not without limitations, offers a way to differentiate between benign policy experimentation and excessive strategic overreach.

Some have also proposed governance mechanisms that reflect the diversity of industrial policy measures. One academic proposal, outlined in Koopman (2025), suggests that sector-specific observatories and typology dashboards could serve as a soft-governance complement to legal enforcement. Although this framework will be discussed in more detail later, it is worth noting here that the empirical material in this section provides much of the rationale for why differentiated approaches to monitoring and dialogue may be preferable to one-size-fits-all disciplines.

Much of the literature reviewed above takes a cross-sector perspective, several more focused contributions provide sector-specific assessments that complement these broad surveys. Goldberg et al. (2024) present one of the most systematic analyses of the semiconductor industry – arguably the most strategically significant of today's targeted sectors. Their study employs a three-pronged methodology: (i) a historical review of state support, (ii) the use of natural language processing (NLP) to identify and quantify industrial policies in the GTA database (2010–2022) and (iii) a structural model drawing on proprietary data from the Global Semiconductor Alliance (2004–2015) to infer unobserved production subsidies.

They show that subsidies – in the form of grants, tax incentives, loans and equity injections – are pervasive across all major producers, and have significantly ramped up since 2020, with China, the US, Japan, South Korea and India substantially increasing financial support. The measures typically target production upgrading and capacity expansion, alongside R&D and innovation. Policymakers are motivated by goals of economic growth, international competitiveness and, increasingly, resilience and national security. Although China stands out in absolute monetary terms, the estimates indicate that the country is not an outlier once market size is considered, as South Korea's intensity can be higher, though cross-country comparability is imperfect. The conclusions are supported by both the NLP-based and model-based approaches. Moreover, they note that the sharp scaling up of subsidies across all major semiconductor-producing countries, together with the expanded use of tools driven by geopolitical concerns – including export controls, foreign investment screening and merger reviews – has intensified the risk of a global "subsidy race".

Bown and Wang (2024) echo this point, complementing the empirical evidence with a policy-oriented perspective on semiconductors as the emblematic case of modern industrial policy. They trace the sector's evolution – from early US dominance and the US-Japan disputes of the 1980s to the rise of TSMC and South Korean memory producers – and stress that contemporary interventions, increasingly shaped by geopolitical concerns, now extend well beyond subsidies. Their analysis situates the US CHIPS and Science Act, the European Chips Act and Japan's support for TSMC and Rapidus within this broader global contest, warning of overcapacity and renewed trade conflict reminiscent of the 1980s and 1990s. Importantly, they argue that the interaction of subsidies, trade restrictions and a highly integrated GVC raises fundamental questions about multilateral compatibility, underscoring the governance challenges examined later in this chapter.

Finally, it is important to recognize that many industrial policies are deployed to serve overlapping goals, including innovation, employment and resilience. Their evaluation, therefore, cannot be confined to trade metrics or short-term output effects alone. As the next section will explore, a full accounting of impacts also requires attention to firm-level upgrading, convergence dynamics and changes in investment behaviour – especially in sectors with global strategic significance.

5.4 Economic Impacts: Firm Behaviour, Productivity and Supply Chain Reconfiguration

The economic impacts of industrial policy are not limited to direct effects on output or trade volumes. In many cases, interventions are intended to alter firm behaviour, shift production strategies and induce broader structural changes in how firms interact within and across value chains. While the aggregate effects of these interventions can be difficult to isolate, firm-level and sectoral data increasingly allow for more targeted

assessment of whether, and how, industrial policy supports upgrading, convergence and reconfiguration in global production. The study by Bai et al. (2025) investigates the effectiveness of the quid pro quo (market for technology) policy – an important and controversial component of China's industrial policy. This policy which mandated foreign automakers to partner with domestic firms to gain market access, aims in part to facilitate technology/knowledge transfer. The paper explores whether, to what extent and through what channels the quid pro quo policy contributes to knowledge spillovers and enhanced product quality in the domestic automotive sector compared to the unrestricted foreign direct investment (FDI) policy.

Using rich, firm-level data the authors test whether the domestic automaker affiliated with foreign joint ventures (JVs) learn more from their foreign partners than non-affiliated peers. They show that domestic affiliates converge in the specific quality strengths of their foreign partners – evidence of directed learning rather than a generic rise in averages. Quantitatively, affiliation-based spillovers add roughly 8.3% to affiliates' quality gains over 2001-2014, over and above industry-wide spillovers from foreign presence. Bai et al. (2025) further trace the transmission mechanism to worker mobility and shared supplier networks. Knowledge flows from JVs to affiliated domestic automakers strengthened with the share of high-skilled workers (engineers and designers) involved, with worker mobility explaining up to 54% of total spillover effects. While "shared supplier spillovers" (Kee, 2015) – where the high-quality standards imposed by JVs raise the performance of shared domestic parts suppliers – explain up to 65% of affiliation-based knowledge spillover.

To quantify how quality upgrading affects sales and profits, the authors then estimate a structural model to recover consumers' willingness to pay for quality. They find that the 3.8-12.7% quality improvement from 2007 to 2014, driven by quid pro quo-induced knowledge spillovers, increased sales by 0.9-3.9% and profits by 1.0-3.5% for affiliated domestic models.

Overall, they find that while quid pro quo industrial policy facilitates knowledge spillovers and quality upgrading relative to unrestricted FDI, its overall impacts on domestic quality, sales and profits are modest. In the context of current US-China trade tensions, these findings suggest that China's recent policy change to remove the joint ownership requirement may not significantly hinder the quality upgrades and sales performance of Chinese domestic automakers.

This study also highlights the importance of industrial policy in shaping GVC governance: state-shaped participation rules do not just raise averages; they shape how knowledge spreads within global value chains, influencing who learns and through what linkages. Together, the findings illustrate how well-designed industrial policies can support learning and integration within global production networks, offering insights for developing economies seeking to strengthen domestic industries.

In another study, Barwick and colleagues examine China's large, ambitious and multi-instrument industrial policy programme to build a world-class shipbuilding industry (Barwick et al., 2024, 2025). Among the instruments are production subsidies, investment subsidies, entry subsidies and post-crisis consolidation measures like "whitelists" of targeted firms. Using firm-level data (1998–2014) and a dynamic industry equilibrium structural model with entry/exit, investment and production, they estimated hidden subsidies and simulated long-run outcomes under alternative policy designs. Their study addresses two sets of questions: how China's industrial policy shaped the industry's domestic and global evolution, and how effectively different subsidy instruments performed.

According to their estimates, China provided about RMB 624 billion ($91 billion) in shipbuilding policy support/subsidies between 2006 and 2013, roughly half of the industry's revenues. Of this, 6% went to investment subsidies, 25% to production subsidies and 69% to entry subsidies. Unlike Japan and South Korea, which focused on a few large firms, China's programme was broad-based, resulting in the establishment of a large number of new shipyards between 2006 and 2008 (more than 30 shipyards per year).

Their estimates suggest that subsidies between 2006 and 2013 boosted China's domestic shipbuilding investment and entry by 140% and 120%, respectively, and expanded its global market share by 42%. However, only 30% of the output gain reflected real global growth; the rest came from crowding out rivals in Japan and South Korea. Meanwhile, they also suggest that the programme caused fragmentation, excess capacity and depressed global ship prices. In the long run, the gross return rate on the entire policy mix – measured by the lifetime net profit gains of domestic firms divided by total subsidies (Δ net profit / subsidy, details below) – was just 18%. Put differently, every dollar of subsidies generated only 18 cents in additional profits for domestic producers, implying a net return of -82% once fiscal costs are considered. The poor performance stemmed largely from entry subsidies, which encouraged inefficient producers.

Based on these estimates, the authors conduct counterfactual simulations to assess the relative effectiveness of different policy instruments. They employ two main metrics. The first, "Δ revenue / subsidy", measures the increase in industry revenue generated per unit of subsidy; it captures how effectively a given instrument stimulates sectoral output and sales. The second, "Δ net profit / subsidy", gauges the net profit gained per unit of subsidy. This latter reflects the gross rate of return: a value below 100% indicates that the subsidy's costs outweigh its benefits to the domestic industry.

The authors find (see Table 5.3) that production and investment subsidies can be justified if the goal is revenue maximization, as each raises lifetime industry revenue by RMB 1.53 per RMB of subsidy (Δ revenue / subsidy ≈ 153%). Moreover, investment subsidies yield higher profits (Δ net profit / subsidy ≈ 74%) than production subsidies (Δ net profit / subsidy ≈ 50%), because they expand capacity in ways that reduce future costs. Entry subsidies are the least effective (Δ net profit / subsidy ≈ 32%) and

wasteful even by revenue metric (Δ revenue / subsidy ≈ 66%), generating fragmentation and idleness. They also note that using all instruments in conjunction lowers returns compared to using each in isolation because distortions are convex.

Beyond the choice of policy instrument, the authors demonstrate, through a series of other counterfactuals, that other aspects of industrial policy design – timing, targeting and duration – are equally critical. They show that counter-cyclical subsidies during the 2009-2013 downturn yielded a 70% return – nearly double the 38% from pro-cyclical support. Targeting profitable firms ("whitelist") raised returns to 71% versus 37% for universal subsidies. Short-term, targeted programmes also outperformed permanent ones by limiting inefficient entry and strengthening scale economies.

They also conclude that there is insufficient evidence to support the standard rationales for industrial policy in the context of the shipbuilding industry. They find no evidence of meaningful strategic trade rents, given the industry's fragmented global structure and slim markups; no sign of industry-wide learning-by-doing, since the main ship types relied on mature technologies; and only limited evidence for domestic spillovers to labour markets, steel or related sectors.

From a GVC perspective, China's shipbuilding subsidies illustrate how a domestic intervention in an upstream capital goods sector can reverberate internationally. By reallocating production from more efficient yards in South Korea and Japan to a fragmented set of Chinese entrants, the industrial policy programme reshaped the geography of shipbuilding and pushed down global ship prices by 9-17% for bulk carriers and tankers. These price declines translated into lower freight rates – around 6% for bulk carriers and 2% for containerships – which in turn boosted China's trade volume by roughly 5% (about $144 billion annually between 2006 and 2013). Manufactured exports carried in containerships rose by about 5.5%, while raw-material imports transported in bulk carriers grew by 4.3%. In GVC terms, the subsidies redistributed surplus away from rival producers towards global buyers and traders, showing how a sector-specific policy can propagate through downstream trade networks and alter cross-border competitiveness, underscoring the need to evaluate industrial policy through an explicitly international lens.

A growing body of evidence shows that industrial policy can influence productivity dynamics by shaping firms' participation in GVCs. Using matched Chinese customs and industrial firm data from 2000-2013, Ma et al. (2024) conduct one of the most systematic analyses of this relationship, focusing on firm productivity dispersion in Chinese manufacturing. They first estimate a baseline regression linking firm-level backward GVC participation to intra-industry productivity convergence. The results show a statistically significant negative relationship between GVC participation and the productivity gap between firms and the sectoral frontier, suggesting that firms with greater access to imported intermediates tend to converge towards the industry frontier more rapidly. The table below (Table 5.4) reports their main estimates.

Table 5.3: Welfare Effects of Industrial Policy		
	Δ Net profit / Subsidy	Δ Revenue / subsidy
Panel A. Comparison of different policy instruments		
Investment subsidy	74 %	153 %
Production subsidy	50 %	153 %
Entry subsidy	32 %	66 %
All subsidies (aggregate)	18 %	72 %
Panel B. Industrial policy and the business cycle		
Procyclical subsidies	38 %	189 %
Counter-cyclical subsidies	70 %	168 %
Panel C. Targeted industrial policy		
Subsidize All firms	37 %	85 %
Subsidize "Whitelist" firms	71 %	105 %

Source: Table 1 ("Welfare Effects of Industrial Policy") in Barwick et al. (2024).

Table 5.4: Impact of GVC Participation on Firm Productivity Gap (Baseline Estimates)			
Specification	Coefficient for GVC participation	Standard error	Significance
(1)	−0.0331	(0.0034)	***
(2)	−0.0332	(0.0034)	***
(3)	−0.0332	(0.0034)	***
(4)	−0.0333	(0.0034)	***
(5)	−0.0330	(0.0033)	***
(6)	−0.0328	(0.0033)	***

Note: Controls incrementally added across specifications (age, financing constraints, subsidies, profits, leverage); Significance levels: * 0.10;** 0.05; *** 0.01.
Source: Adapted from Table 2 ("Baseline Regression") in Ma et al. (2024).

Ma et al. (2024) further demonstrate the robustness of these results using instrumental variable estimation strategies, establishing a causal link between GVC participation and productivity convergence. They show that this convergence is not driven by uniform improvements across firms but by asymmetric effects: lagging firms gain disproportionately (more substantial and statistically very significant) from GVC integration, while frontier firms experience smaller (and not statistically significant) changes. This tends to suggest a selection and diffusion mechanism – where lower-productivity firms benefit from technology transfer, while top firms become more specialized and face weaker innovation incentives. The table below (Table 5.5) summarizes these heterogeneous effects by productivity quartile.

Table 5.5: Heterogeneous Impacts of GVC Participation Across Productivity Quartiles			
TFP quartile	Coefficient for GVC participation partiparticipation	Standard error error	Significance
TFP < Q1	0.052	(0.007)	***
Q1 ≤ TFP < Q2	0.001	(0.001)	
Q2 ≤ TFP < Q3	0.002	(0.001)	
Q3 ≤ TFP	0.004	(0.006)	

Note: Significance levels: *** 0.01.
Source: Adapted from Table 6 ("Differential Impacts on TFP Quartiles (TFP)") in Ma et al. (2024).

Further contributing to this understanding, Zhang et al. (2024) provide evidence that industrial subsidies play a role in fostering innovation and quality upgrading (see Table 5.6). Their analysis shows that both direct and indirect subsidies are associated with higher export prices and improved product quality. Crucially, despite higher prices, these interventions lead to a lower quality-adjusted price for exports, suggesting a net welfare-enhancing effect for foreign consumers. This quality upgrading is driven by direct subsidies through increased firm-level investment and R&D expenditure, while indirect subsidies stimulate export activity through intermediate inputs from upstream industries. This implies that subsidized firms can invest in R&D and quality control to produce higher-quality exports, which is crucial for maintaining competitiveness in global markets.

Table 5.6: The Effect of Subsidies on Quality						
	(1)	(2)	(3)	(4)	(5)	(6)
	Entry	Entry	Value	Value	Quantity	Quantity
Subsidy	0.0120***	0.0120***	0.0124***	0.0124***	0.0116***	0.0116***
	(0.000127)	(0.000127)	(0.000644)	(0.000644)	(0.000659)	(0.000659)
Subsidy_up1		-0.289***		0.117		-0.158
		(0.0208)		(0.0269)		(0.107)
Subsidy_up2		0.0221***		-0.0229		-0.00407
		(0.00606)		(0.0269)		(0.0284)
Productivity	0.0327***	0.0326***	0.103***	0.103***	0.0796***	0.0796***
	(0.000400)	(0.000400)	(0.00212)	(0.00212)	(0.00217)	(0.00217)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Destination-product-year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	10313270	10313270	4931475	4931475	4931475	4931475
adj. R-sq	0.211	0.211	0.644	0.644	0.758	0.758

Note: Dependent variables: log unit value, log product quality, and log quality-adjusted unit value; Independent variables are defined as follows: subsidy denotes direct government support received by each firm; subsidy_up1 and subsidy_up2 capture the indirect effects of first-tier and second-tier upstream subsidies transmitted through input–output linkages; productivity is firm-level labour productivity, included as a control for efficiency differences; *Firm FE* is firm fixed effects; *Destination-product-year FE is Destination-product-year* fixed effects; ASIF-Customs matched sample 2000–2012. Standard errors are clustered at the firm level. Significance levels: * 0.10;** 0.05; *** 0.01.
Source: Adapted from Table 8 ("Subsidy and product quality: Firm-product-destination-level") in Zhang et al. (2024).

While Ma et al. (2024) focus on convergence among firms already embedded in GVCs, other studies have looked more directly at how industrial policies affect sourcing, investment and production strategies. Wong et al. (2024) analyse firm responses to recent semiconductor-related industrial policies in East Asia, particularly in South Korea, Chinese Taipei and mainland China. Their research draws on firm-level data, policy documents and investment records to track how leading chip producers have adjusted to US export controls, domestic subsidy programmes and anticipated shifts in demand (see Table 5.7). In Chinese Taipei and South Korea, firms have increasingly pursued "dual-GVC" strategies – maintaining high-end fabrication capacity domestically or in allied countries, while continuing limited-volume or lower-tier production in China. This approach reflects not only regulatory pressure but also strategic hedging, with firms seeking to preserve access to both Western and Chinese markets.

Table 5.7: Comparative Semiconductor Firm GVC Strategies in Response to US Semiconductor-Related Policies, Based on Wong Et Al. (2024)

Firm	Geographic Strategy	Technology Allocation	Policy Linkage
TSMC	High-end fabs in Chinese Taipei; low-end in China & Japan; selective expansion to US	3nm–2nm in Chinese Taipei; ≥16nm in Nanjing; 5nm in Arizona	CHIPS Act subsidies; licensing for China fabs
Samsung	DRAM fully domestic; foundry in US; NAND in China	DRAM in Korea; logic 4nm in Texas; NAND in Xi'an	Waivers for Chinese fabs; US subsidies
SMIC	Fully domestic; minor legacy integration with global firms	Focus on 14–7nm (DUV-based); heavy investment in domestic tooling	Self-reliance plan; export control constraints
YMTC	Domestic-only; rising layer count in NAND	232-layer NAND; mature lithography	National funding; limited foreign access

Source: Authors' compilation based on Wong et al. (2024).

Chinese firms, meanwhile, have responded by increasing their reliance on domestic supply networks and by ramping up investment in local equipment manufacturing and chip design. However, Wong et al. (2024) note that the absence of key inputs and equipment, many of which remain subject to foreign export restrictions – continues to constrain China's ability to move up the value chain. Their analysis emphasizes that the effectiveness of industrial policy in enabling upgrading depends not only on financial support, but also on access to complementary technologies and international market integration. In this sense, policy effectiveness is conditional not only on domestic institutional capacity, but on the international policy environment in which firms operate.

This asymmetry in response also reflects differences in industrial policy instruments and institutional capacity. Chinese Taipei and South Korea have pursued collaborative investment agreements and public-private coordination mechanisms, whereas China's approach has emphasized state-led direction and extensive fiscal support. The outcomes to date underscore the importance of external constraints, such as export restrictions and supplier diversification, shaping the feasibility of policy goals.

This theme also emerges in Zhang et al. (2024), whose analysis of Chinese subsidy spillovers, discussed in the previous section, includes estimates of how sectoral input-output position affects firms' responsiveness to industrial policy. They find that firms more deeply embedded in domestic supply chain – either as critical input providers or as downstream assemblers – exhibit greater responsiveness to sectoral subsidies in terms of export growth and technology adoption. These results are consistent with the idea that the "transmission elasticity" of industrial policy depends on a firm's position within the value chain and its exposure to policy-relevant nodes.

Complementing these studies, Goldberg et al. (2024) provide a model-based assessment of learning by doing (LBD) in the semiconductor sector. Their estimates show that plant- and product-specific LBD is far smaller than often assumed, while economies of scope across technologies within firms are more substantial (around 4.7%). Most strikingly, incorporating cross-border effects nearly doubles the learning rate (around 8%), revealing significant international spillovers embedded in the fabless-foundry model. Yet these benefits are neither automatic nor inevitable: firms may restrict access to frontier technologies, and historical evidence shows that no domestic semiconductor industry has advanced without international technology transfer via FDI, licensing or collaborative R&D. From a GVC perspective, these findings highlight that subsidies in one jurisdiction can reduce costs and spur innovation abroad, complicating attribution of policy impacts solely at the national level.

Taken together, these studies reinforce the idea that industrial policy effects are highly heterogeneous and mediated by structural features of production networks. They also suggest that focusing exclusively on direct beneficiaries may underestimate the full scope of policy impacts. In sectors with dense input-output linkages or strong agglomeration effects, second- and third-order impacts may be at least as important as direct responses. The presence of large multinational firms, which coordinate production across jurisdictions, further complicates attribution, as firm-level decisions are often shaped by policy packages across multiple countries.

Beyond firm-level behaviour, there is also evidence that industrial policy is contributing to broader supply chain reconfiguration. This is especially visible in sectors with both high strategic salience and heavy capital intensity. Semiconductors, battery storage and green technologies have seen significant new investment announcements, often involving site selection decisions that respond not only to cost and infrastructure, but also to policy incentives and geopolitical risk assessments. Several studies, including those reviewed in Section 5, provide evidence that FDI flows are being redirected towards "connector" countries positioned to serve multiple export markets. While the long-term effects of these shifts remain uncertain, they are likely to affect regional trade patterns, supplier development and the geography of technological diffusion.

The studies reviewed thus far employ diverse methodological approaches – from firm-level reduced-form regressions to structural dynamic models to computable general

equilibrium simulations. Each approach has distinct strengths and limitations that shape what can be inferred from the results.

Several findings have emerged with cross-study support, including productivity convergence effects from GVC participation and the presence of upstream and downstream subsidy spillovers through input-output networks. However, many results – such as the specific magnitudes of learning-by-doing effects in semiconductors (Goldberg et al., 2024), the precise welfare impacts of China's shipbuilding subsidies (Barwick et al., 2024), and the quantitative estimates of quid pro quo policy effects (Bai et al., 2025) – reflect specific sectoral and institutional contexts that may not generalize.

The relationship between subsidy magnitude and trade distortion also remains contested. Bekkers and Jhunjhunwala's CGE work (2024) suggests that subsidies in highly networked sectors can generate positive international spillovers, potentially supporting the view that concerns about distortion may be overstated in some contexts. However, these findings apply primarily to large-scale interventions in network-intensive sectors like semiconductors, not to the modest development finance or SME support programmes that comprise much of the interventions tracked in global databases, as Dadush (2022) emphasizes.

In sum, the economic effects of industrial policy are increasingly being mediated through firm decisions about sourcing, investment and upgrading within GVCs. Evaluating these effects requires empirical strategies that account for network position, firm heterogeneity and strategic interdependence. While the full set of dynamic consequences is difficult to observe in real time, recent research has begun to clarify the conditions under which industrial policy supports convergence and structural transformation, and where it may instead reinforce fragmentation or stasis. These questions become even more salient in the context of international rivalry and strategic competition, the subject of the next section.

5.5 Strategic Rivalry and the Geography of Adjustment

Building on the firm-level patterns discussed earlier, this section shifts from microeconomic behaviour to the broader geopolitical forces shaping GVC geography and industrial strategy. The recent resurgence in industrial policy cannot be separated from shifts in the global political economy. In many cases, state interventions have been prompted by concerns about geopolitical rivalry, technological leadership and the perceived vulnerabilities associated with concentrated production or input dependencies. While such concerns are not new, their prominence in industrial strategy – especially among large economies – marks a significant break from earlier policy frameworks built around liberalization, specialization and market-based adjustment.

Strategic dynamics are also affecting broader patterns of production and investment. A growing number of firms are reconfiguring supply chains to reduce exposure to geopolitical shocks, particularly those involving the US, China and their respective trade partners. The study by Zhang et al. (2026/forthcoming) examines supply chain vulnerability in the Guangdong-Hong Kong-Macao Greater Bay Area and across the Strait. Their analysis links cross-border production relationships to risk sensitivity in key sectors such as electronics, information technology and machinery. Using sector-level and firm-level data, they identify where cross-Strait production is highly integrated and is most exposed to external disruption (see Figure 5.7), and how firms have responded through sourcing diversification and asset relocation.

The Goldberg et al. (2024) analysis further highlights how the semiconductor sector exemplifies the strategic dilemmas of industrial policy. Their model-based simulations suggest that when multiple countries expand subsidies simultaneously, outcomes may range from destructive zero-sum reallocation of market share to more benign scenarios where international spillovers turn the contest into a "race to the top". In this latter case, subsidies provided in one jurisdiction reduce costs and accelerate innovation abroad, such that competition among states enhances overall technological progress and global welfare rather than eroding it. These findings reinforce the view that strategic rivalry in semiconductors cannot be assessed solely in national terms: the sector's cross-border spillovers mean that subsidy races, while often wasteful, may also produce (sometimes unintended) global complementarities.

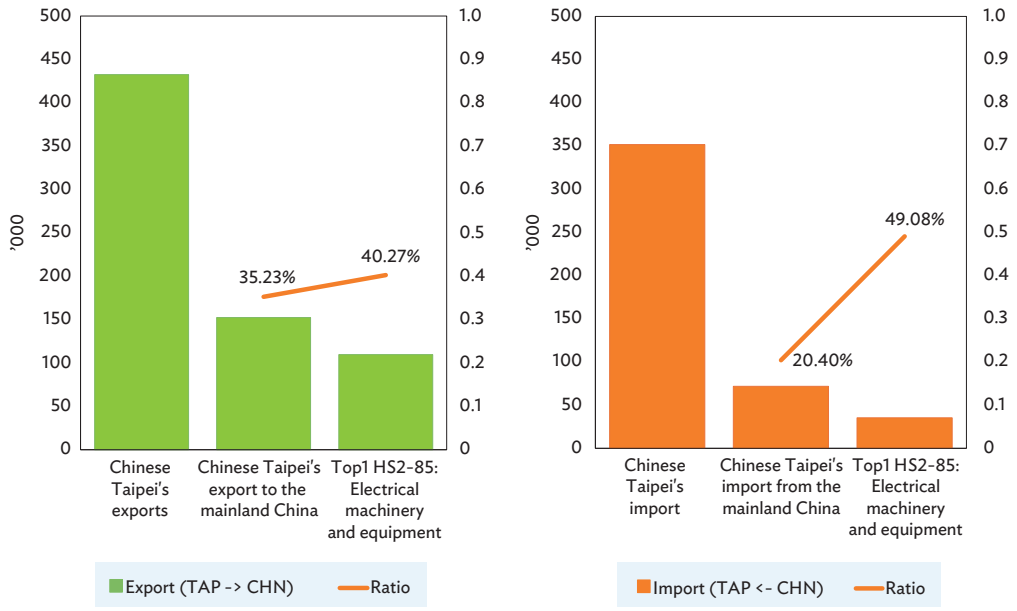
These findings are consistent with recent work on "connector countries", which has highlighted the role of third-party economies in absorbing trade and investment displaced by strategic rivalry. Jakubik et al. (2024) synthesise evidence from multiple studies showing that countries such as Viet Nam, Mexico, Türkiye and members of ASEAN have gained export market share and FDI as firms seek to reduce concentration in sensitive markets. These gains have been most pronounced in electronics, textiles, automotive parts and select energy technologies. While in many cases the shifts reflect re-routing rather than deep restructuring, the long-term effects on industrial upgrading and regional economic integration remain significant.

Recent IMF analysis also examines how trade fragmentation and supply-chain rerouting affect non-aligned economies, or so-called connector countries (see Box 5.2).

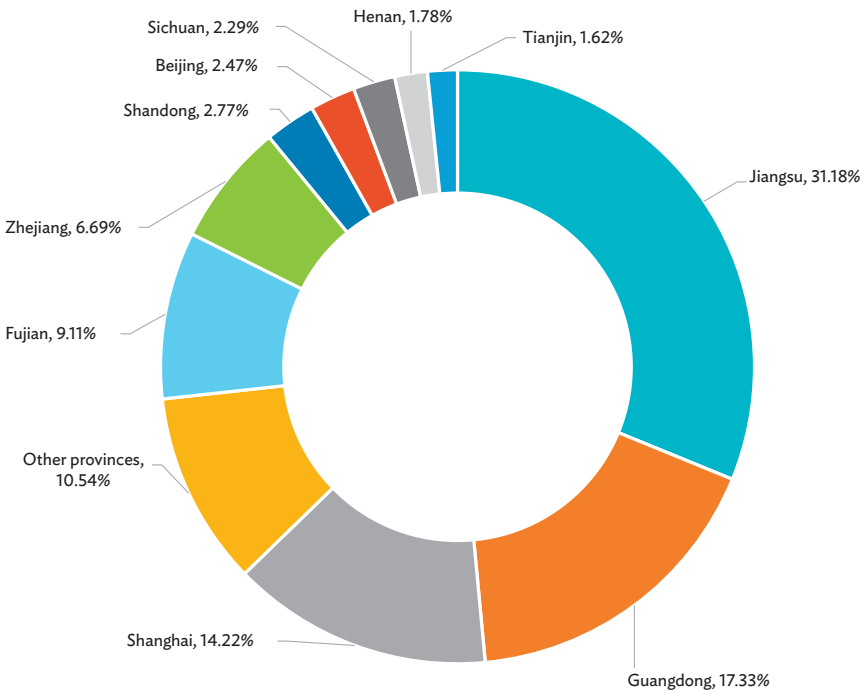
Freund et al. (2024) and Gopinath et al. (2025) offer complementary evidence based on global investment flows and trade patterns. Their analyses show that while the overall structure of GVCs has not collapsed, there are clear signs of decoupling in strategic sectors and of a move towards multi-regional sourcing strategies. In practice, this has meant shorter supply chains, new logistical hubs and growing attention to the political geography of trade. These patterns may accelerate if industrial policy continues to be used as a tool of strategic alignment rather than simply economic development.

Figure 5.7: Cross-Strait Production Integration and Vulnerability to External Shocks

A. Trade between Chinese Taipei and mainland China



B. Regions where Chinese Taipei's firms have invested in mainland China



TAP = Chinese Taipei.

Note: Panel A shows that bilateral trade between Chinese Taipei and the mainland has expanded rapidly since the early 2000s, peaking before the US-China trade conflict and remaining highly asymmetric: Chinese Taipei's exports to the mainland – dominated by intermediate goods in electronics and machinery – far exceed its imports. The pattern illustrates deep cross-Strait production linkages in high-technology sectors. Panel B. shows that Chinese Taipei's firms' investments are concentrated in coastal provinces – particularly Guangdong, Jiangsu, Fujian, and Shanghai – with recent diversification towards central and western regions such as Sichuan and Chongqing. The geographic spread mirrors both the evolution of China's industrial upgrading and firms' efforts to manage costs and supply-chain risks.

Source: Figure 3 ("Trade between Chinese Taipei and Mainland China") and Figure 4 ("Regions where Chinese Taipei's firms have invested in Mainland China") in Zhang et al. (2026/forthcoming).

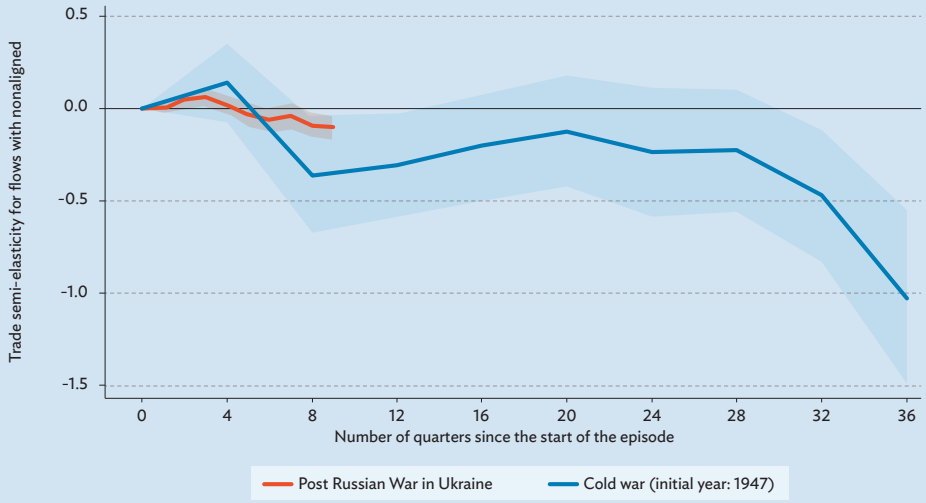
Box 5.2: What Do We Know About the Impact of Geoeconomic Fragmentation on Third Countries?

As geopolitical tensions mount and countries adopt new policy measures, trade and investment flows are shifting across countries. Some third countries – if not directly affected by the measures adopted by countries in geopolitical confrontation – may, under certain conditions, replace links between previous partners. This note summarizes key findings from the economic literature on the effects of US-China tariff policies and Western trade sanctions on Russia on trade and FDI of such third countries.

Against this backdrop, global trade and investment flows are reallocated across countries. Major economies are adopting trade, investment and other policy measures to reduce reliance on certain countries for geopolitical reasons. This involves the use of tariffs – as in the case of 2018-2019 US-China tariff hikes that covered $450 billion in trade flows – and other measures. As directly affected partners may reduce their respective market shares, this can create opportunities for third countries to fill in the void.

Certain third countries with suitable economic and policy conditions may reap some short-term benefits from such shifts in economic activity but also face risks associated with higher geoeconomic fragmentation. Certain non-aligned countries may be able to substitute for declining Chinese imports by the US (Gopinath et al, 2025). The economic mechanism is simple: as firms internalize the effect of new policies on their supply and buy decisions, they substitute their business partners and shift their economic activity towards alternative locations, which may result in more opportunities for these countries. The role played by such countries has been highlighted as a critical differentiating factor between the current period and the Cold War when trading blocks were more isolated (Gopinath et al, 2025 and Figure B 5.2.1). Yet, the degree of such shifts depends on many factors, including the size and distribution of tariffs and other measures imposed on different countries – including those third countries – and the degree of product substitutability. The reallocation of GVCs to such countries may also reflect broader long-term shifts related to those countries' attractiveness as a business location and is sensitive to whether those countries will themselves be subject to policy actions.

Figure B 5.2.1: Trade Fragmentation: the Cold War and Now



Source: Gopinath, Gourinchas, Presbitero, and Topalova (2025)

Such supply chain reconfigurations can take multiple forms. They may mean trade reallocation involving changes in real economic activity – for example, when a firm opens a new factory in another country, either to produce there, or to export products from that location. This decision may be driven by a particular policy or broader economic factors. They may also involve sheer rerouting, whereby the same product is transshipped through third countries to circumvent trade restrictions. Changes in FDI flows can be associated with either, or none, of these phenomena as multinational firms amplify trade reallocation or rerouting patterns.

Which countries can facilitate reallocation depends on the type of flow and policy in question. Geographic proximity, structural similarity to the partner affected by the measure, supply capacity, pre-policy patterns of comparative advantage and supply chain linkages can influence which country experiences potential changes in trade and investment patterns. For example, in the case of US-China tariff policies of 2018-2019, countries similar in terms of their economic structure to those countries affected by bilateral tariffs have been found to increase their exports to the relevant markets according Fajgelbaum et al. (2024). In the case of the Western sanctions on Russia, several Central Asian countries have experienced a rise in trade opportunities (Corsetti et al., 2024).

Overall, there is strong evidence of supply chain reallocation through changes in trade and investment flows (e.g., Fajgelbaum et al., 2024; Freund et al., 2024; Gopinath et al., 2025, Graziano et al, 2024). Direct trade between the affected partners is found to drop while third

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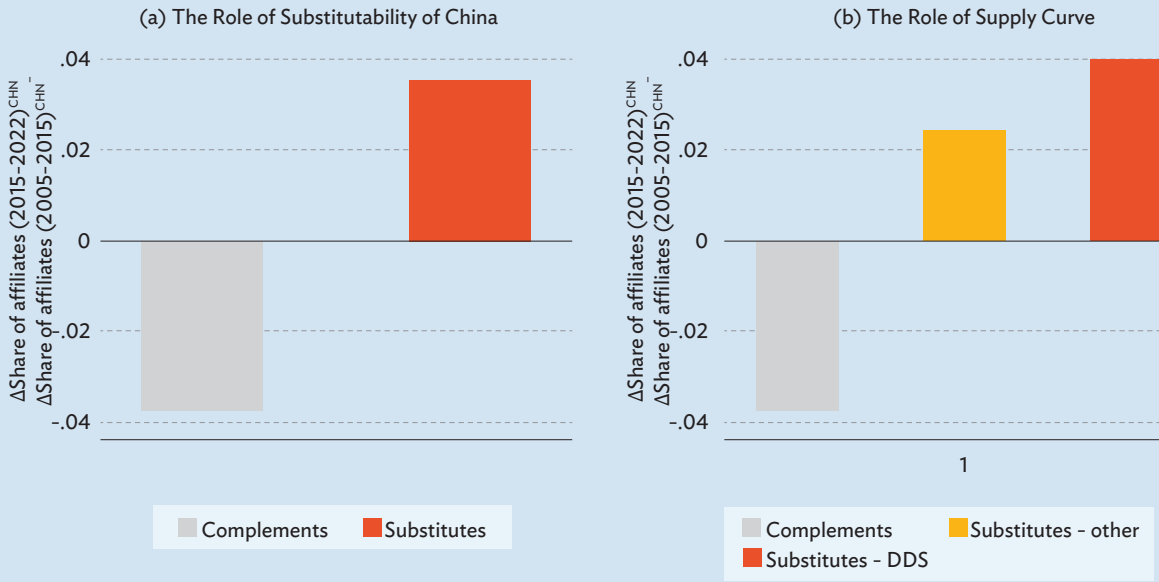
Box 5.2: continued

countries not directly affected by the policies increased their market shares. The literature also provides further evidence on the nature of such reallocation of trade, FDI and other economic activity, some of which are highlighted below:

- Trade patterns: Several studies show that following the US-China tariff policies of 2018-2019, some third countries increased imports from China and exports to the US, particularly in sectors most affected by trade restrictions (Gopinath et al., 2025; Fajgelbaum et al., 2024). Policies other than tariffs can also unleash adjustment. For example, stand-by countries in the region not targeted by the Western trade sanctions on Russia since 2022 also experienced surges in exports to Russia and imports from EU, especially in sanctioned products (Borin et al., 2023, Corsetti et al., 2024).
- Foreign direct investment: Evidence further shows that countries whose exports increased the most as a consequences of trade diversion are also the ones that received the strongest boost in FDI inflows (Ahn et al., 2023, Aiyar et al., 2023, Aiyar et al., 2024, Xue, 2024); and that there is a correlation between countries' gain in US imports market share and their gain in Chinese outward FDI (Gopinath et al., 2025). Studies also find that multinational firms increased the number of affiliates in countries that are China's substitutes and have economies of scale (Figure B 5.2.2), especially in sectors most exposed to the tariffs (Graziano et al. 2024). Country-specific studies also find a confirmation of adjustment in FDI flows (e.g., Arizala et al., 2025) and that the changes in trade were driven by exports and imports by foreign-owned firms (e.g., Utar et al., 2023; Wu, 2023).
- Nature of adjustment: There is weak evidence that third countries that increased trade in response to US-China tariffs serve as mere platforms to circumvent trade barriers through transshipment while they connect different blocs through value added trade and FDI flows (Utar et al., 2023; Iyoha et al., 2024; Schulze and Xin, forthcoming). This is consistent with the findings that changes in trade have been associated with increases in employment, trade diversification and activities of multinational firms operating in such countries (Utar et al., 2023; Rotunno et al., 2024, Fajgelbaum et al., 2024; Graziano et al. 2024). Meanwhile, some partial rerouting of trade to Russia through some Eurasian Customs Union countries might have emerged as a response to EU sanctions in 2022 (Chupilkin et al., 2023, Borin et al., 2023).
- Country characteristics: Pre-shock country characteristics can influence how bystander countries are affected. This includes the extent of their prior supply chain linkages and specialization patterns (Freund et al., 2024), the level of substitutability of the affected trading partner and supply capacity of the third country (Fajgelbaum et al., 2024), and the coverage by preferential trade agreements (Barattieri et al., 2024, Utar et al., 2023, Graziano et al., 2024). The specific set of countries that benefit most depend on the policy measure and type of activity. For example, Vietnam, Thailand, South Korea and Mexico, experienced largest export increases following the tariff hikes.[1] Meanwhile, Türkiye saw increased exports to Russia after the imposition of trade sanctions and Armenia, Kazakhstan and the Kyrgyz Republic emerged as a route for EU exports to Russia following sanctions.

Figure B 5.2.2: Reallocation of Multinational Activity Across Countries



Note: The figure shows the mean difference between the change in the share of foreign affiliates of MNEs from China (in a given country relative to all Chinese MNEs globally) in 2015-2022 and in 2005-2015 across countries within the following groups: Complements, Substitutes, Substitutes with downward-sloping supply curve (DSS) and Substitutes - Other, following the classifications from Fajgelbaum et al. (2024).
Source: Graziano, Sztajerowska and Volpe Martincus (2024)

[1] The average export growth in taxed products across countries is 6.4% with a standard deviation across countries of 6.2% (compared to a standard deviation of just 1.4 percent implied by a specification with homogeneous tariff elasticities).

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Box 5.2: continued

To conclude, geoeconomic fragmentation has already led to significant reallocation of trade and investment flows towards third countries, and there may be further adjustments going forward. Studies find increases in trade and investment activity within products and sectors affected by US-China tariff measures and to a lesser extent sanctions on Russia. At least in the case of adjustments to the imposition of tariff, changes involved reallocation of supply chains rather than mere transshipment. As more recently countries adopted new FDI policies – notably investment screening mechanisms – going forward, trade and investment patterns are likely to reflect not only changes to trade but also those policies and their possible interactions. For example, reallocation of investment may also take place in reaction to FDI measures as multinational firms can reroute their investment through intermediary countries (Damgaard et al., 2019, Tan, 2024).

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Note: The authors of this box are Lorenzo Rotunno and Monika Sztajerowska. The views expressed herein are those of the author and should not be attributed to the IMF, its Executive Board, or its management.

The evolving geography of adjustment has implications for developing and middle-income countries as well. Some countries stand to benefit from diversification efforts, while others may find themselves marginalized if they lack the capacity to meet sourcing, standards or compliance expectations in increasingly regulated sectors. These distributional consequences are difficult to model, but are becoming more visible in trade data, investment flows and policy dialogue. They also raise questions about

whether industrial policy coordination – or at least transparency – can help avoid fragmented competition that produces inefficient duplication or capacity gluts.

To date, institutional responses have been limited. The WTO's subsidy rules, while still in force, provide little direct guidance on how to evaluate spillovers or coordination failures that arise from simultaneous strategic interventions. Efforts such as the Joint Subsidy Platform have focused more on improving data availability than on resolving tensions. The IMF, in its most recent analytical guidance, has acknowledged the role of geopolitical fragmentation in shaping both macroeconomic and structural risks. Still, formal governance of industrial policy in a strategic rivalry context remains underdeveloped.

In this environment, the work by Zhang et al. provide valuable insights into how rivalry manifests in production and investment decisions. These findings reinforce the idea that industrial policy today operates not only through its direct economic channels, but also through its role in structuring global expectations and shaping firm-level responses to risk.

The next section considers how institutions are responding – or struggling to respond – to these developments, and how proposals for more transparent and differentiated governance might address some of the resulting challenges.

5.6 Governance Gaps and Institutional Responses

The resurgence of industrial policy has raised questions about how these policies are to be monitored, assessed and, where appropriate, coordinated. While domestic industrial strategies are shaped by national priorities and fiscal capacities, the effects of these interventions often extend beyond national borders. Given the cross-border nature of global production and the growing overlap in strategic sectors targeted by multiple governments, the challenge of governance is not simply one of discipline, but of information, interpretation and response.

The current multilateral rules on industrial subsidies are structured under the WTO's Agreement on Subsidies and Countervailing Measures (SCM). The SCM distinguishes between prohibited subsidies – such as export-contingent payments or local content requirements – and actionable subsidies that may cause adverse effects to other members. In theory, this framework provides both notification requirements and legal remedies. In practice, however, its operation has been constrained by institutional and political limitations. Notification rates remain low, dispute settlement is in partial paralysis and the analytical tools required to assess sectoral spillovers are not well developed within the legal context.

Parallel to these trade rule challenges, recent IMF and World Bank analyses highlight that industrial policy has become embedded in national fiscal frameworks and sovereign investment strategies, underscoring the need for greater macro-financial transparency and coordination (IMF, 2024b; Benitez and Bisbey, 2021; Baquie et al., 2025). Moreover, the SCM was designed at a time when industrial policy was primarily associated with classical trade distortions, rather than with climate, security or resilience goals. As such, it offers limited guidance on how to evaluate subsidies introduced as part of broader structural transformation agendas. It also provides no exemptions for measures adopted in response to supply chain disruptions or technological decoupling pressures. These omissions have led many observers to conclude that while the SCM remains a relevant legal foundation, it is insufficient on its own for governing the new generation of industrial policies.

In response, several multilateral institutions have sought to improve the informational and analytical environment surrounding industrial policy. The Joint Subsidy Platform, launched in 2023 by the IMF, the OECD, the World Bank and the WTO, aims to consolidate data, promote transparency and support peer dialogue. Its initial focus has been on assembling a common taxonomy of subsidy types, standardizing reporting templates and encouraging voluntary disclosure. While participation remains uneven and the platform is still developing its evaluative capacity, it represents a constructive attempt to re-establish shared baselines on policy trends.

Recent empirical work has begun to address these gaps. The OECD's new MAGIC (MAnufacturing Groups and Industrial Corporation) database provides standardized, firm-level estimates of subsidies – including grants, tax relief and below-market finance – for nearly 500 of the world's largest manufacturing firms over the period 2005-2022. By triangulating disclosures and applying benchmark estimation methods, the database reveals significant unreported and persistent subsidy flows, especially in strategic sectors such as semiconductors, steel and aluminium.

The IMF has also taken steps to clarify its role in the evolving industrial policy landscape. In a 2024 policy note, it emphasized that industrial policy can be relevant to surveillance when it has implications for fiscal sustainability, cross-border spillovers or macro-critical externalities. It proposed a set of criteria to assess the economic rationale for such policies, including the presence of identifiable market failures, the proportionality and targeting of interventions and the coherence with overall policy frameworks. Importantly, the IMF recognizes that some objectives, such as addressing climate risks or mitigating geopolitical vulnerabilities, may justify the use of selective industrial support, even in the absence of traditional efficiency justifications.

These efforts are complemented by academic proposals that seek to address transparency and coordination through more differentiated governance tools. One such proposal, outlined in Koopman (2025), suggests the establishment of a Global Industrial Policy Transparency Platform (GIPTP). Rather than functioning as a legal adjudication

body, this platform would organize policy observatories along sectoral lines, with each observatory responsible for tracking, analysing and reporting on industrial policy interventions in its respective domain. The intent is not to enforce disciplines, but to create a shared analytical space where policies can be evaluated based on their stated objectives, spillover effects and relevance to supply chain interdependence.

The proposed GIPTP also includes mechanisms for peer learning and structured dialogue. Observatories would generate typology dashboards to group policies by function, magnitude and exposure to international production. These dashboards could support multilateral forums in identifying areas of potential friction or coordination, without requiring formal consensus or legal rulings. While the proposal remains conceptual, it reflects a broader trend towards developing non-binding but structured approaches to industrial policy transparency.

Dadush (2022) offers a cautionary perspective on the design of governance responses. Rather than dismissing oversight efforts, he urges that they remain proportionate and grounded in data. Many subsidy programmes involve modest outlays or target SMEs, and should not be conflated with large-scale, distortionary interventions. He supports improved data tools but warns that miscalibrated governance could stifle legitimate development objectives. Recent OECD analysis based on the MAGIC database partially addresses this gap. While the database identifies certain firms as recipients of sustained and substantial support, the median annual subsidy across firms and years is relatively modest, typically below 1% of revenue. This reinforces the point that industrial policy, although visible and sometimes controversial, remains limited in scale for most global firms.

Taken together, these initiatives and perspectives suggest that the governance of industrial policy is entering a period of experimentation. There is no clear institutional consensus, and few binding mechanisms are likely to emerge in the near term. Still, the combination of soft-law platforms, enhanced data collection and sector-specific dialogue offers a practical way forward. These efforts may help reduce the risk of subsidy escalation, support more informed national policy design and improve the multilateral community's capacity to track and interpret the distributional effects of industrial policy.

The next and final section summarizes the main empirical and institutional observations of the chapter, highlighting where recent developments raise new questions for researchers and policymakers alike.

Before turning to that section, it is worth noting that the growing complexity of industrial policy is also reshaping how firms themselves compete, invest and organize production. Box 5.3 presents a business perspective on these dynamics, illustrating how companies are adapting their global strategies to navigate the new era of strategic subsidies and policy-driven competition.

Box 5.3: The View from Business: Competing in the Era of Strategic Subsidies

Introduction: A Shifting Policy Landscape

Several governments have recently adopted a more activist approach to industrial policy, reviving it as an instrument of national competitiveness and geopolitical statecraft. For firms in affected industries, this new policy environment has become a defining feature of today's competitive landscape.

The proliferation of subsidies, incentive schemes, public procurement mandates, local-content requirements, strategic public investments and technology partnerships has transformed how firms plan investments, structure supply chains and manage risk. From a corporate standpoint, industrial policy is no longer something governments impose on business; it is a systemic dynamic that firms must actively navigate and integrate into strategic planning. The sections that follow explore how businesses are adapting to, rather than resisting, the realities of this new policy environment.

1. Firms as Strategic Respondents, Not Passive Beneficiaries

While governments view subsidies as instruments to advance national priorities, firms increasingly interpret them as strategic signals guiding capital allocation and long-term planning. Semiconductor producers such as TSMC and Intel now calibrate global investments based on the interaction between financial incentives, policy stability and access to technological ecosystems. For instance, TSMC's decision to expand in Arizona under the US CHIPS Act and Intel's establishment of its Magdeburg facility with substantial German support illustrate how firms internalize public incentives into their investment calculus (Reuters, 2023; TSMC, 2024). In clean-energy industries, Northvolt's cell manufacturing projects in North America and Europe, backed by production-linked tax credits and green-industrial funding, and BYD's localization of electric vehicle production in Hungary demonstrate how industrial policy has become a roadmap for global expansion (Government of Canada, 2023; Northvolt AB, 2023; AP, 2023).

These developments underscore that businesses are no longer passive recipients of industrial policy. Rather, they are strategic participants shaping and responding to the evolving rules of the game. As one senior executive at Intel noted, "The support of European government partners is critical for success," emphasizing that private investment decisions now depend as much on the credibility and design of public frameworks as market fundamentals (Intel, 2022).

2. Policy Credibility and Institutional Capacity

The experience of Hyundai Motor Group and SK On illustrates how firms design investment and partnership strategies to manage compliance risk. Their memorandum of understanding on battery supply for North America explicitly aims to help both firms meet the Inflation Reduction Act's (IRS) domestic content provisions, requiring critical minerals and components to originate from the US or its free trade agreement (FTA) partners (HSAGP, 2024; Reuters, 2022). The evolving guidance issued by the US Treasury and IRS on the Act's "domestic content bonus" reinforces a broader lesson: administrative clarity is essential for corporate decision-making (US Treasury, 2024).

Even in Europe – long considered a place of strong state administrative capacity – Siemens Energy has voiced concern about the slow pace of state-aid approval. CEO Christian Bruch has gone on record saying "the most important issue is not how big the programme is .. but how to implement it faster" (Reuters, 2023). For many multinationals, policy credibility has become a first-order determinant of competitiveness.

Battery manufacturers share similar concerns. LG Energy Solution CFO Lee Chang-sil warned that "US tariffs and an early end to EV subsidies will put a burden on automakers, potentially leading to vehicle price increases and a slowdown in EV growth in North America" (Reuters, 2025). In Asia, CATL Chief Manufacturing Officer Ni Jun cautioned that uneven regulatory oversight could destabilize market competition: "One big player cannot always lower prices .. if it continues, all of its rivals will not survive (SCMP, 2025)."

3. Fragmentation and Compliance Complexity

The rapid expansion of subsidy regimes and their qualifying regulatory requirements has created not only a complex compliance environment but also a new form of industrial coordination. Governments are embedding industrial-policy objectives directly into regulatory design – using standards, reporting obligations and traceability mechanisms to steer investment, encourage domestic production and shape value chain geography.

For example, the EU's Battery Regulation (EU) 2023/1542 aligns environmental due diligence, carbon footprint and digital passport requirements with the bloc's broader strategic-autonomy agenda, effectively incentivizing localization and responsible sourcing within Europe (European Commission, 2023; CEPS, 2024). Likewise, the US Inflation Reduction Act ties eligibility for clean-energy tax credits to domestic-content and supply chain resilience goals, making compliance a determinant of investment location (CRS, 2024; IEA, 2024).

For multinational firms, this intertwining of regulation and industrial strategy has strategic implications: reporting and traceability obligations now influence where and how companies invest. As the European Automobile Manufacturers' Association notes, "technical implementation timelines have become a core determinant of competitiveness" (ACEA, 2021; ACEA et al., 2022).

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Box 5.3: continued

4. Coordination, Competition and Policy Uncertainty

Industry leaders increasingly draw analogies to past aerospace subsidies, warning that a patchwork of incentives could reignite trade disputes in sectors like electric vehicles and clean energy.

The IMF (2024) has likewise cautioned that "aggressive use of state subsidies risks .. triggering a tit-for-tat subsidy war". For multinational firms operating across these sectors, the challenge is not only to capture available incentives but to anticipate how policy races may reshape demand, margins and global production footprints. Meanwhile, a recent WTO case illustrates the risk: China has formally challenged India's electric vehicle and battery incentive programmes at the WTO, acting in part on complaints from Chinese firms such as BYD and others who say India's localization and production-linked incentives unfairly advantaged their domestic competitors and disadvantage Chinese exporters (Reuters, 2025; Economic Times, 2025).

Against this backdrop, leading business associations have explicitly urged stronger subsidy transparency and notification disciplines at the WTO level. BusinessEurope has called for "increasing transparency in such matters as subsidies notification" as a top priority for WTO reform, alongside a more structured monitoring function (BusinessEurope, 2025). In Japan, business association Keidanren likewise advocates meaningful reforms on industrial subsidies as part of WTO modernization (Keidanren, 2024). These positions align with efforts to develop transparent subsidy registries and enforceable reporting standards that firms say are needed to reduce uncertainty. Recent WTO committee minutes underscore why: compliance with subsidy-notification obligations remains concerningly low, undermining predictability for cross-border investors (WTO, 2024).

5. Implications for Global Value Chains

Subsidy-driven competition is reshaping global production geographies. Firms are no longer simply chasing cost savings – they are hedging geopolitical, policy and supply chain risk. As Apple's CEO Tim Cook explained: "We learned some time ago that having everything in one location had too much risk with it and so we have opened up new sources of supply over time." (Cook, 2025) It is precisely this logic that helps explain why countries such as Viet Nam, Mexico, Türkiye and India are emerging as new nodes in global value chains, offering access to multiple national incentives while reducing exposure to a single dominant market.

Foxconn's Chairman Young Liu described the same shift: "We want to move up on the value chain as much as we can in India. That's what we will be doing .. For sectors other than ICT, we think EVs and energy and also the digital-health industry" (Liu, 2024). Such strategies illustrate how industrial policy has become a determinant of comparative advantage, influencing where and how firms invest across regions.

Conclusion: Navigating the Policy-Driven Economy

The resurgence of industrial policy marks a structural shift in the global economy. Firms now compete not only on technology or cost but on their ability to read and align with policy architectures governments are adopting. What began as subsidies has evolved into a policy-driven environment where administrative credibility and cross-border coordination define competitiveness.

From semiconductors to clean energy and advanced manufacturing, corporate strategy is converging with public policy. Businesses are learning that policy intelligence – understanding how rules, incentives and industrial objectives interact across jurisdictions – has become as valuable as engineering excellence or financial discipline. The most successful firms will be those that treat industrial policy not as constraint or compliance exercise, but as a strategic domain in which advantage can be actively built and assertively exploited.

Global business is thus not merely adapting to the return of the state – it is actively co-authoring the next phase of globalization, one in which industrial coordination, corporate agility and public-private alignment will determine who leads in the age of strategic industrial policy. This box complements Chapter 5's empirical analysis of firm behaviour and supply-chain reconfiguration.

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Box 5.3: continued

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Note: This box was authored by Simon Lacey (formerly with the World Economic Forum, currently with Belt Road Capital Management). The views expressed are those of the author and do not necessarily reflect those of the affiliated institutions.

5.7 Summary Observations and Research Frontiers

The preceding sections have outlined how industrial policy is reemerging as a central feature of economic strategy across both advanced and developing economies. Motivated by a range of objectives – climate transition, technological competitiveness, economic security and resilience – these policies are increasingly implemented in a global context defined by production interdependence, strategic rivalry and institutional fragmentation.

While industrial policy is not a new phenomenon, its contemporary forms differ in several important respects. First, the targeted sectors now span a broader array of activities, notably those with dual-use applications or deep network externalities. Second, interventions increasingly operate within complex supply chains, meaning that direct and indirect effects can propagate through domestic and international production structures. Third, many of the stated goals – particularly those tied to security or decarbonization – do not fit neatly into existing welfare-based evaluation frameworks. As a result, both the measurement and governance of industrial policy have become more analytically and institutionally demanding.

5.7.1 Where the Evidence Converges

Despite the diversity of contexts and methodologies reviewed in this chapter, several findings appear consistently across studies:

Network effects and spillovers are substantial. The evidence strongly supports the view that industrial policy effects propagate through production networks. Multiple studies using different approaches – Liu's input-output analysis (2019), Zhang et al.'s firm-level regressions (2024), Bekkers' CGE simulations (2024), and Barwick et al.'s structural evaluation of China's shipbuilding programme (2024; 2025) – demonstrate that subsidies to upstream sectors generate downstream impacts, and vice versa. The magnitude of these spillovers often exceeds direct effects, particularly in sectors with dense supplier linkages.

GVC participation facilitates productivity convergence. Firm-level studies (Ma et al. 2024) across different countries and time periods consistently show that importing intermediate inputs is associated with faster convergence towards industry productivity frontiers. This effect is particularly strong for lagging firms and in technologically sophisticated sectors, suggesting a role for knowledge diffusion and competitive pressure.

Policy design matters as much as policy presence. The evidence from structural models (Barwick et al. 2024, 2025) and case studies (Juhász and Lane, 2024; Bai et al., 2025) indicates that how industrial policy is implemented – its timing, targeting, duration and coordination with other instruments – determines effectiveness at least as much as the choice to intervene. Counter-cyclical timing, selective targeting and institutional quality emerge as critical factors across contexts.

Firm and sectoral heterogeneity is pronounced. Industrial policy effects vary systematically by firm ownership, productivity level, sector characteristics and position in value chains. Blanket generalizations about whether industrial policy "works" miss this fundamental heterogeneity. The same intervention can accelerate upgrading for some firms while creating inefficiencies for others.

Cross-border effects are inevitable in integrated production systems. Whether through input cost changes, demand shifts or capacity reallocation, industrial policies in one jurisdiction affect firms and workers elsewhere. These effects can be positive (through learning spillovers or lower input prices) or negative (through market share displacement), but they cannot be avoided in sectors characterized by GVC integration.

Taken together, these findings imply that industrial policy is best viewed – and evaluated – as a system-level intervention: its outcomes and welfare effects depend less on the intent than on how interventions are designed and how they interact with production networks, firm heterogeneity and cross-border linkages.

5.7.2 Outstanding Questions and Research Gaps

Despite the recent advances, important questions remain unresolved or inadequately addressed in the current literature:

Long-run dynamic effects are poorly understood. Most empirical work examines short- to medium-term outcomes (typically 5-10 years), leaving the potential for path dependence, lock-in and hysteresis (David, 1985; Arthur, 1989; Krugman, 1991; Neffke et al., 2011; Lee, 2013) largely underexplored empirically. Yet we still know little about whether productivity gains persist, whether subsidized capacity eventually transitions to self-sustaining competitiveness, or how quickly displaced firms and workers adjust.

Optimal policy design remains largely unspecified. While recent studies, notably Barwick et al. (2024, 2025), demonstrate that design choices matter, we still lack systematic frameworks for determining optimal subsidy levels, targeting criteria or phase-out schedules across different contexts. Meanwhile, the conditions under which particular instruments outperform others are not well established beyond specific cases.

Measurement challenges persist. Existing subsidy databases capture different phenomena with varying completeness. Many forms of support – including implicit guarantees, preferential regulation and below-market provision of inputs – remain difficult to quantify. The economic significance of what we measure versus what we miss is unknown. As Dadush (2022) emphasizes, crude counts of interventions may substantially overstate their systemic importance, underscoring the need for more consistent metrics and valuation frameworks.

General equilibrium and welfare assessments are incomplete. Few studies sufficiently account for opportunity costs, revenue-raising distortions or broader economic adjustments triggered by industrial intervention. Existing welfare analyses – primarily based on CGE or structural models – rest on strong assumptions about market structure, consumer preferences and government efficiency. As a result, whether industrial policies generate net welfare gains for implementing countries – let alone globally – cannot be confidently assessed in most cases.

The political economy of policy persistence is underexplored. Once established, industrial support programmes are notoriously difficult to remove. Yet the literature focuses heavily on adoption and short-term impacts, with limited attention to what sustains interventions beyond their economically optimal duration, how they are eventually phased out (if at all), and what happens when they become entrenched rents rather than temporary supports. As Juhász and Lane (2024) emphasize, the durability of industrial policy often reflects institutional and coalition dynamics rather than economic fundamentals, underscoring the need for greater attention to governance and exit design.

Cross-country coordination and subsidy races remain inadequately examined. While Goldberg et al. (2024) and others raise concerns about competitive subsidy escalation, we lack rigorous empirical evidence on whether current patterns constitute destructive races or potentially beneficial competition. The conditions that might support successful coordination versus those that make it infeasible or counterproductive remain largely theoretical, requiring further empirical investigation.

The distributional consequences of industrial policy – both within and across countries – are not yet well understood. Who gains and loses from industrial policy – across skill groups, regions, sectors and countries – receives insufficient systematic attention. The political sustainability and social legitimacy of these interventions likely depend on these distributional outcomes, yet they remain poorly mapped.

5.7.3 What We Can and Cannot Conclude

Based on the evidence reviewed, several conclusions can be stated with reasonable confidence:

- Industrial policy interventions have measurable effects on firm behaviour, investment patterns and trade flows, particularly in targeted sectors.
- These effects extend beyond direct recipients through supply chain networks and competitive dynamics, implying second- and third order impacts that partial equilibrium metrics miss. Policy effectiveness varies substantially with institutional capacity, design choices and sectoral characteristics.
- The scale of contemporary industrial policy has increased significantly in strategic sectors such as semiconductors and green technologies, though the aggregate economic significance relative to GDP remains debated.
- Cross-border spillovers – both positive and negative – are an inherent feature of industrial policy in GVC-integrated sectors, so assessment must account for incidence on third countries and feedback effects through production networks.

We cannot yet conclude:

- Whether most industrial policies generate net welfare gains for implementing countries or globally, given heterogeneity in market structure, firm and sectoral characteristics, learning externalities and cross-border spillover effects.
- What the optimal instruments, targeting criteria or phase-out strategies are across different contexts.
- How persistent the observed effects are – i.e., whether they represent temporary distortions (e.g., capacity cycles) or lasting capability-building (productivity, innovation, and quality upgrading).
- Whether current patterns constitute a problematic "subsidy race" or reflect reasonable responses to market failures and strategic imperatives.
- How severely informal and hard-to-measure forms of support distort the apparent picture based on tracked interventions, given notification gaps and limited observability of many instruments.

The evidence is insufficient to support:

- Strong prescriptive recommendations about when countries should or should not adopt industrial policies, as context-dependence, network exposure and administrative capacity, among so many other factors, materially shape outcomes.
- Confident predictions about long-run effects on global production geography or technological leadership, as complex and dynamic factors – such as relocation, innovation, learning and policy interactions – evolve over multi-year horizons with continuous policy feedback.
- Clear judgments about whether specific interventions are "legitimate" responses to market failures versus protectionist rent seeking without standardized disclosure on aims, magnitudes, network incidence and so on.

5.7.4 Implications for Future Research

The renewed prominence of industrial policy reflects deeper changes in the global economy – technological, environmental and geopolitical. Several research priorities emerge from this review:

Methodologically, there is a need for longer panel datasets, better measurement of hard-to-observe support mechanisms, and research designs that can credibly identify causal effects in the presence of multiple simultaneous policy changes and strategic behaviour by firms and governments.

Substantively, priority areas include understanding long-run dynamic effects, mapping distributional consequences more systematically, developing frameworks for assessing optimal policy design across contexts and examining the political economy of policy persistence and termination.

Institutionally, continued efforts to improve transparency through platforms like the Joint Subsidy Platform, sector-specific observatories and standardized reporting are essential for building the shared factual basis necessary for both research and dialogue. As Koopman (2025) proposes, differentiated governance approaches that reflect sectoral variation and capacity differences may prove more practical than uniform disciplines.

The institutions tasked with global economic governance are beginning to adapt, but the frameworks in place remain incomplete. While no consensus has emerged on how industrial policy should be governed in an era of strategic interdependence, the evidence reviewed here provides a stronger empirical foundation for ongoing efforts. What remains clear is that industrial policy will continue to be a central tool of economic management, particularly in strategic sectors. Understanding its effects, supporting transparency and developing appropriate governance mechanisms will require sustained engagement from researchers, policymakers and international institutions alike.

Industrial policy has re-emerged as a defining feature of global economic strategy. Its reach now extends beyond traditional development objectives to encompass resilience, security, and technological leadership. The evidence assembled in this chapter underscores both the potential and the pitfalls of state intervention in an interdependent world economy. Effective governance will hinge on transparency, coordination and the capacity to balance national objectives with global stability.

As the discussion turns from industrial policy to the financial foundations of globalization, Chapter 6 examines how capital – both long-term and short-term – sustains participation in GVCs. It explores how FDI and trade finance operate as complementary pillars of global production, shaping not only where industries locate, but also how deeply firms integrate and upgrade within cross-border networks.

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