

Policy Approaches to Supply Chain Risk

Samuel Hardwick, Rojan Joshi, Tisha Shah and Jason Tabarias

February 2024

Contents

Abstract..... 3

Introduction 3

Key concepts..... 4

 Risk..... 4

 Vulnerability..... 5

 Resilience 5

 Robustness..... 6

Excessive supply chain risk 7

 Cases where excessive risk can arise 7

 Other factors affecting risk 8

Optimal policymaking 11

 Essential goods and services..... 12

 Policy strategies 15

Review of policy responses..... 18

 New architecture: United States, Australia, India, Japan and South Korea 21

 Institutional continuity: PRC and Taiwan 22

 Distinctive approaches: EU, Malaysia, New Zealand and Singapore 23

Conclusions 23

References 25

Appendix: List of policies 35

Abstract

We provide a review of research on supply chain resilience and major international policy initiatives in 11 economies. We first present a set of cases in which supply chain risk may become excessive from a public policy standpoint. These cases include the presence of externalities and short termism in investing to reduce risk, as well as regulatory and informational issues. Certain characteristics of supply network structures can also affect risk. In practice, policy approaches to manage risk have varied by country, with some governments defining supply chain resilience more broadly than others. Some initiatives prioritise national dominance of supply chains over resilience. Few policies directly tackle informational limitations, with some exceptions, including proposals for early warning systems and stress testing requirements. We conclude by proposing questions for future research.

Introduction

This paper reviews the theoretical literature and major international policy initiatives on supply chain resilience. It establishes the policy context and importance of supply chain resilience research and where this research should be targeted.

In the first section of the paper, we outline five key factors that contribute to excessive levels of supply chain risk in certain markets or sectors. These are: failure to account for positive externalities associated with market entry or risk-reducing investments, short termism in investment decisions, regulations that inadvertently disincentivise risk management, and information constraints including limited supply chain visibility. In addition, a growing literature underscores the significance of supply chain network structures in understanding vulnerability (Acemoglu et al 2012; Elliott and Golub 2022).

Policy approaches to supply chain resilience ranges from broad to specific — from improving the macro-level environment in which supply chains function to ensuring the supply of specific critical products. Most governments employ a mix of the two. Given the ubiquity of risk and the often-superior capabilities and incentives of the private sector to manage that risk, sector-specific approaches should be concentrated on products or sectors that are rigorously assessed as vulnerable and essential.

In practice, some governments take a broader view of supply chain policy than others. Australia, the European Union and the United States, in particular, have associated a wide range of policy initiatives with building resilience, from manufacturing tax incentives to bespoke supply chain advisory bodies. Not all supply chain policies build resilience. Some aim to embed dominance in strategic sectors and create bottlenecks, reducing responsiveness to shocks and contributing to geoeconomic fragmentation in exchange for local industry development.

Few policies directly address informational limitations in supply chains. Yet there are notable exceptions, including proposals for early warning systems, sometimes at an international level, and for mandatory stress testing. Internationally, the Indo-Pacific Economic Framework (IPEF) Supply Chain Pillar presents a range of opportunities in this area.

The next section begins by presenting definitions for key terms: risk, vulnerability, resilience and robustness. We then present cases where status quo supply chain management may result in excessive risk from a policy standpoint, before outlining some issues that are frequently raised in supply chain discussions but do not necessarily point to excessive risk.

The third section puts forward a framework for policymaking to manage supply chain risk, characterised by a combination of economy-wide settings with policies that cautiously target vulnerable, essential products. The final section reviews policy initiatives that relate to supply chain risk that have been proposed in major regional economies, with a focus on Australia and its main trading relationships. We conclude by suggesting areas that would be promising for future empirical research.

Key concepts

A supply chain is a network of firms that transforms inputs into a final product and distributes that product to end users, involving multiple links or stages. For example, raw materials production, manufacturing, assembly, sales and delivery may each be completed by a different firm.

Supply chains may be domestic or international, with the latter usually referred to as global supply chains or global value chains (GVCs). In a GVC, at least two stages involved in producing a good or service occur in different countries, with each stage adding value (Antràs and Chor 2022, p. 300). The distinction is politically and economically relevant. Domestic and international supply chains are shaped by different policy levers, and multistage production is a key source of national gains from trade.

A well-functioning supply chain is one that provides ‘the right products and services on time, with the required specifications, at the right place and to the right customer’ (Carvalho et al 2012, p. 329). Individual supply chains face any number of obstacles that may prevent the fulfilment of these objectives. An extensive literature examines these challenges and the ways in which supply chains may overcome or be shielded from them. Four key concepts — risk, vulnerability, resilience, and robustness — help frame this analysis and offer objectives for firms and policymakers.

Risk

While definitions vary by discipline, risk is commonly understood as the ‘possibility of loss, injury, or other adverse or unwelcome circumstance’ (OED 2023). In the supply chain context, the events that bring about these circumstances are often referred to as disturbances or disruptions (Barosso et al 2008; Carvalho et al 2012). Barroso et al (2008, p. 1872), for example, define a disturbance as ‘a foreseeable or unforeseeable event, which affects directly the usual operation and stability of an organization or a SC [supply chain]’.

For measuring risk, the supply chain literature offers two sets of methods: probabilistic and scenario-based (Owen & Daskin 1998). The probabilistic approach, drawing on concepts from finance, measures risk as the fluctuation around an expected value of returns. Methods of measurement — such as mean-variance, standard deviation, value-at-risk and conditional-value-at-risk — focus primarily on financial impacts. Scenario-based approaches, in contrast, aim to capture uncertainty through planning responses to a range of potential sequences of events.

Probability distributions may be well suited to internal supply chain management issues, such as optimal lead time and the selection of suppliers, but estimating distributions of uncertain events that cause widespread supply chain shocks is a different and more difficult proposition. To that end, Heckmann et al (2015, p. 123), drawing on the classification of Rosenhead et al (1972), outline three levels of information availability:

- i. **certainty**, in which all parameters are known, including the relationship from input to output,
- ii. **risk**, in which probability distributions govern the input–output relation, and

iii. **uncertainty**, in which there is a lack of information about the likelihood of parameter changes.

In economics, risk generally refers to situations where probabilities can be assigned to various possible outcomes — sometimes in contrast to uncertainty, where such probabilities cannot be assigned (Hashimzade et al 2017).¹ Similarly, Simchi-Levi (2010, p. 75) distinguishes between known-unknowns and unknown-unknowns, and between controllable versus uncontrollable risks. If risks are known-unknowns, they can be predicted based on the past. If they are controllable, their probability and impact can be lowered through firms' actions. Some risks are neither known nor controllable.

Vulnerability

Vulnerability is a condition in which something is exposed to risk. In their review, Heckmann et al (2015, p. 125) offer an accepted definition as 'the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard'. They note that researchers have understood vulnerability from various perspectives, including as synonymous with risk or as a function of a supply chain's characteristics. There is often a focus on the risk of failure to meet objectives given a disruption (Carvalho et al 2012; Ozdemir et al 2022). Svensson (2010, p. 15) defines vulnerability as 'a condition that affects a company's goal accomplishment dependent upon the occurrence of negative consequences of disturbance'.

Resilience

Resilience is a commonly stated goal for policymakers. The 2022 IPEF ministerial statement, for example, explicitly establishes its objective as building resilient supply chains (IPEF 2022).² The statement defines resilience broadly as the ability to 'anticipate, withstand, or rapidly recover from shocks'. Carvalho et al (2012, p. 331) describe resilience more precisely as a 'system's ability to return to its original state or to a new, more desirable, one after experiencing a disturbance, and ... to prevent shifting to undesirable states'.

While there is a dynamic element implied in these definitions, there is no commonly agreed timeframe for analysis, reflecting the diversity of real-world conditions shaping the return to an original or desirable state. In the studies reviewed, the most explicit example of a timeframe for resilience was the Australian Productivity Commission's (2021) use of six months following a disruption in their *Vulnerable Supply Chains* report.

Nagurney and Ermagun (2022) provide a quantitative definition of supply chain resilience. They simulate labour shocks — reductions in labour availability or productivity — and examine how these shocks affect supply chain efficiency. The lower the drop in efficiency, the more resilient the supply chain.

Another measurement of resilience is the extent of GDP fluctuations during a shock. Studying the effects of labour shocks on global supply chains during the COVID-19 pandemic, Bonadio et al (2021) define resilience as changes in GDP induced by implementing such policies. Labour shocks are calibrated using indices of the ease of doing jobs from home and the stringency of different countries' lockdowns. While about a quarter of the modelled drop in real GDP was transmitted through international supply chains, 'renationalising' these supply chains generally does not make countries more resilient, as domestic

¹ Whether 'risk' and 'uncertainty' are defined separately, or used interchangeably, varies by context.

² This is the statement on Pillar II. The four IPEF pillars are trade, supply chains, clean economy, and fair economy.

inputs are also prone to disruption. Trade promotes resilience when foreign inputs are less disrupted than domestic equivalents.

Khanna et al (2022, p. 2) employ a definition of resilience drawn from a Brookings Institution study:

the ability of a given supply chain to prepare for and adapt to unexpected events; to quickly adjust to sudden disruptive changes that negatively affect supply chain performance; to continue functioning during a disruption ... and to recover quickly to its pre-disruption state or a more desirable state (Iakovou & White 2020).

They measure the resilience of buyer–supplier links in three ways: i) whether shocks lead to a drop in input usage and output, ii) whether supplier links are maintained following the shock, and iii) whether new suppliers can easily replace existing suppliers when links are broken.

Novak et al (2021) argue that while most studies examine resilience from the perspective of an equilibrium-seeking focal firm, a supply chain should instead be viewed as a complex adaptive system (CAS) that evolves through dynamic interactions between independent agents within this system. The authors posit that supply chains never reach equilibrium. Following a disruption, a CAS is highly unlikely to return to a pre-disruption baseline and will instead shift to a new normal.

The implication of their analysis is not that supply chains are automatically resilient at a systemic level, but that focusing on individual firms or equilibria misses the bigger picture. Actions that build resilience within one firm or industry may impede the functioning of a broader system, with consequences across different geographical locations, time periods or functionalities. The distinction between firm- and system-level resilience raises significant questions. Does enhanced resilience at the firm scale imply enhanced resilience at the supply chain scale? Might the resilience-building strategies of one firm decrease the overall system's resilience?

Novak et al (2021) offer four principles for viewing resilience through a CAS perspective:

- i. firm resilience should not be a proxy for supply chain resilience, as firms are an actor within a dynamic supply chain and not the system itself;
- ii. resilience should not be evaluated using only economic variables;
- iii. supply chains do not exist in equilibrium but continually evolve; and
- iv. resilience requires strategies of both buffering (safeguards to minimise exposure to risk) and bridging (ability to adapt) at the scale of the system.

Ultimately, they define supply chain resilience as follows:

[supply chains are] resilient to the extent that the system can maintain core functionality by continually adapting, evolving and transforming in response to the dynamic multiscale feedbacks that occur between the multitude of interconnected organizations, institutions, and social and ecological systems that are all parts of the larger supply chain (p. 332).

Robustness

Some studies additionally distinguish between resilience and robustness (Iakovou & White 2020). Brandon-Jones et al (2014, p. 58) define resilience as 'the ability of a system to return to its original state, within an acceptable period of time', while robustness is the ability to maintain its function throughout a disruption. These two concepts lead to different considerations for policymakers.

Miroudot (2020b) suggests that single-sourcing and long-term relationships with a single supplier are useful strategies to build resilience, but not optimal for robustness, which is better served by diversified suppliers in multiple locations.

Todo et al (2022) examine the relationships between supplier–customer firm pairs, and in doing so, present additional definitions of robustness and resilience. In other words, the study focuses on the links in the supply chain. In this context, Todo et al (2022) define robustness as the continuation of firm-to-firm links, and resilience as the substitution between links after a shock. The study, using a survey of 1400 firms in ASEAN countries and India, found that links were particularly robust if one firm was foreign-owned, and the other was based in the owner’s home country.

Excessive supply chain risk

This section describes a set of cases in which an economy may exhibit socially excessive supply chain risk. It then discusses other factors often raised in the context of supply chain resilience that are important for assessing risk but for which the policy implications are more ambiguous.

Cases where excessive risk can arise

Firms make decisions that affect the resilience of their broader supply networks, and the consequences of these decisions do not always align with the public interest. Economists have catalogued these ‘wedges’ between private and public incentives or private and public risk tolerances (Baldwin & Freeman 2022; Elliott & Golub 2022). Understanding their origins can help policymakers determine whether interventions are likely to benefit the public and groups beyond supply chain participants, and if so, where policies should be targeted.

These wedges generally fall into one of five categories:

- i. **externalities** from firms reducing risk in their supply network, which they fail to internalise;
- ii. **bottleneck firms** that under-produce certain inputs;
- iii. **short termism** in risk-reducing investment decisions;
- iv. **regulations** that discourage investment in risk management; and
- v. **informational limitations**, which mask the true level of risk.

Whenever a firm does not absorb all the benefits of investing in its own risk management, a wedge opens between public and private incentives (Elliott & Golub 2022). Firms can extract some of these benefits, but not all of them. For example, Firm X may decide to source an input from three suppliers instead of one. This multi-sourcing is costly but reduces disruption risk. Over time, decisions like this may give the firm a reputation for being reliable, allowing it to charge its clients more. It is not just immediate clients, however, that benefit from Firm X’s reliability; downstream agents can also benefit. Because it is not practical for Firm X to negotiate contracts with every downstream firm, many of which may not know that Firm X comprises part of its supply chain, some of those benefits invariably get left on the table.

Similarly, in the presence of both entry costs and disruption risk, supply networks can have inefficiently few firms. Consumers and producers, in aggregate, would be better off if more firms entered, as diversification lowers overall risk. These inefficiencies result from a failure to account for the positive externalities that new firms confer on their network (Bimpikis et al 2019).

Bottleneck positions in supply networks confer market power on firms, leading to higher mark-ups and lower production than would otherwise be the case. Given the gains from occupying a bottleneck, these firms' incentives diverge from those optimal for supply chain resilience (Elliott & Golub 2022).

Bottlenecks are persistent over time and typically occur in industries with fewer new entrants. Firms in bottleneck positions tend to be larger, older and more profitable than others (Carvalho et al n.d.).

Short termism in investment decisions — an observed phenomenon, for example, in private research and development (R&D) investment (Terry 2023) — may also result in inefficiently vulnerable supply networks. This case is relevant when disruptions are expected to be infrequent but potentially large.³ Firms may profit, for example, from locating production away from others in the sector, lowering the risk of a shared shock and making them more appealing to risk-averse customers. But this location choice is costly and forgoes some benefits of agglomeration. If investors are short sighted, they may not be willing to finance it (Elliott & Golub 2022). In a similar vein, there may be instances where firms that invest in risk management lose a cost advantage and are driven out by cheaper producers with shorter time horizons (PC 2021, pp. 133–134).

Regulations in essential industries, such as pharmaceuticals, may inadvertently lead to underinvestment in risk management by firms. The Productivity Commission (2021) gives the example of pharmaceutical pre-distributors that may stock an insufficient backup supply because they are not permitted to charge a premium in the case of a shortage. In this instance, price regulation could be complemented by other policies that encourage holding a buffer stock.

Firms may have informational limitations that hinder risk management, which governments or international organisations, through their financing and coordinating capacities, can help address. Even large firms typically have low visibility of their supply chains past the first tier. The costs of detailed supply chain mapping are high with uncertain returns. Governments may be able to reduce the costs of supply chain mapping, for example, by securely bringing together various datasets. They may also shed light on economy-wide risks, such as by publishing weather warnings or financial stress test results.

In some sectors, such as hospitals or defence, governments themselves are major procurers. Aware that public appetite for risk in these sectors is low, government departments may collect and process information about suppliers more extensively than private firms do. Essential sectors, where public preferences for risk versus reward are lower than those of the private sector, are explored below.

Other factors affecting risk

As supply chains become longer, the gains from specialisation increase, but so does the risk of failure, which leads to a trade-off of value and volatility. This dynamic is particularly important in GVCs, given the increased efficiency of locating each stage of production in the country where marginal costs are lowest. Levine (2012) examines the value–volatility trade-off and observes that with their greater tolerance for volatility, it is efficient for higher income economies to choose longer production chains. In this context, policies to shorten production networks mitigate volatility but reduce overall welfare.

Globalisation has made supply chains more sensitive to shocks that impede international transportation, such as port congestion or restrictive trade policies (Elliott & Golub 2022). This increased sensitivity has been coupled with greater access to more valuable, less expensive inputs and consumer products. It

³ Examples include pandemics, volcanic eruptions, financial crises and military conflicts (Lund et al 2020).

highlights the importance of transport infrastructure productivity and of minimising trade policy uncertainty in an interconnected world.

However, the link between an economy's dependence on GVC trade and its vulnerability at the macroeconomic level is not straightforward. Miroudot (2020a), for example, observes no correlation between G20 countries' import intensity of production and their projected GDP change in 2020, despite the massive disturbance to trade that year. Analysis by Bonadio et al (2021) underscores the role played by international trade in insulating national economies from COVID-19 disruptions.

Firms that invest in risk mitigation may be driven out by cheaper providers. Customers may plan to buy cheaply and switch to another option if there is a disruption to the cheaper source of supply (PC 2021, p. 133). In some cases, this situation may be consistent with a well-functioning economy. It is not efficient for risk tolerance to be exactly zero. In other cases, this may present a policy problem — for example, if it is a symptom of short termism in financing decisions, as discussed above.

An economy's network structure, including the size and influence of firms or industries in a network, can affect how macroeconomic shocks propagate (Acemoglu et al 2012). In addition to bottlenecks, discussed above, researchers have pointed to four other network features that can impact resilience or the spread of shocks. These are hub firms, loops, sectoral asymmetry and second-order connectivity.

Hub firms and loops are significant factors in the spread of shocks throughout economic networks, as analysis of the Great East Japan Earthquake of 2011 has shown (Todo and Inoue 2019). Hub firms are simply firms that are connected to an extremely large number of suppliers and customers. The greater the numbers of hub firms and their spokes, the faster shocks can propagate. Loops, also called complex cycles, are supply chains where firms at the top of the chain use final goods in their production processes. For example, companies that make circuit boards use computers in their operations. These loops tend to make shocks propagate more widely and their effects more persistent.

Acemoglu et al (2012) develop a general equilibrium model to show that aggregate volatility depends on the network structure of an economy's input–output links. Two features are particularly important in determining whether a sector-specific shock will have a macroeconomic impact. The first feature is asymmetry in sectors' roles as suppliers. If sectoral asymmetry is high, some sectors are connected to many sectors (high-degree), but others are connected to few sectors (low-degree). Under high sectoral asymmetry, shocks will propagate more widely.

The other feature is second-order connectivity, defined as the extent to which high-degree sectors are themselves interconnected through common suppliers (Acemoglu et al 2012).⁴ This concept is akin to the 'diamond' structures observed by Elliott and Golub (2022) which are, counterintuitively, fragile. For example, say two competing electric vehicle (EV) manufacturers source battery cells from a diverse array of suppliers, lowering their risk of disruption. Those battery cell manufactures, however, tend to source their materials from the same few refineries. The two EV manufacturers, despite their diversified sourcing practices, have highly correlated supply chain risk profiles. A disruption for one is likely to mean a disruption to the other, making the final supply less reliable.

⁴ *First-order* interconnectedness between firms and their immediate customers offers 'little or no information' about the risk of cascade effects in this model (Acemoglu et al 2012, p. 1993).

Similarly, an upstream firm may follow an optimal risk management strategy for itself, but downstream firms may benefit from the upstream firm following a different strategy. For example, if a downstream firm has two suppliers, and these two suppliers both diversify their inputs in the exact same way, risk profiles across the network will be highly correlated. This issue can be identified and managed in various ways by downstream firms. These include supply chain mapping, risk exposure measurement, standardisation of inputs to improve substitutability, and cross-contingent contracting (Bimpikis et al 2018).

Firms that invest more in supply chain visibility tend to be better prepared to handle disruptions (Choi et al 2020). That said, it is difficult and costly for firms to map their supply chains effectively, especially beyond two tiers. The numbers involved are remarkable: according to Lund et al (2020), General Motors has 856 tier-one suppliers and over 18,000 tier-two suppliers. Since it can be costly even to identify all of a firm's suppliers, it is difficult to enact supply chain risk reduction measures, including negotiating contracts with upstream firms that would improve robustness.

Low input substitutability, referred to by the Productivity Commission (2021) as criticality, is another key factor behind the propagation and persistence of shocks (Todo and Inoue 2019). Approaches for assessing substitutability are discussed in the next section.

Assuming there are market imperfections across many sectors, some economies may benefit from government support to sectors with high 'distortion centrality'. These are sectors that are both relatively upstream and relatively small (Liu 2019).⁵ In these sectors, subsidies are beneficial because of the tendency for market imperfections to accumulate through backward linkages in a supply network. Liu (2019) uses this theory to explain some positive effects of historical industrial policies in South Korea and China (the analysis does not assess whether the policies were optimal overall). In doing so, the study demonstrates a potential role for industrial policies guided by supply chain structure.

There may be lessons for supply chain risk management from models (and regulation) of financial contagion, but there are also caveats. The notion of a 'systemically important producer' in a supply network could easily give way to moral hazard and rent-seeking issues. In the presence of political economy frictions, policies to manage supply chain risk by boosting public investment in key sectors may also give rise to new risks, including crowding out private investment and private risk management. Absent strong institutional checks, governments may designate politically influential firms or sectors as 'critical' or 'essential' without sufficiently demonstrating their relevance to the public interest.

Policies may increase or reduce systemic risks. The rules and norms of an open trading system, for example, reduce the risk of unexpected trade frictions, lowering the risk management burden for firms. High levels of trade policy or regulatory risk have the opposite effect. Higher uncertainty — in the sense of a higher incidence of events that cannot be anticipated — adds significantly to the costs of preparing for disruption. Uncertainty, unlike traditional risk, prevents firms from narrowing down the location in their supply networks from which disruptions are likely to originate.

⁵ Formally, distortion centrality is the ratio between a sector's influence on the economy's input-output structure and its Domar weight. Subsidising influential sectors, all else equal, is more beneficial, and subsidising large sectors is more costly.

Optimal policymaking

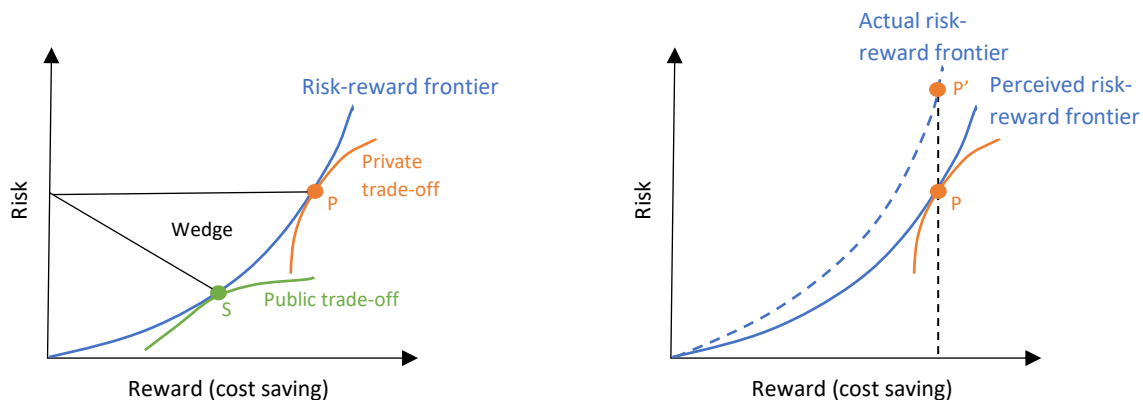
There are many circumstances in which supply chains can exhibit inefficiently high levels of risk. The question for policymakers is when to act to reduce this risk, since intervention will often be costly, and policymakers operate within limits on capacity and resources. The economic literature to date has focused on the sources of inefficiency and firm-level strategies, leaving the issue of optimal national and international policymaking relatively unexplored, suggesting opportunities for future research.

Baldwin and Freeman (2022) illustrate the case for intervening in supply chains with ‘wedges’ between private and public preferences for risk versus reward. The externalities discussed in the previous section create these wedges. Separately, the private sector may take on inefficiently high risk because it has incomplete information about the risk–reward frontier. Governments or international organisations might be able to improve this information through greater coordination (at a cost).

Each of these cases is shown in Figure 1, based on the work of Baldwin and Freeman (2022). In the example illustrated, it is assumed that greater cost saving comes with greater risk and vice-versa. For example, multi-sourcing may reduce a firm’s supply chain risk but increase cost. Cost saving is generally desirable, and risk is generally undesirable, but the public may have a lower risk appetite than the private sector. This situation is shown in the left panel, where a wedge arises between the private sector’s risk–reward trade-off (P) and what the public would prefer (S).

In the right panel, the private sector has incomplete information on the risk–reward frontier. For example, a firm may be unaware of a bottleneck in the second tier of its supply chain. In the diagram, the firm believes it is operating at P , but its real risk level is higher at P' . There is still a wedge between public and private preferences, which, in this case, is made larger by the lack of information.

Figure 1: Supply chain risk versus reward



Source: Based on Baldwin and Freeman (2022).

As a starting point, successful policies for supply chain resilience are those with a benefit–cost ratio greater than one and greater than that of alternative approaches. Benefits and costs are dynamic and subject to change over time. Obtaining the information needed to make an accurate assessment may be challenging, given the uncertainty and granularity of data involved. There may also be distributional concerns, since policies may transfer resources from one group to another.

If the aim is to reduce supply chain risk to socially preferred levels, then the benefits of a policy will be proportionate to how much it shrinks the wedge shown in Figure 1. The previous section outlined key sources of these wedges: externalities, bottlenecks, myopic finance, regulatory barriers, and informational limits. Because these imperfections are so widespread and policymakers' resources and attention are scarce, it is necessary to diagnose where wedges are likely to be especially large. A large wedge signals a large potential benefit, to then be weighed against the costs of attaining it.

Essential goods and services

When firms invest in supply chain risk management, consumers and other producers in that supply network benefit indirectly from the reduction in risk. There is a host of practical reasons why risk-reducing firms will generally not be rewarded commensurately for all these benefits (Elliott & Golub 2022). These externalities are everywhere and usually not significant enough to merit attention, but they are especially large for 'essential' goods. These are goods characterised by large divergences between public and private risk-reward preferences regarding their supply.

Essentiality is multidimensional and subjective, but not impossible to define or assess empirically. For example, a narrow definition of essential goods and services is 'those that support basic needs' like 'food, shelter, water and health' (PC 2021, p. 47). The European Commission (2021, p. 12) highlights 'sensitive ecosystems', referring to critical raw materials and technologies lists from existing legislation, plus industries important to health, security and 'green transformation' interests. In practice, essential goods and services are being constantly defined and revised by government departments and legislators, from lists of critical infrastructure to registries of medicines. Democratic processes and public consultations, despite proneness to lobbying, are among the tools available for uncovering risk preferences around the supply of certain goods and services.

In addition to these tools, we offer three analytic lenses for thinking about essentiality and making the economic case for or against including various products in a working definition. These are threshold effects, network structures and informational advantages.

Some goods are characterised by large threshold effects, where negative externalities arise when supply drops below a certain level. As an extreme example, a small fluctuation in food supply that causes famine will exacerbate social unrest and disease, but if food is plentiful, a fluctuation of the same magnitude will not. Other basic needs, such as water, shelter, power and medicine, have similar characteristics. Dynamic concerns are critical: the social consequences of power outages, for example, scale nonlinearly with the duration of the outage. Lists of COVID-19 essential sectors, such as those allowing exemptions for employees from travel or work restrictions, offer useful precedents. While a pandemic is a specific category of risk, the systemic nature of COVID-19 highlighted the industries where prolonged disruptions were judged to be most socially harmful, regardless of the cause.

The growing literature on the importance of network structure to shock propagation suggests this should be a consideration when defining essentiality. This area is where data-driven approaches offer clear advantages — for example, the simulation studies of Inoue and Todo (2019) which use commercially available Japanese supply chain data. Hub firms that have a high number of connections to others cause bigger economic impacts if they are disrupted. The second tier of the chain is also important: even if a firm or sector has highly diversified supply, if its second-tier suppliers do not, the resulting network structure will be relatively fragile. In addition to firm-level transaction data, input–

output tables can shed light on how shocks propagate. For example, Weber et al (2022) use input–output tables and price data to identify sectors that are systemically significant for price stability.⁶

Diagnosing supply chain risk is costly and time consuming, involving the mapping of a constantly evolving network and drawing on sector-specific expertise. For policymakers, it is practical to look first at sectors where government already has information about suppliers or incentives to collect information. Public goods, where consumption is non-rivalrous and nonexcludable — with national defence being the least controversial example — fall into this category. Any sector, however, where governments are already major procurers, such as public hospitals, offer advantages for gathering information to assess risk. Grid-bound infrastructure, including road or rail transportation, water, telecommunications and electricity transmission are other examples, given traditionally high government involvement in these sectors.

To assess supply chain risks, firms and governments can utilise information from at least four categories:

- i. information about the supply chain’s basic **structure**;
- ii. the appropriate level of **aggregation** of the good, service or sector;
- iii. the degree of **substitutability** (or inversely, the criticality) of inputs; and
- iv. the **nature of risks** or degree of uncertainty facing the supply chain.

A first step in assessing vulnerability is to produce a simple model or map of key inputs to the product of interest. Products that are relatively more essential — where the wedge between public and private risk tolerance is large — recommend more investment in a detailed model. Some initial questions might include whether geographic concentration of production is high and what regulatory barriers or requirements different producers in the network face. A more detailed inquiry would look at the firms involved: are there hub firms or bottleneck firms in the supply chain?

Like macroeconomic modelling, supply chain modelling requires assumptions about whether aggregates of products can be treated as single units — for example, food as opposed to apples. When these assumptions are not appropriate, which is common, there is said to be an aggregation problem (Felipe & Fisher 2008). The appropriate level of aggregation is inherently uncertain and requires discretion and sector-specific insights from the supply chain mapper.⁷ If components of aggregates are easily substitutable, for example, then there is no real problem.

The relevance of aggregation problems to supply chain resilience was demonstrated by shortages of diesel exhaust fluid (DEF), also known by the brand name, AdBlue, in Australia and the Republic of Korea in 2021. While most of Australia’s DEF supply is manufactured domestically, the urea used as an input is mostly imported. Chinese export controls were widely reported as the cause of Australia’s shortages,⁸ yet in 2019 before the crisis, only 15 per cent of Australia’s imported urea, at the most granular classification available from open-source data, came from China (UN Comtrade 2023).⁹

⁶ They identify eight sectors out of the US Bureau of Economic Analysis’ 71 input–output industries: petroleum and coal products, oil and gas extraction, utilities, chemical products, farms, food and beverage and tobacco products, housing, and wholesale trade (Weber et al 2022).

⁷ The Productivity Commission (2021) uses sensitivity analysis to help address aggregation problems, but data limitations remain.

⁸ For example, Hannam (2021) and Vincent and Johnson (2021).

⁹ In 2022, China’s share dropped to about 2 per cent (UN Comtrade 2023).

Most of this urea, however, was for fertiliser rather than DEF, for which technical-grade urea is needed. In 2022, Australian customs began reporting each of these types of urea separately. Of total urea imported that year, about 84.2 per cent was for fertiliser, 2.5 per cent was technical grade, and 0.2 per cent was DEF itself (DFAT 2023). The latter two types were hidden in the aggregate data.

As the DEF case illustrates, the aggregation problem is related to lack of substitutability. Substitutability depends on the time, cost and feasibility of switching from one input to another, or from one input source to another. Products traded in organised international exchanges, for example, are generally highly substitutable between sources. Rauch (1999) presents a classification of homogenous versus differentiated products and shows that homogenous products are less affected by search costs. The Productivity Commission (2021) use import price elasticity analysis to estimate the criticality of certain inputs. Analysis of tariff change impacts, like that of Fontagné et al (2022), presents another useful methodology to this end.

In addition to considering network structure, aggregation and substitutability, policymakers need to understand the nature of risks and uncertainty to which a supply chain is exposed. These risks may be environmental, geopolitical, economic, financial or technological. The distinction between risk and uncertainty is important. It may be prohibitively costly or impossible to reliably estimate the levels of risk associated with different events. Lund et al (2020), for example, classify supply chain shocks into the categories of unanticipated catastrophes, foreseeable catastrophes, unanticipated disruptions and foreseeable disruptions.

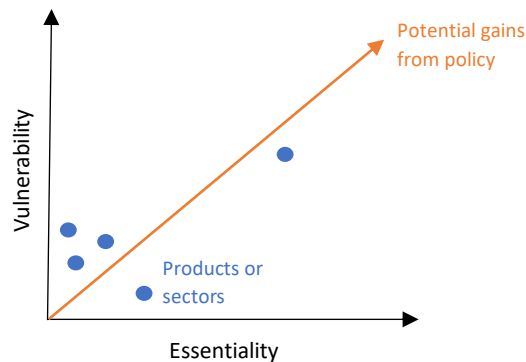
The DEF case highlights the importance of delineating sources of risk and uncertainty. A shock from a trading partner's export controls — as China sought to secure its domestic fertiliser supply — might be considered a foreseeable economic disruption. But viewing this disruption in isolation misses the underlying complexity. For example, while Australia did import most of its technical-grade urea from China as of 2022 (DCCEEW 2023), the world's largest DEF producer, Yara, has production facilities in Canada, France, Italy, Germany and the Netherlands; the last being the largest (Yara 2023a; 2023b).

The DEF shortage came amid a perfect storm that illustrates the effects of global uncertainty. Food price inflation was growing before the pandemic, impacted by African swine fever in China and US–China trade disputes (Bogmans et al 2021). Fertiliser demand increased as farmers saw profit potential in higher crop prices. Hurricane Ida hit key US fertiliser refineries, bumping up urea prices from the supply side (Hannam 2021). Energy demand was skyrocketing from the depths of the COVID-19 recession — coal and natural gas prices in December 2021 were more than double what they had been 12 months earlier.¹⁰ Since large urea refineries rely on fossil fuels, supply tightened further.

Each of the variables discussed above — network structure, aggregation, substitutability, and the nature of risk or uncertainty — help build understanding about a supply chain's overall vulnerability.

¹⁰ Based on natural gas price and Australian thermal coal price indices from IMF (2023).

Figure 2: Vulnerability and essentiality



Governments should prioritise interest and interventions in supply chains that are essential, and scale their interest according to both vulnerability and essentiality (Figure 2). However, if essentiality and vulnerability are not defined with discretion and empirical evidence — if they are allowed to be captured — then policy outcomes will be distorted, and public value threatened. The optimal approach to supply chain policymaking therefore depends on the strength and contestability of the institutions that design and implement it.

Rigorously assessing which products are essential, which many governments already do, is a sensible first step. It is uneconomical to assess the vulnerability of every product in an economy. National import data can be used to highlight very broad patterns of concentration in one tier of a GVC, which may suggest vulnerability, but there are serious limitations to this approach. These include questions of appropriate aggregation and substitutability, and the potential demotion of domestic relative to international sources of risk, given the availability and tractability of trade data compared to national microdata.

Sometimes shocks will occur that could not have been reasonably predicted — those that satisfy the ‘unknown-unknown’ and ‘uncontrollable’ criteria of Simchi-Levi (2010, p. 74). Like the climate, supply networks are complex systems. In this context, mechanisms for effectively responding to crises may be just as important as mechanisms for anticipating them. Policy approaches for managing risk and uncertainty in supply chains are discussed further below.

Policy strategies

Obtaining sufficient information is one costly aspect of supply chain policymaking. There are also immediate and long-term budgetary outlays, such as the costs of maintaining a stockpile or subsidising production. Unwinding favourable treatment once it is no longer socially productive can be challenging for political economy reasons. Other potential consequences include exacerbating policy uncertainty, which dampens investment, and shifting scarce resources away from other sectors of public importance.

One way to categorise supply chain policies is on a spectrum from economy wide to sector specific, with most governments employing a combination of the two. At the economy-wide end, the Productivity Commission (2021) highlight the importance of open, rules-based trade and effective regulatory environments, which facilitate timely and low-cost substitution between products and sources. Supply chain risk often stems from barriers to entry and market imperfections such as transaction and

contracting costs. To the extent these barriers can be reduced, firms will be more responsive in entering industries and expanding production, resulting in more diverse and more efficient supply networks.

Responsive fiscal and monetary policy, infrastructure improvements and productivity-enhancing reforms are categories of policies that generally improve the environments in which supply chains function. In this sense, prudent economy-wide policies can build both resilience by facilitating timely recovery from shocks, and robustness by providing greater resources to withstand them.

Policies can also alleviate supply chain risk by improving public information and reducing uncertainty. These include efforts to maintain transparent and accountable public institutions, make credible international commitments on trade and stick to them, and disseminate useful information through public media. Automatic stabilisers, such as taxes that decrease and transfers that expand when the economy slows, help cushion households from the blows of economic volatility more generally. The impact on public welfare of a supply chain disruption is therefore lower in the presence of these systems than it would be otherwise.

When it comes to individual sectors, governments have historically been most concerned with supply chain risks regarding energy, raw materials and food. To improve the security of supply, three sector-specific approaches have typically been followed, outlined by Cooper (1975):

- increased control over supply, for example, through developing a domestic source of supply,
- diversifying sources of supply, or
- maintaining domestic stockpiles.

Each of these has its own benefits, costs and risks. Localised production, for example, remains vulnerable to domestic disruptions. On one hand, it may reduce risk by making a supply chain shorter, more visible and less exposed to transportation-based shocks, but it also gives up on risk reduction from geographical diversification.

Diversification involves costs, such as reduced access to volume pricing and higher transportation requirements, and substitutability may be low in the short term. Stockpiling involves, at the very least, storage costs and forgone interest on the tied-up capital (Cooper 1975). Related to stockpiling, governments may mandate firms to keep certain inventory levels, which entails additional monitoring costs and could crowd out private risk management efforts.

An additional option is the development of private or government-to-government arrangements for the long-term reliable supply of the needed materials (Crawford & Okita 1978; Drysdale 1988, p. 115). These arrangements can avoid some of the costs associated with diversification and stockpiling, relying instead on cooperative behaviour enabled by institutions and long-term associations among partners. Economists proposed similar arrangements amid pandemic supply disruptions, including shared plurilateral medical stockpiles (Posen 2020) and an open global mechanism to boost production and facilitate trade in medical goods (Evenett 2020).

More recently, Yeo and Cutler (2023) proposed plurilateral swap systems as a potential mechanism under IPEF's Supply Chain Pillar. They note some precedent for informal swaps, such as South Korea and Japan redirecting liquified natural gas to the European Union during the sudden European energy shock after the invasion of Ukraine. Countries' domestic stockpiles of critical goods could be designed to be

interoperable. A similar rationale was behind the establishment of the International Energy Agency in 1974, with an Emergency Sharing System for oil, though this mechanism has not been used to date.

A final category of sector-specific policy is information-based, which includes mapping and stress testing, and sharing information between private and public actors or between different jurisdictions. Stress testing is highlighted by Baldwin and Freeman (2022) as a ‘no-regrets option’ already commonplace in the financial sector. Yeo and Cutler (2023) suggest private–public partnerships as a principle for the IPEF Supply Chain Pillar. The Australian government’s supply chain roundtables with key sectors perform this function at a domestic level (DISR n.d.). If multiple countries could securely link transactions data from their customs and tax departments, it would be possible to model international supply networks with high granularity, generating positive international externalities.

There may be benefits in sharing data that can be used to detect bottlenecks. Research is underway that uses Ugandan firm-level transaction data to this end (Carvalho et al n.d.). Some bottlenecks, however, will remain almost impossible to detect, particularly at deeper tiers of the supply chain and at finer grains of product aggregation.

There are lessons for supply chain policy from broader experience with industrial policy. The two areas overlap; each is often justified based on externalities. Hufbauer and Jung (2021) review 50 years of US industrial policy and draw some instructive conclusions. Import protection usually failed to lead to a competitive domestic industry. Rather than targeting single firms as technology leaders, which led to inconsistent results, funding multiple firms at the outset promoted greater competition. Across all case studies, R&D promotion fared much better, on average, than trade measures or subsidies.

Subsidies can become entrenched, leading to lasting fiscal pressure, particularly if the beneficiaries are politically well organised (Gupta et al 2000). Consideration of this risk is especially important for supply chains, which are constantly evolving depending on technological progress. For example, US industrial policy beneficiary Solyndra went bankrupt after their proprietary technology, a type of thin-film solar cell, became uncompetitive against now-dominant crystalline silicon cells (Hufbauer and Jung 2021). Not every program can be a success — and it is counterproductive to aim for a 100 per cent success rate — but programs should be designed such that failures sunset at the right time. Focusing on goods that exhibit supply chain vulnerability *and* are used in essential sectors limits the risk of wasteful public spending.

Interventions can have unintended consequences stemming from the complexity of international supply networks. In 2018, the United States blacklisted Russian aluminium company Rusal. The sanctions were ultimately reversed at the behest of European car manufacturers, which relied on Rusal for a critical input (Farrell & Newman 2020). In March 2020, the US Trade Representative stated that, weeks earlier, it had removed tariffs on critical medical products (Lighthizer 2020). Yet it had overlooked inputs: leading sanitiser and ventilator manufacturers soon wrote to the administration requesting tariff exemptions, eventually granted, for critical Chinese parts (Bown 2020).

A final distinction can be made between *ex ante* and *ex post* supply chain policy. *Ex ante* policies aim to reduce disruption risk or improve resilience in case a disruption occurs. This category could include anything from supporting an open trading system, funding R&D into potentially substitutable technologies, or maintaining a national stockpile. *Ex post* policies aim to support fast recovery of production or supply after a shock. These policies involve planning a response to disruption, like drawing

down a stockpile or activating an international swap system. Developing action plans internationally could help improve transparency and predictability (Yeo and Cutler 2023), for example, by highlighting alternatives to measures like export bans that increase global uncertainty.

To return to the example used earlier, the 2021 DEF shortage posed a unique challenge due to its inherent unpredictability. While improving the ability to anticipate crises is important, it should also be acknowledged that surprises are inevitable, and it is valuable to have broad-based mechanisms for international cooperation ready if needed. Despite the challenges, both Australia and South Korea were ultimately able to avert significant impacts on their transport networks resulting from the shortages.

The adoption of enhanced visibility, consultation and rigorous stress testing would undoubtedly have been beneficial in the DEF case. Early warning signs in the urea markets existed, which could have elicited more prompt responses had policymakers access to better information. The adoption of strict last-resort stockpiling, per the Australian government’s response, along with continuous monitoring, seems a prudent choice in the current landscape. That will only be the case, however, while DEF remains a critical (very hard to substitute) technology for inland freight.

Review of policy responses

This section provides an overview of major international and Australian policy efforts initiated by governments to address supply chain risk or otherwise influence global supply chains. It presents a taxonomy of responses based on policy intents and levers. The economies that we selected for analysis were Australia and Australia’s 10 largest two-way trading partners in 2021–22: China, Japan, the European Union, the United States, South Korea, Singapore, India, Taiwan, Malaysia and New Zealand.¹¹

Policies were initially sourced from the Asia Society Policy Institute’s project *Supply Chains: A Shifting Indo-Pacific*, which compiles a list of investment and supply chain policies implemented by regional governments from April 2018 to April 2022 (Asia Society 2023f). These were supplemented by government policy statements, think tank and media reporting, and peer-reviewed journals up to September 2023.

The list of policies, provided in the appendix, is not exhaustive but aims to document the main approaches taken in these 11 economies since 2019. Policies with the explicit aim of addressing supply chain risk or supply chain resilience were reviewed. Also included were major policy initiatives that involved similar mechanisms but were adopted to achieve different stated intents, such as technological advancement or supporting the energy transition. Widening the net in this way reveals the variance in countries’ motivations behind similar policy measures, or vice versa: the variance in policies used to address similar stated objectives.

To structure the analysis, we categorised policies according to common intents and levers, shown in Table 1. Policies can be associated with more than one intent or lever. The complete list of policies discussed in this paper is provided in the appendix.

Table 1: Identified policy intents and levers

Policy intents	<ul style="list-style-type: none">• Advancing technological leadership
-----------------------	--

¹¹ Trading partners based on DFAT (2022).

	<ul style="list-style-type: none"> • Boosting employment • Building international partnerships • Diversifying production • Mitigating supply chain risk • Supporting energy transition
Policy levers	<ul style="list-style-type: none"> • Creating a domestic advisory body • Developing a strategic plan • Disseminating or collecting information • Facilitating foreign investment • Investing in infrastructure or human capital • Establishing an international institution or dialogue • Implementing regulatory policy (not included elsewhere) • Implementing trade measures

A few key cross-country findings emerged from this exercise. Nearly all economies enacted policies to build domestic production capacity using subsidies, tax incentives or government financing. Many of these interventions focused on high value-added manufacturing or critical minerals sectors. Establishing new international institutions was another common policy, indicating a nascent but growing architecture for managing supply chain issues. Several of these institutions are primarily for dialogue, but some, like the IPEF Supply Chain Pillar, aim to establish more active mechanisms, such as early warning systems.

While each of the 11 economies had a unique mix of policies and approaches, the following section organises them into three groups. These groups are defined by similarities in rankings of policy intents and levers. The aim was not to create a rigid taxonomy — it would have been equally possible to define other metrics and generate different groups. Instead, the groupings are defined to elucidate prevailing supply chain policy narratives internationally, drawing attention to the elements of continuity and change within them.

Australia, India, Japan, the United States and South Korea are each part of several new international institutions or dialogues, all of which explicitly mention supply chain resilience as a guiding objective. This reflects the proliferation of institutional arrangements on supply chain issues established by the Biden administration in the United States, from IPEF to bilateral memoranda of understanding. The language of supply chains is also salient at the domestic level. Each country’s government has linked a recent subsidy program to objectives of supply chain resilience, robustness or addressing vulnerabilities.

Neither the People’s Republic of China (PRC) nor Taiwan are party to supply chain agreements with the United States or its allies.¹² International engagement on supply chain issues is conducted through existing bodies, like APEC and bilateral dialogues, or BRICS in the PRC’s case.¹³ Domestically, China’s recent policy mix has much in common with that of the United States or South Korea, including vast

¹² Issues of supply chain resilience or risk are not mentioned in the negotiating mandate for the 2023 US–Taiwan Trade Initiative (USTR 2023).

¹³ See China Daily (2022; 2023a; 2023b).

subsidies in strategic sectors like chips and EV inputs. Taiwan and the PRC also appeared to be unique in having foreign investment facilitation policies aimed at stabilising or building resilient supply chains (Invest Taiwan 2020; Asia Society 2023a).

The remaining economies — the European Union, Malaysia, New Zealand and Singapore — had unique features that set them apart from either grouping above. The European Union's supply chain policies were typically linked to emissions reduction and more likely to use regulatory policies as their primary levers. For Malaysia, this review found little use of 'supply chain resilience' or 'supply chain risk' language in policy reporting, other than in reference to cooperation with the United States. New Zealand is unique in their absence of new subsidy programs touted as resilience-boosting. Singapore appears characteristically outward looking, with building international partnerships as its dominant stated intent, and a policy emphasis on trade facilitation and strategic stockpiles.

Some jurisdictions, particularly Australia, the United States and the European Union, have tended to associate supply chain resilience with industrial policy initiatives. These initiatives typically involve tax incentives or government financing mechanisms for high-tech manufacturing or critical minerals sectors. This pattern was less apparent in other countries, with New Zealand and Singapore occupying the other end of the spectrum. Policies described by these governments as resilience enhancing instead tend to emphasise trade facilitation, freight and logistics.

We found few policies that directly address informational limitations as causes of supply chain risk, such as initiatives to map supply networks, conduct stress tests or establish early warning systems. There are notable exceptions, chiefly in Australia, the European Union, Japan, the United States and South Korea. The United States has the Advisory Committee on Supply Chain Competitiveness and a Semiconductor Alert Mechanism for businesses to report disruptions (Department of Commerce 2023a; ITA 2023). Early warning systems are also mentioned in the August 2023 US–Japan–South Korea trilateral statement and a 2021 Chinese State Council statement (China Daily 2021; White House 2023b). The European Union's proposed Critical Raw Materials Act would mandate stress testing for certain companies (Procedure 2023/0079/COD).

For these 11 economies, the main international initiative targeting resilience is the Supply Chain Pillar in IPEF, which is still under development. The agreement aims to establish three new structures. The first, the Supply Chain Council, will create action plans for sectors designated as critical. The Supply Chain Response Network, an 'emergency communications channel', aims to facilitate quick coordinated responses when supply chain crises occur. The third structure is an advisory board focused on labour rights (Arasasingham et al 2023). These structures should be useful channels for governments to share policymaking frameworks and experience, though action may be slow given differences in interests among IPEF's 14 diverse members.

In some cases, the aim of policy may be not to build resilience in global supply chains, but to build, dominate or hold critical positions and bottlenecks within them. Taiwanese legislation, for example, provides R&D tax credits to companies that 'occup[y] a key position in the international supply chain' (MOJT 2023). Building an industry that provides an alternative source of international supply to an existing dominant supply source may improve international supply chain resilience. However, policies that purport to boost resilience or reduce risk can be anti-resilience at an international level where they entrench dominance and further concentrate supply. The current trend towards geoeconomic fragmentation, highlighted by IMF researchers (Aiyar et al 2023), should be viewed not just as driven by

national security, but as a potential driver of international insecurity. The following section takes a closer look at each country's policy mix.

New architecture: United States, Australia, India, Japan and South Korea

The United States has been forward leaning in its international engagement, entering new supply chain-focused partnerships with Japan, Malaysia, South Korea, the United Kingdom and others. Supply chain resilience was frequently cited as a motivation behind policy initiatives, including the Biden administration's flagship Inflation Reduction Act and the CHIPS and Science Act.¹⁴ The Executive Order on America's Supply Chains, issued in February 2021, is an early example, authorising reports on products like semiconductors and EV batteries as part of a 100-day review (White House 2022a).

While some of these policies use traditional industrial policy tools, the United States has also adopted initiatives to address informational issues that may generate supply chain risk. These include the industry and government-staffed Advisory Committee on Supply Chain Competitiveness, and the Semiconductor Alert Mechanism, a tool for reporting disruptions in chip supply chains (ITA 2023). There is often a geoeconomic element, such as exclusion from electric vehicle tax credits if battery components are sourced from a 'foreign entity of concern' (Reinsch et al 2022).

Australia is second only to the United States amongst our comparison set in the number of policies reviewed that cite supply chain resilience as an objective. Like the United States, this includes recent industrial policy programs, like the Modern Manufacturing Strategy, which included a Supply Chain Resilience Initiative, and later the National Reconstruction Fund.¹⁵ The term is also used on the website of the Simplified Trade System Taskforce, a body that implements trade facilitation reforms. Australia's Office of Supply Chain Resilience within the federal Department of Industry, Science and Resources engages with industry and international partners, including the United Kingdom, to assess risk and give policy advice, applying a policy framework (DISR n.d.) that draws on the Productivity Commission's report.

Internationally, India is involved in a wealth of supply chain-focused initiatives with the other Quad countries. It is party to IPEF, participated in the US-hosted 2022 Supply Chain Ministerial, has a US memorandum of understanding on semiconductor supply chains and a trilateral Supply Chain Resilience Initiative with Australia and Japan. Unlike Australia and the United States, however, there is little mention of resilience in an industrial policy context. A government press release for Production-Linked Incentive Schemes, which target key manufacturing sectors, mentions making India more integrated and 'an integral part' in global supply chains — a different objective from reducing risk (PIB 2020). A recent Indian list of critical minerals was promoted as enhancing supply chain resilience (PIB 2023a).

Japan's headline supply chain policy is the 2022 Economic Security Promotion Act, which aims to ensure stable supply of critical products and the reliable functioning of critical infrastructure. It enshrines principles to this end, designates critical products and infrastructure, commits to R&D and human capital investment for critical technologies, and regulates the disclosure of patent applications in sensitive technologies (Izumi et al 2023; MOJJ 2023). Supply chains are often invoked in a geoeconomic context. The Program for Promoting Investment in Japan to Strengthen Supply Chains, sometimes

¹⁴ See appendix for list of policies and sources.

¹⁵ See Andrews and Morrison (2020) and DISR (2022).

termed the ‘China exit’ subsidy (Akiyama 2020), is an onshoring subsidy initiative aimed at ‘products, parts, and materials for which Japan is highly dependent on one country’ (JETRO 2023).

South Korea engages internationally on supply chain issues through bilateral initiatives with the United States and in IPEF. Its August 2023 trilateral meeting with Japan and the United States resulted in commitments to piloting an ‘early warning system’ to improve coordination on supply chain disruptions (White House 2023b). Domestically, like its trilateral partners, South Korea enacted onshoring subsidies in 2020 and recently expanded semiconductor production incentives. A suite of industrial strategies — the Materials, Parts, Equipment 2.0 Strategy, the 2030 K-Battery Development Strategy and the K-Semiconductor Strategy — aims to build more resilient or sustainable supply chains, through infrastructure and R&D investment as well as tax breaks.¹⁶ Active international engagement is coupled with inward-looking industrial policy, ‘aimed at creating a stable supply chain at home’ (MOEF 2021).

Institutional continuity: PRC and Taiwan

In contrast to the United States, China’s international engagement on supply chain issues has occurred through existing mechanisms, rather than new initiatives. Supply chain resilience was discussed at the 13th BRICS Trade Ministers’ Meeting in August 2023 and at the China–ASEAN Business and Investment Summit in September, for example (China Daily 2023a; 2023b). This reflects the security posture inherent in most supply chain initiatives in the US-allied sphere, which often seek to reduce trade dependence on China — the CHIPS and Science Act and ‘China exit’ subsidies being two examples.

A search of English-language government policy statements yields little supply chain resilience language around China’s industrial plans and incentive programs, unlike for Japan or South Korea. The concept is not absent from China’s policy landscape, however. The Dual Circulation Strategy, incorporated in the 14th Five-Year Plan, aims to ensure ‘access to critical inputs by diversifying supply chains’ and channelling investment to favoured sectors (CSIS n.d.). During the pandemic, China pursued foreign investment facilitation and trade liberalisation policies to keep supply chains stable (Asia Society 2023a). A March 2021 statement by 13 central departments mentions efforts to ‘establish a global supply chain risk warning system for key sources and products’ (China Daily 2021).

Taiwan, like the PRC, is outside the new institutional frameworks on supply chains that typically centre on Quad countries. Elsewhere, there are similarities with other East Asian economies. Like Japan and South Korea, Taiwan released a policy strategy in 2020 aimed at shifting investment by Taiwanese companies overseas back onshore (Asia Society 2023g). Its Pioneers for Innovation Leadership on Technology (PILOT) Program, seeking to cement Taiwan’s place as a global high-tech R&D centre, offers incentives for manufacturing and R&D investment, including for foreign companies (MOEA n.d.).¹⁷ In unveiling the program, the Premier cited pandemic supply chain disruptions as motivation for Taiwan to ‘carve out a distinctive role’ and ‘expand industrial advantages’ (Invest Taiwan 2020). Amendments to the Statute for Industrial Innovation cite supply chains not in the context of building resilience, but of building dominance, seeking to ‘reinforce domestic industries’ foothold on the global supply chain’ (MOJT 2023).

¹⁶ See Asia Society (2023e), OECD (2023), and Xu and Yoon (2021).

¹⁷ Pre-empting the US Inflation Reduction Act, there are exclusions for mainland Chinese companies (MOEA n.d.).

Distinctive approaches: EU, Malaysia, New Zealand and Singapore

More than any other economy reviewed, the European Union's policies jointly sought to progress the green energy transition and address supply chain risk. The European Union was also the only economy for which regulatory policies were the most common policy lever. A notable example is the proposed Critical Raw Materials Act. The regulation stipulates that member states — or, if they do not have capacity, the European Commission — should conduct stress tests for vulnerabilities in strategic raw materials supply chains at least every three years. The results are to be published alongside any recommendations for mitigating risks, such as building buffer stocks. Large manufacturers of 'strategic technologies' that use strategic raw materials are also to run stress tests and supply chain audits (Procedure 2023/0079/COD).

As with Taiwan, we found little reference to supply chain concepts in Malaysia's English-language policy statements and government press releases. The exception is in the context of international initiatives such as IPEF or the US–Malaysia Memorandum of Cooperation on Semiconductor Supply Chain Resilience. In July 2021, companies involved in 'global supply chains' in certain sectors, including electronics, machinery equipment and healthcare, received exemptions to COVID-19 movement restrictions (Asia Society 2021c).

New Zealand was unique in that it announced very few industrial policy initiatives, other than R&D incentives, during the period examined (Department of State 2023). In 2020, the Ministry of Business, Innovation and Employment released a 'refreshed industry strategy in response to COVID-19', with strategic plans for eight key sectors. While the plans are partly responding to pandemic supply issues, they do not focus specifically on supply chain resilience or risk management (MBIE 2021). In 2022, the NZ government announced its Trade Recovery Strategy 2.0, which includes a resilience pillar (MFAT n.d.). Following its Australian counterpart, the NZ Productivity Commission is undertaking an inquiry focused on supply chain risk, *Improving Economic Resilience* (NZPC 2023). New Zealand established a bilateral Supply Chain Working Group with Singapore in April 2022 (Ardern 2022).

Singapore's holistic approach to supply chain resilience is outlined in its 2022 *Singapore Public Sector Outcomes Review*. In its section on resilience, the review emphasises Singapore's status as a reliable and trusted trading partner, having avoided export controls throughout the pandemic. In May 2020, Singapore signed a joint statement with Australia, Canada, New Zealand and South Korea, committing to facilitate trade and essential travel. Singapore maintains a range of stockpiles, some of which, like the Rice Stockpile Scheme established in 1990, are operated with the private sector. In October 2021, the government announced temporary fuel reserve requirements and other energy management measures (MOF 2022). Trade facilitation and stockpiling are common themes. As with New Zealand, traditional industrial policy levers like tax incentives are not typically discussed in relation to resilience.

Conclusions

Several market and government factors can increase supply chain risk. These include failure to account for externalities from risk-reducing investments, short termism, regulatory obstacles discouraging risk management, and informational constraints. Recent research also highlights the importance of supply chain network structures in assessing vulnerability (Elliott and Golub 2022). Governments can reduce risk through a combination of economy-wide policy settings and sector-specific levers. The latter, given

the incentives and capabilities of private firms to manage their own risks, should be focused on vulnerable and essential products, assessed cautiously and empirically.

Governments have employed a range of policies in recent years aimed at building supply chain resilience. Some governments define this goal broadly and include traditional industrial policy initiatives, like tax credits for high value-added manufacturing, within its scope. In some cases, policies seek domestic dominance of a supply chain, favouring the creation or expansion of bottlenecks that can cause negative externalities internationally where this reduces, rather than expands, supply options. Few policies directly address supply chain informational limitations, though some have proposed early warning systems, sometimes at an international level, as well as stress testing.

Supply chain resilience is a relatively new area of economic inquiry with many unanswered questions. One issue is differentiating between robustness and resilience. Companies can adopt different strategies for each. It may be instructive to explore the distinction further from a public policy perspective, given the different levers available to governments, and the desire, articulated in IPEF, for cooperation to target robustness or resilience at an international level.

Some jurisdictions, like the European Union, are implementing stress-testing measures. More research like that of Carvalho et al (n.d.) is needed to show policymakers what bottlenecks look like in real-world situations. Empirical research could also help outline scenarios that governments and businesses should consider for stress tests.

Governments face the challenge of creating policies for resilience in uncertain conditions, including the basis for prioritising investment and interest, about the correct level of product aggregation and the timing and distribution of future risks. Economic research can help design better policy frameworks for making decisions under this uncertainty. Lastly, case study research, focused on crisis response as well as prevention, can offer insights into what successful and unsuccessful supply chain risk management looks like.

References

- Acemoglu, D., Carvalho, V. M., Ozdaglar, A., & Tahbaz-Salehi, A. T. (2012). The Network Origins of Aggregate Fluctuations. *Econometrica*, 80(5), 1977–2016. <https://doi.org/10.3982/ECTA9623>
- Aiyar, S., Chen, J., Ebeke, C. H., Garcia-Saltos, R., Gudmundsson, T., Ilyina, A., Kangur, A., Kunaratskul, T., Rodriguez, S. L., Ruta, M., Schulze, T., Soderberg, G., & Trevino, J. P. (2023). Geoeconomic Fragmentation and the Future of Multilateralism. International Monetary Fund Staff Discussion Notes No. 2023/2001. <https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2023/01/11/Geo-Economic-Fragmentation-and-the-Future-of-Multilateralism-527266>
- Akiyama, H. (2020). Japan Companies Line up for ‘China Exit’ Subsidies to Come Home. *Nikkei Asia*, 9 September. <https://asia.nikkei.com/Economy/Japan-companies-line-up-for-China-exit-subsidies-to-come-home>
- Andrews, K., & Morrison, S. (2020). *Transforming Australian Manufacturing to Rebuild Our Economy*. Press Release, 1 October. <https://www.minister.industry.gov.au/ministers/karenandrews/media-releases/transforming-australian-manufacturing-rebuild-our-economy>
- Antràs, P., & Chor, D. (2022). Global Value Chains. In G. Gopinath, E. Helpman & K. Rogoff (Eds.), *Handbook of International Economics*, Vol. 5, Elsevier, pp. 297–376. <https://doi.org/10.1016/bs.hesint.2022.02.005>
- Arasasingham, A., Benson, E., Goodman, M. P., & Reinsch, W. A. (2023). Assessing IPEF’s New Supply Chains Agreement. *Center for Strategic and International Studies*, 31 May. <https://www.csis.org/analysis/assessing-ipefs-new-supply-chains-agreement>
- Ardern, J. (2022). *NZ, Singapore Join Forces on Supply Chain Disruption*. Press Release, 20 April. <https://www.beehive.govt.nz/release/nz-singapore-join-forces-supply-chain-disruptions>
- Asia Society (2023a). China. *Supply Chains: A shifting Indo-Pacific*. <https://asiasociety.org/policy-institute/supply-chains-shifting-indo-pacific/china>
- (2023b). India. *Supply Chains: A shifting Indo-Pacific*. <https://asiasociety.org/policy-institute/supply-chains-shifting-indo-pacific/india>
- (2023c). Malaysia. *Supply Chains: A shifting Indo-Pacific*. <https://asiasociety.org/policy-institute/supply-chains-shifting-indo-pacific/Malaysia>
- (2023d). Singapore. *Supply Chains: A shifting Indo-Pacific*. <https://asiasociety.org/policy-institute/supply-chains-shifting-indo-pacific/singapore>
- (2023e). South Korea. *Supply Chains: A shifting Indo-Pacific*. <https://asiasociety.org/policy-institute/supply-chains-shifting-indo-pacific/south-korea>
- (2023f). *Supply Chains: A shifting Indo-Pacific*. <https://asiasociety.org/policy-institute/supply-chains-shifting-indo-pacific>
- (2023g). Taiwan. *Supply Chains: A shifting Indo-Pacific*. <https://asiasociety.org/policy-institute/supply-chains-shifting-indo-pacific/taiwan>
- Australian Government (2020). *Make It Happen: The Australian Government’s Modern Manufacturing Strategy*. https://www.australianminerals.gov.au/_data/assets/pdf_file/0004/106447/make-it-happen-modern-manufacturing-strategy.pdf
- Baldwin, R. E., & Freeman, R. (2022). Risks and Global Supply Chains: What we know and what we need to know. *Annual Review of Economics*, 14, 153–180. <https://doi.org/10.1146/annurev-economics>

- Barroso, A. P., Machado, V. H., & Machado, V. C. (2008). A Supply Chain Disturbances Classification. *2008 IEEE International Conference on Industrial Engineering and Engineering Management, Singapore, 8–11 December 2008*. Institute of Electrical and Electronics Engineers.
<https://doi.org/10.1109/IEEM.2008.4738196>
- Bimpikis, K., Candogan, O., & Ehsani, S. (2019). Supply Disruptions and Optimal Network Structures. *Management Science*, *65*(12), 5449–5956. <https://doi.org/10.1287/mnsc.2018.3217>
- Bimpikis, K., Fearing, D., & Tahbaz-Salehi, A. (2018). Multisourcing and Misscoordination in Supply Chain Networks. *Operations Research*, *66*(4), 893–1188. <https://doi.org/10.1287/opre.2017.1708>
- Bogmans, C., Pescatori, A., & Prifti, E. (2021). Four Facts about Soaring Consumer Food Prices. IMF Blog, 24 June. <https://www.imf.org/en/Blogs/Articles/2021/06/24/four-facts-about-soaring-consumer-food-prices>
- Bonadio, B., Huo, Z., Levchenko, A. A., & Pandalai-Nayar, N. (2021). Global Supply Chains in the Pandemic. *Journal of International Economics*, *133*. <https://doi.org/10.1016/j.jinteco.2021.103534>
- Bown, C. P. (2020). COVID-19: Trump’s Curbs on Exports of Medical Gear Put Americans and Others at Risk. *Trade and Investment Policy Watch*, Peterson Institute of International Economics, 9 April. <https://www.piie.com/blogs/trade-and-investment-policy-watch/covid-19-trumps-curbs-exports-medical-gear-put-americans>
- Brandon-Jones, E., Squire, B., Autry, C. W., & Petersen, K. J. (2014). A Contingent Resource-Based Perspective of Supply Chain Resilience and Robustness. *Journal of Supply Chain Management*, *50*(3), 55–73. <https://doi.org/10.1111/jscm.12050>
- Business (2023). *Funding for Businesses to Invest in Capabilities to Address Supply Chain Vulnerabilities*. Australian Government, 7 March. <https://business.gov.au/grants-and-programs/supply-chain-resilience-initiative>
- Carvalho, H., Barroso, A. P., Machado, V. H., Azevedo, S., & Cruz-Machado, V. (2012). Supply Chain Redesign for Resilience Using Simulation. *Computers and Industrial Engineering*, *62*(1), 329–341. <https://doi.org/10.1016/j.cie.2011.10.003>
- Carvalho, V. M., Elliott, M., & Spray, J. (n.d.). *Supply Chain Bottlenecks in a Pandemic*. <https://covid.econ.cam.ac.uk/files/carvalho-files/BottlenecksPandemicNote.pdf>
- Center for Strategic and International Studies (n.d.). Will the Dual Circulation Strategy Enable China to Compete in a Post-Pandemic World? *ChinaPower*, Center for Strategic and International Studies. <https://chinapower.csis.org/china-covid-dual-circulation-economic-strategy/>
- China Daily (2021). *China Unveils Steps to Boost Manufacturing*. The State Council, People’s Republic of China, 24 March. http://english.www.gov.cn/statecouncil/ministries/202103/24/content_WS605a7632c6d0719374afb46b.html
- (2022). *China Calls for Extra Cooperation on Global Supply Chain Security*. The State Council, People’s Republic of China, 3 November. http://english.www.gov.cn/statecouncil/ministries/202211/03/content_WS636315f4c6d0a757729e2396.html
- (2023a). *BRICS Ties Support Trade, Recovery, MSMEs*. The State Council, People’s Republic of China, 10 August. http://english.www.gov.cn/news/202308/10/content_WS64d4347cc6d0868f4e8de761.html

- — — (2023b). *China–ASEAN Relations Are Most Successful, Dynamic Model in Asia-Pacific Cooperation: Chinese Premier*. The State Council, People’s Republic of China, 17 September. http://english.www.gov.cn/news/202309/17/content_WS65070543c6d0868f4e8df872.html
- Choi, T. Y., Rogers, D., & Vakil, B. (2020). Coronavirus Is a Wake-Up Call for Supply Chain Management. *Harvard Business Review*, 27 March. <https://hbr.org/2020/03/coronavirus-is-a-wake-up-call-for-supply-chain-management>
- Cooper, R. N. (1975). Natural Resources and National Security. *The Adelphi Papers*, 15(115), 8–16. <https://doi.org/10.1080/05679327508448394>
- Crawford, J., & Okita, S. (Eds.) (1978). *Raw Materials and Pacific Economic Integration*. Canberra: Australian National University Press.
- CSIS, see Center for Strategic and International Studies
- DCCEEW, see Department of Climate Change, Energy, the Environment and Water
- Department of Climate Change, Energy, the Environment and Water (2023). Submission Concerning Brenntag Australia’s Application. 19 June. <https://www.accc.gov.au/public-registers/authorisations-and-notifications-registers/authorisations-register/adblue-manufacturers-and-distributors>
- Department of Commerce (2022). *Joint Press Release: U.S. Department of Commerce and Malaysian Ministry of International Trade and Industry Sign Memorandum of Cooperation to Strengthen Semiconductor Supply Chain Resiliency and Promote Sustainable Growth*. Press Release, 11 May. <https://www.commerce.gov/news/press-releases/2022/05/joint-press-release-us-department-commerce-and-malaysian-ministry>
- — — (2023a). *Advisory Committee on Supply Chain Competitiveness*. <https://www.trade.gov/advisory-committee-supply-chain-competitiveness>
- — — (2023b). *United States–Korea Supply Chain and Commercial Dialogue Ministerial Joint Statement*. Press Release, 27 April. <https://www.commerce.gov/news/press-releases/2023/04/united-states-korea-supply-chain-and-commercial-dialogue-ministerial>
- Department of Foreign Affairs and Trade (2021). *Joint Statement on the Supply Chain Resilience Initiative by Australian, Indian and Japanese Trade Ministers*. 27 April. <https://www.dfat.gov.au/news/media-release/joint-statement-supply-chain-resilience-initiative-australian-indian-and-japanese-trade-ministers>
- — — (2022). *Australia’s Trade in Goods and Services by Top 15 Partners*. <https://www.dfat.gov.au/sites/default/files/australias-goods-services-by-top-15-partners-2021-22.pdf>
- — — (2023). *Trade Statistical Pivot Tables*. <https://www.dfat.gov.au/trade/trade-and-investment-data-information-and-publications/trade-statistics/trade-statistical-pivot-tables>
- Department of Industry, Science and Resources (2020). *Modern Manufacturing Initiative and National Manufacturing Priorities Announced*. 1 October. <https://www.industry.gov.au/news/modern-manufacturing-initiative-and-national-manufacturing-priorities-announced>
- — — (2021). *The Modern Manufacturing Initiative Opens Funding for National Manufacturing Priority Areas*. 19 February. <https://www.industry.gov.au/news/modern-manufacturing-initiative-opens-funding-national-manufacturing-priority-areas>

- — — (2022). *National Reconstruction Fund: Diversifying and transforming Australia’s industry and economy*. 27 October. <https://www.industry.gov.au/news/national-reconstruction-fund-diversifying-and-transforming-australias-industry-and-economy>
- — — (2023). *Critical Minerals Strategy 2023–2030: Vision and objectives*. <https://www.industry.gov.au/publications/critical-minerals-strategy-2023-2030/vision-and-objectives>
- — — (n.d.). *Office of Supply Chain Resilience*. <https://www.industry.gov.au/trade/office-supply-chain-resilience>
- Department of State (2022a). *2022 Supply Chain Ministerial*. <https://www.state.gov/supply-chain-ministerial/>
- — — (2022b). *Joint Statement of the U.S.–Japan Economic Policy Consultative Committee: Strengthening Economic Security and the Rules-Based Order*. 29 July. <https://www.state.gov/joint-statement-of-the-u-s-japan-economic-policy-consultative-committee-strengthening-economic-security-and-the-rules-based-order/>
- — — (2023). *2023 Investment Climate Statements: New Zealand*. Report. <https://www.state.gov/reports/2023-investment-climate-statements/new-zealand/>
- DFAT, see Department of Foreign Affairs and Trade
- DISR, see Department of Industry, Science and Resources
- Drysdale, P. (1988). *International Economic Pluralism: Economic policy in East Asia and the Pacific*. Sydney: Allen & Unwin.
- Ebrahimi, A. (2023). China Boosts Semiconductor Subsidies as US Tightens Restrictions. *The Diplomat*, 28 September. <https://thediplomat.com/2023/09/china-boosts-semiconductor-subsidies-as-us-tightens-restrictions/>
- EDB Singapore and Enterprise Singapore (2021). *New Alliance to Help Manufacturers Expand into Southeast Asia*. Press Release, 3 February. https://www.edb.gov.sg/content/dam/edb-en/about-edb/media-releases/news/sea-manufacturing-alliance/SEA_Manufacturing_Alliance_-_Media_Release.pdf
- Elliott, M. & Golub, B. (2022). Networks and Economic Fragility. *Annual Review of Economics*, 14, 665–696. <https://doi.org/10.1146/annurev-economics-051520-021647>
- European Commission (2021). *Strategic Dependencies and Capacities*. Commission Staff Working Document, 5 May. https://commission.europa.eu/system/files/2021-05/swd-strategic-dependencies-capacities_en.pdf
- — — (2022a). *Corporate Sustainability Due Diligence*. https://commission.europa.eu/business-economy-euro/doing-business-eu/corporate-sustainability-due-diligence_en
- — — (2022b). *Just and Sustainable Economy: Commission Lays Down Rules for Companies to Respect Human Rights and Environment in Global Value Chains*. Press Release, 23 February. https://ec.europa.eu/commission/presscorner/detail/en/IP_22_1145
- — — (2023a). *Critical Raw Materials Act*. https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/critical-raw-materials/critical-raw-materials-act_en
- — — (2023b). *Critical Raw Materials: Ensuring secure and sustainable supply chains for EU’s green and digital future*. Press Release, 16 March. https://ec.europa.eu/commission/presscorner/detail/en/IP_23_1661
- — — (2023c). *European Chips Act*. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-chips-act_en

- — — (2023d). *European Chips Act: Monitoring and crisis response*. 21 September. <https://digital-strategy.ec.europa.eu/en/factpages/chips-act-monitoring>
- — — (2023e). *EU–US Trade and Technology Council*. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/stronger-europe-world/eu-us-trade-and-technology-council_en
- — — (2023f). *Net-Zero Industry Act*. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/green-deal-industrial-plan/net-zero-industry-act_en
- — — (2023g). *Questions and Answers: The Net-Zero Industry Act and the European Hydrogen Bank*. 16 March. https://ec.europa.eu/commission/presscorner/detail/en/qanda_23_1666
- Evenett, S. J. (2020). Flawed Prescription: Export curbs on medical goods won't tackle shortages. In R. E. Baldwin & S. J. Evenett (Eds.), *COVID-19 and Trade Policy: Why turning inward won't work*. CEPR Press.
- EY (2023). *China Tax and Investment Express*. Issue No. 2023035, EY China Tax Center, 22 September. https://assets.ey.com/content/dam/ey-sites/ey-com/en_cn/topics/china-tax-alerts/ey-ctie-2023035-en.pdf
- Farrell, H., & Newman, A. (2020). The Folly of Decoupling from China. *Foreign Affairs*, 3 June. <https://www.foreignaffairs.com/articles/china/2020-06-03/folly-decoupling-china>
- Felipe, J., & Fisher, F. M. (2008). Aggregation (Production). In S. N. Durlauf & L. E. Blume (Eds.), *The New Palgrave Dictionary of Economics*. Palgrave Macmillan. <https://doi.org/10.1007/978-1-349-58802-2>
- Fontagné, L., Guimbard, H., & Orefice, G. (2022). Tariff-Based Product-Level Trade Elasticities. *Journal of International Economics*, 137. <https://doi.org/10.1016/j.jinteco.2022.103593>
- Garcia Herrero, A. (2023). Resilience of Global Supply Chains: Facts and Implications. ADBI Working Paper Series No. 1398, June. <https://www.adb.org/sites/default/files/publication/891616/adb-wp1398.pdf>
- Gupta, S., Verhoeven, M., Gillingham, R., Schiller, C., Mansoor, A. I., & Cordoba, J. P. (2000). *Equity and Efficiency in the Reform of Price Subsidies*. International Monetary Fund. <https://www.imf.org/external/pubs/ft/equity/index.htm>
- Hannam, P. (2021). What Is Urea and AdBlue, and Why Does a Worldwide Shortage Threaten Australia's Supply Chain? *The Guardian*, 10 December. <https://www.theguardian.com/australia-news/2021/dec/08/what-is-urea-and-why-does-a-worldwide-shortage-threaten-australias-supply-chain>
- Hashimzade, N., Myles, G., & Black, J. (2017). Uncertainty. In *A Dictionary of Economics*, Oxford University Press, <https://doi.org/10.1093/acref/9780198759430.001.0001>
- Heckmann, I., Comes, T., & Nickel, S. (2015). A Critical Review on Supply Chain Risk: Definition, measure and modelling. *Omega*, 52, 119–132. <https://doi.org/10.1016/j.omega.2014.10.004>
- Hufbauer, G. C., & Jung, E. (2021). *Scoring 50 Years of US Industrial Policy, 1970–2020*. PIIE Briefing 21-5, Peterson Institute for International Economics, November. <https://www.piie.com/publications/piie-briefings/scoring-50-years-us-industrial-policy-1970-2020>
- Iakovou, E. & White, C. (2020). How to Build More Secure, Resilient, Next-Gen US Supply Chains. Brookings Institution, 3 December. <https://www.brookings.edu/articles/how-to-build-more-secure-resilient-next-gen-u-s-supply-chains/>
- IEA (2022a). *14th FYP for Raw Material Industry Development*. 7 November. <https://www.iea.org/policies/14702-14th-fyp-for-raw-material-industry-development>

- (2022b). *New Energy Vehicle Industry Development Plan (2021–2035)*. 30 October. <https://www.iea.org/policies/15529-new-energy-vehicle-industry-development-plan-2021-2035>
- (2023). *Subsidy on New Energy Vehicle 2023*. 25 May. <https://www.iea.org/policies/17536-subsidy-on-new-energy-vehicle-2023>
- IMDA, see Infocomm Media Development Authority
- IMF, see International Monetary Fund
- Indo-Pacific Economic Framework (2022). *Ministerial Statement for Pillar II of the Indo-Pacific Economic Framework for Prosperity*. <https://www.commerce.gov/sites/default/files/2022-09/Pillar-II-Ministerial-Statement.pdf>
- Infocomm Media Development Authority (2023). *Future Communications Research and Development Programme (FCP)*. 10 October. <https://www.imda.gov.sg/how-we-can-help/future-communications-research-and-development-programme>
- Inoue, H., & Todo, Y. (2019). Firm-Level Propagation of Shocks Through Supply-Chain Networks. *Nature Sustainability*, 2, 841–847. <https://doi.org/10.1038/s41893-019-0351-x>
- International Monetary Fund (2023). *Primary Commodity Prices*. <https://www.imf.org/en/Research/commodity-prices>
- International Trade Administration (2023). *Semiconductor Alert Mechanism*. Department of Commerce, United States of America. <https://www.trade.gov/microelectronics-early-alert-system>
- Invest Taiwan (2020). *Taiwan Sets Sights on Becoming Asia’s High-Tech Hub*. 4 June. <https://investtaiwan.nat.gov.tw/newsPage41680eng?lang=eng&search=41680>
- (2021). *Amendments to the Act for the Recruitment and Employment of Foreign Professionals Approved by the Legislative Yuan*. 18 June. <https://investtaiwan.nat.gov.tw/newsPage51791eng?lang=eng&search=51791>
- IPEF, see Indo-Pacific Economic Framework
- ITA, see International Trade Administration
- Izumi K., Chihara T., Hirosaki T., Kunito T., Yuta M., Nagano H., Shimizu R., Sudo S., Takahashi I., Ueda R., & Zakoji T. (2022). Japan’s Economic Security Promotion Act: Background and overview. *Asia-Pacific Review*, 29(3), 28–55. <https://doi.org/10.1080/13439006.2022.2154520>
- Japan External Trade Organization (2023). *Manufacturing Government Initiatives*. https://www.jetro.go.jp/en/invest/attractive_sectors/manufacturing/government_initiatives.html
- JETRO, see Japan External Trade Organization
- Khanna, G., Morales, N., & Pandalai-Nayar, N. (2022). Supply Chain Resilience: Evidence from Indian firms. National Bureau of Economic Research Working Paper Series No. 30689. <https://doi.org/10.3386/w30689>
- Lee, J., & Kim, S. (2023). South Korea Passes Its ‘Chips Act’ amid US–China Friction. *Bloomberg*, 30 March. <https://www.bloomberg.com/news/articles/2023-03-29/south-korea-to-pass-its-own-chips-act-amid-us-china-friction/>

- Levine, D. K. (2012). Production Chains. *Review of Economic Dynamics*, 15(3), 271–282.
<https://doi.org/10.1016/j.red.2012.01.003>
- Lighthizer, R. (2020). Lighthizer Responds on Medical Trade Tariffs. *Wall Street Journal*, 20 March.
<https://www.wsj.com/articles/lighthizer-rebuts-zoellick-on-medical-trade-11584732340>
- Liu, E. (2019). Industrial Policies in Production Networks. *The Quarterly Journal of Economics*, 134(4), 1883–1948.
<https://doi.org/10.1093/qje/qjz024>
- Lund, S., Manyika, J., Woetzel, J., Barriball, E., Krishnan, M., Alicke, K., Birshan, M., George, K., Smit, S., Swan, D., & Hutzler, K. (2020). *Risk, Resilience, and Rebalancing in Global Value Chains*. Report, McKinsey Global Institute. <https://www.mckinsey.com/business-functions/operations/our-insights/risk-resilience-and-rebalancing-in-global-value-chains.pdf>
- MBIE, see Ministry of Business, Innovation and Employment
- Medina, A. F. (2021). How Malaysia’s PERMAI Stimulus Package Benefits Businesses. *ASEAN Briefing*, 9 February.
<https://www.aseanbriefing.com/news/how-malaysias-permai-stimulus-package-benefits-businesses/>
- METI, see Ministry of Economy, Trade and Industry
- MFAT, see Ministry of Foreign Affairs and Trade
- Ministry of Business, Innovation and Employment (2021). *Industry Policy*. 23 June.
<https://www.mbie.govt.nz/business-and-employment/economic-development/industry-policy/>
- Ministry of Economic Affairs (n.d.). *Pioneers for Innovation Leadership on Technology Program (PILOT)*. Presentation.
[https://aiip.tdp.org.tw/doctemp/edddata/%E8%A8%88%E7%95%AB%E8%AA%AA%E6%98%8E%E7%B0%A1%E5%A0%B1\(Eng\)1090807.pdf](https://aiip.tdp.org.tw/doctemp/edddata/%E8%A8%88%E7%95%AB%E8%AA%AA%E6%98%8E%E7%B0%A1%E5%A0%B1(Eng)1090807.pdf)
- Ministry of Economy and Finance (2021). *Economic Policies, H2 2021*. Press Release, 28 June.
<https://english.moef.go.kr/pc/selectTbPressCenterDtl.do?boardCd=N0001&seq=5163>
- Ministry of Economy, Trade and Industry (2021). “*Strategy for Semiconductors and the Digital Industry*” Compiled. 4 June. https://www.meti.go.jp/english/press/2021/0604_005.html
- (2023). *Green Innovation Fund*. 3 February.
https://www.meti.go.jp/english/policy/energy_environment/global_warming/gifund/index.html
- Ministry of Finance (2022). Strengthening Our Supply Chain Resilience. *Singapore Public Sector Outcomes Review*, 6 December. <https://www.mof.gov.sg/singapore-public-sector-outcomes-review/citizens/our-shared-future-and-place-in-the-world/strengthening-our-supply-chain-resilience>
- Ministry of Foreign Affairs and Trade (n.d.). *Trade Recovery Strategy 2.0*.
<https://www.mfat.govt.nz/en/trade/trade-recovery-strategy/trade-recovery-strategy-2-0/>
- Ministry of Justice (Japan) (2023). *Outline of the Economic Security Promotion Act*. Japanese Law Translation.
<https://www.japaneselawtranslation.go.jp/outline/75/905R403.pdf>
- Ministry of Justice (Taiwan) (2023). Statute for Industrial Innovation, Amended 28 June 2023. *Laws and Regulations Database of the Republic of China (Taiwan)*.
<https://law.moj.gov.tw/ENG/LawClass/LawAll.aspx?pcode=J0040051>

- Miroudot, S. (2020a). Reshaping the Policy Debate on the Implications of COVID-19 for Global Supply Chains. *Journal of International Business Policy*, 3, 440–442. <https://doi.org/10.1057/s42214-020-00074-6>
- (2020b). Resilience Versus Robustness in Global Value Chains: Some policy implications. In R. E. Baldwin & S. J. Evenett (Eds.), *COVID-19 and Trade Policy: Why turning inward won't work*. CEPR Press.
- MOEA, see Ministry of Economic Affairs
- MOEF, see Ministry of Economy and Finance
- MOF, see Ministry of Finance
- MOJJ, see Ministry of Justice (Japan)
- MOJT, see Ministry of Justice (Taiwan)
- Nagurney, A., & Ermagun, A. (2022). Resilience of Supply Chain Networks to Labor Disruptions. *Findings*, June. <https://doi.org/10.32866/001c.36315>
- New Zealand Productivity Commission (2023). *Improving Economic Resilience*. Inquiry. <https://www.productivity.govt.nz/inquiries/resilience/>
- Novak, D. C., Wu, Z., & Dooley, K. J. (2021). Whose Resilience Matters? Addressing issues of scale in supply chain resilience. *Journal of Business Logistics*, 42(3), 323–335. <https://doi.org/10.1111/jbl.12270>
- NZPC, see New Zealand Productivity Commission
- OECD (2023). *The 2023 K-Battery Development Strategy*. STIP Compass, 11 July. <https://stip.oecd.org/stip/interactive-dashboards/policy-initiatives/2023%2Fdata%2FpolicyInitiatives%2F99997435>
- OED, see Oxford English Dictionary
- Office of the United States Trade Representative (2023). *USTR Announcement Regarding U.S.–Taiwan Trade Initiative*. Press Release, 18 May. <https://ustr.gov/about-us/policy-offices/press-office/press-releases/2023/may/ustr-announcement-regarding-us-taiwan-trade-initiative>
- Owen, S. H., & Daskin, M. S. (1998). Strategic Facility Location: A review. *European Journal of Operational Research*, 111(3), 423–447. [https://doi.org/10.1016/S0377-2217\(98\)00186-6](https://doi.org/10.1016/S0377-2217(98)00186-6)
- Oxford English Dictionary (2023). Risk, *N.*, Sense 1.a. *Oxford English Dictionary*, Oxford University Press, December. <https://doi.org/10.1093/OED/8295829941>
- Ozdemir, D., Sharma, M., Dhir, A., & Daim, T. (2022). Supply Chain Resilience During the COVID-19 Pandemic. *Technology in Society*, 68. <https://doi.org/10.1016/j.techsoc.2021.101847>
- Parker, D. (2020). *Trade Strategy for the Recovery from the Impacts of Covid-19*. Speech, 8 June. <https://www.beehive.govt.nz/speech/trade-strategy-recovery-impacts-covid-19>
- (2023). *Supply Chain Strategy Will Boost Productivity and Resilience of Our Freight Connections*. Press Release, 18 August. <https://www.beehive.govt.nz/release/supply-chain-strategy-will-boost-productivity-and-resilience-our-freight-connections>
- PC, see Productivity Commission
- PIB, see Press Information Bureau

- Porter, C. (2021). *Securing Australia's Supply Chain Resilience for Critical Products*. Press Release, 30 June. <https://www.minister.industry.gov.au/ministers/porter/media-releases/securing-australias-supply-chain-resilience-critical-products>
- Posen, A. S. (2020). Japan Can Do Much to Rebuild the Global Economic System. *East Asia Forum Quarterly*, 12(3), 8–10. <http://doi.org/10.22459/EAFAQ.12.03.2020>
- Press Information Bureau (2020). *Cabinet Approves PLI Scheme to 10 Key Sectors for Enhancing*. 11 November. <https://pib.gov.in/Pressreleaseshare.aspx?PRID=1671912>
- (2023a). *Mines Ministry to Unveil "List of Critical Minerals for India"*. 27 June. <https://pib.gov.in/PressReleasePage.aspx?PRID=1935587>
- (2023b). *MoU on Semiconductor Supply Chain and Innovation Partnership Between India and US Signed Following the Commercial Dialogue 2023*. 10 March. <https://www.pib.gov.in/PressReleasePage.aspx?PRID=1905522>
- Procedure 2023/0079/COD. *Proposal for a Regulation of the European Parliament and of the Council Establishing a Framework for Ensuring a Secure and Sustainable Supply of Critical Raw Materials and Amending Regulations (EU) 168/2013, (EU) 2018/858, 2018/1724 and (EU) 2019/1020*. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023PC0160>
- Productivity Commission (2021). *Vulnerable Supply Chains*. Study Report. <https://www.pc.gov.au/inquiries/completed/supply-chains/report>
- Rauch, J. E. (1999). Networks Versus Markets in International Trade. *Journal of International Economics*, 48(1), 7–35. [https://doi.org/10.1016/S0022-1996\(98\)00009-9](https://doi.org/10.1016/S0022-1996(98)00009-9)
- Reinsch, W. A., Chauhan, A., & Duncan, E. (2022). An Electric Debate: Local Content Requirements and Trade Considerations. *Center for Strategic and International Studies*, 12 October. <https://www.csis.org/analysis/electric-debate-local-content-requirements-and-trade-considerations>
- Rosenhead, J., Elton, M., & Gupta, S. K. (1972). Robustness and Optimality as Criteria for Strategic Decisions. *Operational Research Quarterly*, 23(4), 413–431. <https://doi.org/10.2307/3007957>
- Seo, J., Lee, J., Lee, J. Y., & Lee, H. I. (2023). *Enactment of the K-Chips Act — Government's Support and Regulatory Policies for the Semiconductor Industry*. 22 May. https://www.kimchang.com/en/insights/detail.kc?sch_section=4&idx=27331
- Simchi-Levi, D. (2010). *Operations Rules: Delivering customer value through flexible operations*. The MIT Press.
- Simplified Trade System Implementation Taskforce (2023). *About Us*. <https://www.simplifiedtrade.gov.au/about-us>
- STS Taskforce, see Simplified Trade System Implementation Taskforce
- Svensson, G. (2010). Dyadic Vulnerability in Companies' Inbound and Outbound Logistics Flows. *International Journal of Logistics Research and Applications*, 1, 13–43. <https://doi.org/10.1080/13675560110114261>
- Terry, S. J. (2023). The Macro Impact of Short-Termism. *Econometrica*, 91(5), 1881–1912. <https://doi.org/10.3982/ECTA15420>
- Todo, Y., & Inoue, H. (2019). Propagation of Economic Shocks Through Supply Chains. *VoxEU*, CEPR, 10 September. <https://cepr.org/voxeu/columns/propagation-economic-shocks-through-supply-chains>

- Todo, Y., Oikawa, K., Ambashi, M., Kimura, F., & Urata, S. (2022). Robustness and Resilience of Supply Chains During the COVID-19 Pandemic. *The World Economy*, 46(6), 1843–1872. <https://doi.org/10.1111/twec.13372>
- UK Government (2022). *Guidance: UK–Australia Supply Chain Resilience Initiative*. 26 October. <https://www.gov.uk/government/publications/uk-australia-supply-chain-resilience-initiative>
- UN Comtrade (2023). *UN Comtrade Database*. <https://comtradeplus.un.org/>
- USTR, see Office of the United States Trade Representative
- Vincent, P., & Johnson, S. (2021). Inside Australia’s New Plan to Avoid Supply Chain Chaos Amid Fears Supermarket Shelves Could Be Empty by Christmas as Trucks are Brought to a Standstill due to Fuel Shortage Crisis. *Daily Mail Australia*, 15 December. <https://www.dailymail.co.uk/news/article-10310393/Australia-AIRLIFT-AdBlue-urea-just-weeks-left-critical-diesel-truck-additive-left.html>
- Weber, I. M., Jauregui, J. L., Teixeira, L., & Nassif Pires, L. (2022). Inflation in Times of Overlapping Emergencies: Systemically Significant Prices from an Input–Output Perspective. UMassAmherst Economics Department Working Paper Series No. 2022-22. <https://doi.org/10.7275/0c5b-6a92>
- White House (2022a) *Executive Order on America Supply Chains: A year of action and progress*. Report. <https://www.whitehouse.gov/wp-content/uploads/2022/02/Capstone-Report-Biden.pdf>
- — — (2022b). *Fact Sheet: CHIPS and Science Act will Lower Costs, Create Jobs, Strengthen Supply Chains, and Counter China*. Press Release, 9 August. <https://www.whitehouse.gov/briefing-room/statements-releases/2022/08/09/fact-sheet-chips-and-science-act-will-lower-costs-create-jobs-strengthen-supply-chains-and-counter-china/>
- — — (2023a). *Building a Clean Energy Economy: A guidebook to the Inflation Reduction Act’s investments in clean energy and climate action*. January. <https://www.whitehouse.gov/wp-content/uploads/2022/12/Inflation-Reduction-Act-Guidebook.pdf>
- — — (2023b). *The Spirit of Camp David: Joint statement of Japan, the Republic of Korea, and the United States*. Press Release, 18 August. <https://www.whitehouse.gov/briefing-room/statements-releases/2023/08/18/the-spirit-of-camp-david-joint-statement-of-japan-the-republic-of-korea-and-the-united-states/>
- Xu, A., & Yoon, H. Y. (2021). Plan to Make Korea ‘Top Semiconductor Power’ by 2030. *Korea.net*, 14 May. <https://www.korea.net/NewsFocus/policies/view?articleId=198152>
- Yara (2023a). *Diesel Exhaust Fluid*. Yara International. <https://www.yara.com/industrial-nitrogen/diesel-exhaust-fluid/>
- — — (2023b). *AdBlue® for Vehicles*. Yara Australia. <https://www.yara.com.au/chemical-and-environmental-solutions/adblue-for-vehicles/>
- Yeo, H., & Cutler, W. (2023). *Strengthening Regional Supply Chain Resiliency Through the Indo-Pacific Economic Framework (IPEF)*. Asia Society, May. <https://asiasociety.org/policy-institute/strengthening-regional-supply-chain-resiliency-through-indo-pacific-economic-framework-ipef>

Appendix: List of policies

Economy	Intents	Levers	Policies
Australia	Building international partnerships Mitigating supply chain risk	Development of strategic plan Disseminating or collecting information International institution or dialogue	Australia–UK Supply Chain Resilience Initiative
		Creating domestic advisory body Development of strategic plan Disseminating or collecting information International institution or dialogue	Office of Supply Chain Resilience ¹⁸
		International institution or dialogue	Supply Chain Ministerial Forum ¹⁹
		Disseminating or collecting information International institution or dialogue	IPEF Supply Chain Pillar
	Building international partnerships Diversifying production Mitigating supply chain risk	Disseminating or collecting information Foreign investment facilitation International institution or dialogue	Australia–Japan–India Supply Chain Resilience Initiative ²⁰
	Boosting employment Building domestic capability Building international partnerships Mitigating supply chain risk Supporting energy transition	Development of strategic plan	Critical Minerals Strategy 2023–2030 ²¹
	Mitigating supply chain risk	Disseminating or collecting information	Vulnerable Supply Chains Report ²²

¹⁸ DISR (n.d.).

¹⁹ Department of State (2022a).

²⁰ DFAT (2021).

²¹ DISR (2023).

²² PC (2021).

	Building domestic capability	Subsidies, tax incentives or funds	Modern Manufacturing Initiative ²³ (part of Modern Manufacturing Strategy)
	Boosting employment	Subsidies, tax incentives or funds	National Reconstruction Fund ²⁴
	Building domestic capability Diversifying production Mitigating supply chain risks	Subsidies, tax incentives or funds	Supply Chain Resilience Initiative ²⁵ (part of Modern Manufacturing Strategy)
	Diversifying production Mitigating supply chain risks	Creating domestic advisory body Disseminating or collecting information Trade measures (facilitation)	Simplified Trade System Taskforce ²⁶
China	Advancing technological leadership Building domestic capability Diversifying production Mitigating supply chain risk	Development of strategic plan	Dual Circulation Strategy ²⁷
	Advancing technological leadership Building domestic capability Mitigating supply chain risk	Development of strategic plan Disseminating or collecting information	Joint document released by National Development and Reform Commission and 12 other departments ²⁸
	Mitigating supply chain risks	Foreign investment facilitation Regulatory policy Subsidies, tax incentives or funds	Circular No. 28 (2020) on Stabilising Foreign Trade and Investment ²⁹

²³ DISR (2020; 2021).

²⁴ DISR (2022).

²⁵ Australian Government (2020), Business (2023) and Porter (2021).

²⁶ STS Taskforce (2023).

²⁷ CSIS (n.d.).

²⁸ China Daily (2021).

²⁹ Asia Society (2023a).

		Trade measures (reduced tariffs)	Import Tax Policies to Support the Development of the Integrated Circuit Industry and Software Industry ³⁰
	Advancing technological leadership Building domestic capability Supporting energy transition	Development of strategic plan	New Energy Vehicle Industry Development Plan (2021–2035) ³¹
	Building domestic capability	Development of strategic plan	14th Five Year Plan for Raw Material Industry Development ³²
	Building domestic capability Supporting energy transition	Subsidies, tax incentives or funds	Subsidy on New Energy Vehicle 2023 ³³
	Advancing technological leadership	Subsidies, tax incentives or funds	Raising the Super Deduction Ratio of R&D Expenses for Integrated Circuit Enterprises and Enterprises that Produce and Sell Advanced Industrial Machinery ³⁴
EU	Advancing technological leadership Building international partnerships Mitigating supply chain risk	Development of strategic plan International institution or dialogue Regulatory policy	EU–US Trade and Technology Council ³⁵
	Advancing technological leadership Building domestic capability	Disseminating or collecting information (monitoring) Human capital investment Regulatory policy Subsidies, tax incentives or funds	European Chips Act ³⁶

³⁰ Asia Society (2023a).

³¹ IEA (2022b).

³² IEA (2022a).

³³ IEA (2023).

³⁴ EY (2023) and Ebrahimi (2023).

³⁵ European Commission (2023e).

³⁶ European Commission (2023c; 2023d).

	Building domestic capability Diversifying production Mitigating supply chain risk	Development of strategic plan Infrastructure or human capital investment Regulatory policy	Critical Raw Materials Act ³⁷
	Boosting employment Building domestic capability Diversifying production Mitigating supply chain risk	Development of strategic plan Regulatory policy Subsidies, tax incentives or funds	Net-Zero Industry Act ³⁸
	Building international partnerships Mitigating supply chain risk	International institution or dialogue	Supply Chain Ministerial Forum ³⁹
	Mitigating supply chain risk Supporting energy transition	Regulatory policy	Corporate Sustainability Due Diligence Directive ⁴⁰
India	Diversifying production Building international partnerships Mitigating supply chain risk	Disseminating or collecting information Foreign investment facilitation International institution or dialogue	Australia–Japan–India Supply Chain Resilience Initiative ⁴¹
		International institution or dialogue	Supply Chain Ministerial Forum ⁴²
	Building international partnerships	International institution or dialogue	India–US Memorandum of Understanding on Semiconductor Supply Chain and Innovation Partnership ⁴³
	Mitigating supply chain risk	Disseminating or collecting information International institution or dialogue	IPEF Supply Chain Pillar

³⁷ European Commission (2023a; 2023b) and Procedure 2023/0079/COD.

³⁸ European Commission (2023f; 2023g).

³⁹ Department of State (2022a).

⁴⁰ European Commission (2022a; 2022b).

⁴¹ DFAT (2021).

⁴² Department of State (2022a).

⁴³ PIB (2023b).

	Boosting employment Building domestic capability Mitigating supply chain risk	Subsidies, tax incentives or funds	Various Production Linked Incentive (PLI) Schemes (e.g. for telecom products, solar panels, batteries) ⁴⁴
	Building domestic capability	Subsidies, tax incentives or funds	Promotion of Manufacturing of Electronic Components and Semiconductors (SPECS) Scheme ⁴⁵
		Investment in infrastructure Subsidies, tax incentives or funds	Mega-Integrated Textile Region and Apparel Parks
	Building domestic capability Mitigating supply chain risk Supporting energy transition	Development of strategic plan	List of Critical Minerals for India ⁴⁶
Japan	Building international partnerships Diversifying production Mitigating supply chain risk	Disseminating or collecting information Foreign investment facilitation International institution or dialogue Development of strategic plan International institution or dialogue	Australia–Japan–India Supply Chain Resilience Initiative ⁴⁷ Japan–US Economic Policy Consultative Committee ⁴⁸
	Diversifying production	Subsidies, tax incentives or funds	Project to Support the Diversification of Overseas Supply Chains to ASEAN Countries ⁴⁹
	Building domestic capability Mitigating supply chain risk	Subsidies, tax incentives or funds	Program for Promoting Investment in Japan to Strengthen Supply Chains ⁵⁰
	Advancing technological leadership	Development of strategic plan	Semiconductor Digital Industry Strategy ⁵¹

⁴⁴ Asia Society (2023b) and PIB (2020).

⁴⁵ Asia Society (2023b).

⁴⁶ PIB (2023a).

⁴⁷ DFAT (2021).

⁴⁸ Department of State (2022b).

⁴⁹ JETRO (2023).

⁵⁰ JETRO (2023).

⁵¹ METI (2021).

	Building domestic capability	Subsidies, tax incentives or funds	Green Innovation Fund ⁵²
	Supporting energy transition		
	Advancing technological leadership	Development of strategic plan	Economic Security Promotion Act ⁵³
	Mitigating supply chain risk	Regulatory policy	
	Building international partnerships	International institution or dialogue	Supply Chain Ministerial Forum ⁵⁴
		Mitigating supply chain risk	Disseminating or collecting information
International institution or dialogue			
Malaysia	Building domestic capability	Subsidies, tax incentives or funds	Extension of Danajamin Guarantee Scheme to foreign-owned companies ⁵⁵
			Manufacturing tax exemptions under PENJANA stimulus package ⁵⁶
		Regulatory policy	COVID-19 movement restrictions exemption for companies in strategic sectors ⁵⁷
	Boosting employment	Development of strategic plan	National Investment Aspirations ⁵⁸
	Building domestic capability		
	Diversifying production	International institution or dialogue	US–Malaysia Memorandum of Cooperation on Semiconductor Supply Chain Resilience ⁵⁹
	Building international partnerships		
	Mitigating supply chain risk	Disseminating or collecting information	IPEF Supply Chain Pillar
International institution or dialogue			

⁵² METI (2023).

⁵³ Izumi et al (2023) and MOJJ (2023).

⁵⁴ Department of State (2022a).

⁵⁵ Asia Society (2023c) and Medina (2021).

⁵⁶ Asia Society (2023c).

⁵⁷ Asia Society (2023c).

⁵⁸ Asia Society (2023c).

⁵⁹ Department of Commerce (2022).

New Zealand	Boosting employment	Development of strategic plan	Trade Recovery Strategy ⁶⁰
	Building international partnerships	Trade measures (facilitation)	
	Mitigating supply chain risk	Development of strategic plan	Trade Recovery Strategy 2.0 ⁶¹
	Mitigating supply chain risk	Development of strategic plan	Productivity Commission Report <i>Improving Economic Resilience</i> ⁶²
	Building international partnerships	Disseminating or collecting information	New Zealand–Singapore Supply Chain Working Group ⁶³
		International institution or dialogue	
	Mitigating supply chain risk	Disseminating or collecting information	IPEF Supply Chain Pillar
International institution or dialogue			
Mitigating supply chain risk	Development of strategic plan	Aotearoa New Zealand Freight and Supply Chain Strategy ⁶⁴	
Supporting energy transition			
Singapore	Building domestic capability	Regulatory policy	Economic Expansion Incentives (Relief from Income Tax) (Amendment) Act 2020 ⁶⁵
		Subsidies, tax incentives or funds	
	Supporting energy transition	Subsidies, tax incentives or funds	Enterprise Financing Scheme-Green ⁶⁶
		Advancing technological leadership	Regulatory policy
Mitigating supply chain risk	Regulatory policy	October 2021 temporary energy management measures ⁶⁸	

⁶⁰ Parker (2020).

⁶¹ MFAT (n.d.).

⁶² NZPC (2023).

⁶³ Ardern (2022).

⁶⁴ Parker (2023).

⁶⁵ Asia Society (2023d).

⁶⁶ Asia Society (2023d).

⁶⁷ Asia Society (2023d).

⁶⁸ MOF (2022).

	Advancing technological leadership	Human capital investment	Future Communications Research and Development Programme ⁶⁹	
	Building domestic capability	International institution or dialogue		
	Building international partnerships	Subsidies, tax incentives or funds		
	Building international partnerships	Mitigating supply chain risk	International institution or dialogue	Supply Chain Ministerial Forum ⁷⁰
			Disseminating or collecting information	New Zealand–Singapore Supply Chain Working Group ⁷¹
		International institution or dialogue	Southeast Asia Manufacturing Alliance ⁷²	
Foreign investment facilitation				
International institution or dialogue				
Regulatory policy	IPEF Supply Chain Pillar			
Disseminating or collecting information				
International institution or dialogue				
South Korea	Building international partnerships	International institution or dialogue	US–Korea Supply Chain and Commercial Dialogue ⁷³	
		Disseminating or collecting information	IPEF Supply Chain Pillar	
		International institution or dialogue		
	Mitigating supply chain risks	Subsidies, tax incentives or funds	Amendments to Act on Support for Overseas Companies to Return to Korea (November 2020) ⁷⁴	
		Regulatory policy	'K-Chips Act' ⁷⁵	
		Infrastructure and human capital investment		
Subsidies, tax incentives or funds				

⁶⁹ IMDA (2023).

⁷⁰ Department of State (2022a).

⁷¹ Ardern (2022).

⁷² Asia Society (2023d); EDB Singapore and Enterprise Singapore (2021).

⁷³ Department of Commerce (2023b).

⁷⁴ Asia Society (2023e).

⁷⁵ Lee and Kim (2023) and Seo et al (2023).

	Advancing technological leadership Building domestic capability Mitigating supply chain risk	Development of strategic plan	2030 K-Battery Development Strategy ⁷⁶
		Infrastructure investment Subsidies, tax incentives or funds	Materials, Parts, Equipment 2.0 Strategy ⁷⁷
		Infrastructure investment Regulatory policy Subsidies, tax incentives or funds	K-Semiconductor Strategy ⁷⁸
	Building international partnerships Mitigating supply chain risk	International institution or dialogue	Supply Chain Ministerial Forum ⁷⁹
	Taiwan	Building domestic capability	Foreign investment facilitation
Subsidies, tax incentives or funds			Management, Utilization, and Taxation of Repatriated Offshore Funds Act ⁸¹
Advancing technological leadership Building domestic capability		Infrastructure and human capital investment Regulatory policy Subsidies, tax incentives or funds	Statute for Industrial Innovation (Amended 2019 and 2023) ⁸²
		Human capital investment Regulatory policy Subsidies, tax incentives or funds	Amendments to the Act for the Recruitment and Employment of Foreign Professionals (2021) ⁸³
		Advancing technological leadership Boosting employment	Foreign investment facilitation Subsidies, tax incentives or funds

⁷⁶ OECD (2023).

⁷⁷ Asia Society (2023e).

⁷⁸ Asia Society (2023e) and Xu and Yoon (2021).

⁷⁹ Department of State (2022a).

⁸⁰ Asia Society (2023g).

⁸¹ Asia Society (2023g).

⁸² MOJT (2023).

⁸³ Invest Taiwan (2021).

⁸⁴ Asia Society (2023g), Invest Taiwan (2020) and MOEA (n.d.).

	Building domestic capability Mitigating supply chain risk		
United States	Building international partnerships Mitigating supply chain risk	International institution or dialogue	US–Malaysia Memorandum of Cooperation on Semiconductor Supply Chain Resilience ⁸⁵
		International institution or dialogue	US–Korea Supply Chain and Commercial Dialogue ⁸⁶
		International institution or dialogue	Supply Chain Ministerial Forum ⁸⁷
		Disseminating or collecting information International institution or dialogue	IPEF Supply Chain Pillar
	Advancing technological leadership Building international partnerships Mitigating supply chain risk	Development of strategic plan International institution or dialogue Regulatory policy	EU–US Trade and Technology Council ⁸⁸
	Building international partnerships Diversifying production Mitigating supply chain risk	International institution or dialogue Development of strategic plan	Japan–US Economic Policy Consultative Committee ⁸⁹
	Mitigating supply chain risk	Creating domestic advisory body Development of strategic plan	Advisory Committee on Supply Chain Competitiveness ⁹⁰
		Disseminating or collecting information	Executive Order on America’s Supply Chains ⁹¹
		Development of strategic plan	
		Disseminating or collecting information	Semiconductor Early Alert System ⁹²

⁸⁵ Department of Commerce (2022).

⁸⁶ Department of Commerce (2023b).

⁸⁷ Department of State (2022a).

⁸⁸ European Commission (2023e).

⁸⁹ Department of State (2022b).

⁹⁰ Department of Commerce (2023a).

⁹¹ White House (2022a).

⁹² ITA (2023).

	<p>Advancing technological leadership</p> <p>Boosting employment</p>	<p>Subsidies, tax incentives or funds</p> <p>Regulatory policy</p> <p>Infrastructure and human capital investment</p>	<p>CHIPS and Science Act⁹³</p>
	<p>Building domestic capability</p> <p>Mitigating supply chain risk</p> <p>Supporting energy transition</p>	<p>Infrastructure investment</p> <p>Regulatory policy</p> <p>Subsidies, tax incentives or funds</p> <p>Trade measures (local content provisions)</p>	<p>Inflation Reduction Act⁹⁴</p>

⁹³ White House (2022b).

⁹⁴ White House (2023a).