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Industrial Policies: Handle with Care

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Authorized for distribution by Pierre-Olivier Gourinchas
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ABSTRACT: Industrial policies (IPs) are on the rise, calling for a fresh assessment of their potential benefits and costs.This Staff Discussion Note (SDN) leverages various databases, spanning many countries and sectors, to study the drivers of IPs and assess how they interact with the performance of targeted sectors relative to non-targeted ones. It shows that the implementation of IPs appears to respond to economic as well as geopolitical factors. It also finds that IPs are on average associated with only moderate and uneven improvements in economic outcomes, although the association becomes stronger when IPs target highly distorted upstream sectors using the appropriate instruments. Overall, structural reforms typically bring larger benefits than IPs and enhance the link between IPs and economic performance, pointing to the key role of a robust structural reform agenda. While not directly addressed in this SDN, IPs can result in large fiscal costs and unintended cross-industry and cross-country spillovers. The latter are particularly important as they can exacerbate the ongoing trend toward economic fragmentation. Thus, IPs should be handled with care.

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Executive Summary

The use of industrial policies (IPs)—interventions targeting sectors or firms directed at changing the structure of economic activity within an economy—has risen in recent years, calling for an assessment of their impacts. After falling out of favor in the 1990s, IPs have been widely used, especially after 2017. Arguments in IPs' favor relate to market failures, economies of scale, and collective action problems, but factors like limited state capacity and capture by private and political actors can hamper their effectiveness. Moreover, IPs' historical track record has been mixed. As new economic and geopolitical challenges loom, a fresh assessment of IPs' potential economic impacts is warranted. Leveraging various databases spanning many countries and sectors, this Staff Discussion Note (SDN) empirically studies the performance of sectors targeted by IPs relative to non-targeted sectors in the 2009-2021 period and explores differences across instruments and sectoral and country characteristics. This SDN does not assess the overall welfare gains and absolute desirability of IPs. This would require a finer, more structural level of analysis. But it establishes patterns by looking at IPs that have been implemented and gauging their impact along various metrics.

IPs are associated with moderate and uneven improvements in the performance of targeted sectors, but this relationship varies with sector characteristics and instruments. IPs are accompanied by a boost in the competitiveness of targeted products and are linked to moderate and at times short-lived improvements in sectoral outcomes. However, impacts vary with the characteristics of targeted sectors and the instruments used. IPs targeting highly distorted sectors (those with high markups and external financial dependence making firms vulnerable to credit market imperfections) are linked to improvements in value added that are four times as large in the medium term as those targeting less distorted sectors. Similarly, IPs targeting upstream sectors (those providing inputs for other sectors) are associated with broader benefits to the economy through positive spillovers along the supply chain. Targeting products that are closer to the frontier, as gauged by a high initial revealed comparative advantage, also yields faster and larger gains, while IPs targeting products in which the country is not competitive do not show definite gains over the horizon considered. Turning to instruments, export incentives are linked to more sustained competitiveness and productivity improvements (albeit after an adjustment period) compared to domestic subsidies, which are strongly associated with increases in capital accumulation. This is consistent with the historically successful implementation of IPs in East Asian countries.

Structural reforms have, on average, much larger effects than IPs, pointing to their fundamental role. IPs are accompanied by smaller economic benefits than "horizontal policies" focused on lowering corruption, improving governance and enhancing access to credit. Even when IPs may be desirable, horizontal policies are key. IPs are more effective in countries with better institutions, business environment, and financial market conditions, and a more educated workforce. Good institutions limit the capture of IPs by interest groups and facilitate their successful implementation. A strong business environment eases the flow of factors of production to targeted, fast-growing, firms, and pushes them to remain competitive. Efficient financial markets allow targeted firms to get a double boost to unlocking their potential, as IP support can be combined with private credit to seize profitable projects.

IPs can have unintended consequences, including cross-sector and cross-country spillovers, as well as large fiscal costs. IPs typically lead to the reallocation of resources to targeted entities, which may not be welfare enhancing if it is at the expense of more productive sectors or firms. For example, the analysis shows that the link between IPs and economic outcomes varies across firms, with negative impacts found for some firms. It also finds negative cross-sector spillovers when IPs target downstream sectors. Beyond domestic considerations, IPs can negatively affect trading partners by distorting relative competitiveness, thereby fueling a tit-for-tat dynamic and further economic fragmentation. This can erode the benefits for countries implementing IPs. Most export subsidies are prohibited under international trade rules. Thus, countries must carefully weigh the risk of escalating trade tensions, ensure the consistency of IPs with international rules, and prioritize multilateral policy cooperation. Finally, IPs can entail large fiscal costs, amplifying debt sustainability concerns.

In sum, IPs should be handled with care. Even focusing on their relative benefits, the links between IPs and economic performance are modest and depend on the presence of large distortions, limiting their use case. Further, IPs' costs can be large, and they can have unintended domestic and international consequences. Structural reforms appear to be better as they have larger effects than IPs, are less likely to create distortions or be subject to capture and have lower fiscal costs. They are also crucial to enhance IPs' success.

Introduction

Industrial policies, which had fallen out of grace for several decades, are now being re-adopted by governments around the world to address a growing number of complex challenges. For centuries, governments have pursued industrial policies (IPs)—policy interventions targeting sectors or firms directed at changing the structure of economic activity within a country—with the objective of boosting economic performance in selected sectors. IPs fell out of favor across most of the world in the late 1980s and early 1990s, after the mixed macroeconomic performance observed in many countries that pursued IPs in the years after World War II. Yet the economic ripples of the global financial crisis led to a slow buildup of IPs, a pattern that accelerated since 2017 amid heightened geopolitical tensions and calls for self-reliance in industries that are considered critical for national security reasons (for example, semiconductors), the seeming vulnerability of global value chains exposed by pandemic-related disruptions, and the imperative need to accelerate the green transition.

The merits and drawbacks of IPs have long been debated. IPs can help tackle market failures by fostering diversification, reaping the benefits of economies of scale, facilitating the provision of sector-specific public goods, or resolving collective action problems especially for new emerging industries. IPs' relevance is clear in the case of the climate transition, where emission externalities and low carbon technologies' newness can result, absent interventions, in a slower transition compared to what is socially desirable. But IPs entail fiscal costs and can lead to government failures ranging from corruption to misallocation of resources.

So far, the empirical evidence on IPs is mixed. The debate around the effectiveness of IPs has centered around two somewhat opposing narratives. On the negative side, there is the experience of Latin American countries with import-substitution, which, after two decades of favorable economic performance between the 1950s and the 1960s, have struggled to achieve high-productivity growth. On the positive side, there is the experience of Asian economies, such as Hong Kong SAR, Japan, the Republic of Korea, Singapore, and Taiwan Province of China, which focused on export-led growth and provided a blueprint for proponents of IPs. The divergent paths of Latin American and Asian economies have led many observers to stress the importance of design. For example, Cherif and Hasanov (2019) contrast the limitations of IPs focused on the development of domestic markets through import protection, which was the Latin American model, with the virtuous cycle fostered by the export-driven IP model pursued in Asia. Indeed, a growing literature establishes the positive impacts of IPs in Korea (Rodrik, Grossman, and Norman 1995; Choi and Shim 2024; Choi and Levchenko 2024, and Lane, forthcoming). The historical experience of countries that pursued IPs can provide a useful reference point to understand the conditions under which these policies can be effective. However, because most of the existing studies rely on country-specific and time-specific experiences, some of the results are not easily generalizable.

At the same time as IPs have gained momentum, structural reform efforts, which could be pivotal to ensure IPs' success, have waned. After the impetus of the 1990s, progress on the structural reform front has been slow and uneven across countries in recent decades due, in part, to lack of societal consensus (IMF 2024a). However, as the global economy grapples with structural economic weaknesses (lackluster growth, low fertility rates, and aging) and faces new challenges (for example, accelerating the green transition), the need for structural reforms has become clearer. Indeed, structural reforms bolster economic growth and employment (IMF 2019, Budina and others 2023), and help reduce emissions intensity of GDP (Budina and others 2023).

Moreover, anecdotal evidence and case studies suggest that structural reforms can be complementary to IPs, as governance and openness are important elements in the success of IPs (Cherif and Hasanov 2019).

Against this backdrop, this SDN studies the drivers of IPs in recent years, IPs' short- to medium-term economic impacts, and the link between IPs and structural reforms. The note combines data sources gauging competitiveness (proxied by revealed comparative advantage), firm performance (gauged by value added, TFP, payroll and capital accumulation), and innovation, via patent filings, with a comprehensive data set of recent IPs covering advanced economies (AEs) and emerging market and developing economies (EMDEs) to address the following questions: (1) *What factors shape IPs?* (2) *Do IPs, on average, improve the performance of targeted products/sectors?* (3) *How does the impact of IPs compare to that of structural policies?* (4) *What instruments and product/sectoral characteristics make IPs most effective?* (5) *What country characteristics (in particular, which structural reforms), enable more impactful IPs?*

The analysis, however, does not fully assess the welfare implications of IPs. This SDN aims at gauging the expected economic impacts of IPs on targeted sectors relative to non-targeted ones. Although this is an important dimension, it does not fully capture all the elements needed to establish the desirability of IPs. In this sense, this SDN provides a positive (that is, a factual, data driven) and partial assessment of the effectiveness of IPs, rather than a normative assessment gauging their welfare implications. Fully quantifying the merits of IP requires an analysis that accounts for the policy's objective, the fiscal implications of these policies, their potential impact on non-targeted sectors, and their cross-country spillovers. Some IPs may be aimed at achieving objectives that go beyond economic activity (for example, green IPs). Thus, assessing the effectiveness of such policies would require tracking the impact of the policy on the stated objective and linking that to the societal welfare. On the fiscal front, IP expenditures in the 2019–21 period in a sample of OECD countries amounted to about 1.4 percent of GDP (Criscuolo and others 2023). Thus, in the context of high debt levels, IPs can limit governments' ability to save and/or redeploy resources to tackle other challenges. IPs can also affect sectors or firms that are not targeted, through the reallocation of sales or resources to the supported entities. This action may not be welfare enhancing if IPs are not well targeted and this reallocation harms more productive sectors or firms. Moreover, the current geoeconomic landscape adds to the complexity. IPs can lead to cross-border spillovers, raising the risk of retaliation by other countries, which can ultimately weaken the multilateral trading system and worsen geoeconomic fragmentation. This, in turn, can also limit global welfare by stifling innovation incentives and the flow of new technologies across countries. These are important factors that need to be assessed when considering IPs and which, although not directly studied, are discussed throughout this SDN.

The note contributes to the literature in four areas. First, while previous studies assessed the impact of IPs on specific countries (Choi and Levchenko 2024, Lane forthcoming), specific industries (Goldberg and others 2024, Barwick, Kalouptsidi, and Zahur 2024), and specific outcomes like trade flows (Rotunno and Ruta 2024), this note provides a comprehensive assessment of how IPs affect a variety of economic outcomes leveraging a recent database by Juhász and others (2023) that covers a broad set of countries and industries from 2009 to 2022. Second, the analysis broadens the focus beyond the direct impact of IPs on targeted industries and gauges the transmission of such policies through input-output (IO) linkages. Third, this SDN complements the existing literature studying the factors that affect the effectiveness of IPs. The cross-country, cross-sector information in Juhász and others (2023) allows studying how sector-level and country-level characteristics, as well as the instruments used, modulate the impact of IPs on economic outcomes. Fourth, this SDN complements the existing literature by comparing the economic benefits of IPs to those of structural reforms and by assessing the role that structural reforms can play in amplifying the impacts of IPs.

This SDN first presents relevant stylized facts on the recent conduct of IPs across countries and discusses the merits and drawbacks of IPs. It then details results of analyses assessing the drivers of IPs and quantifying the link between IPs and economic performance. It goes on to provide a granular analysis of the impact of different policies, distinguishing between different instruments. It also studies how the impacts of IPs compare to those of other pro-growth policies and underscores the sectoral and country characteristics that make IPs most effective. Finally, this SDN discusses policy considerations in the design of IPs, including the salience of factors not tackled in the analysis.

The Rise of Industrial Policies: Recent Trends and Their Rationale

IPs are once again at the center of the policy debate around the world. IPs, broadly defined as policies explicitly seeking to affect the sectoral structure of an economy, were widely pursued until the mid-1980s. Their use was particularly common in EMDEs,[1] with the objective of protecting infant industries, supporting national champions, achieving economic diversification away from primary products, and breaking their dependence on AEs and geopolitically distant countries. The mixed track record of IPs and the wave of economic liberalization that emerged in the late 1980s and early 1990s, together with the ideological climate of the time, turned the tide away from IPs and toward horizontal policies. In recent years, however, IPs have made a comeback. The rapid development of strategic sectors with high growth and innovation potential, such as semiconductors and products related to the green transition, and growing geoeconomic fragmentation, have increased IPs' appeal.

Building on a comprehensive database recording trade-related IPs, this section documents recent trends in the use of IPs. The primary source of IPs used in this SDN is Juhász and others (2023). The database builds on the Global Trade Alert (GTA) project, which deploys an international network of policy experts to identify state policy measures and credible announcements that discriminate against foreign commercial interests since November 2008 (Evenett and Fritz 2020). Juhász and others (2023) define IPs as policies aimed at "shaping the sectoral composition of economic activity." In addition, GTA experts provide an assessment on each policy of whether it is discriminatory (protective policies), trade liberalizing, or neither. The rest of this SDN borrows the definition in Juhász and others (2023) and focuses primarily on protective IPs, leaving the analysis of trade-liberalizing measures for the discussion of the benefits of structural reforms. Given this, protective IPs are labeled as IPs when no clarification is needed. There are two main reasons to focus on protective measures. First, the current policy debate around IPs focuses mostly on trade restricting measures (for example, subsidies fostering domestic production). Second, most measures in the database are protective and the motivations and characteristics of liberalizing are less clearly defined compared to protective ones.

Importantly, the data cover a wide range of tariff and non-tariff measures and distinguishes between different instruments. The data identify seven broad categories of policy instruments: export barriers (for example, export bans and quotas); import barriers (for example tariffs and import licensing;, domestic subsidies (such as state loans, loan guarantees, and production subsidies); export incentives (such as tax-based incentives and trade financing); restrictions on foreign direct investment (FDI) (for example, ownership

[1] Examples include Latin America countries and East Asian countries such as Hong Kong SAR, Japan, Korea, Singapore, and Taiwan Province of China. Leipzinger and Petri (1993) illustrate examples of industrial policies (IPs) among advanced economies.

requirements and FDI screening decisions); procurement policies, and local content requirements.[2] The focus is primarily on three instruments that account for the bulk of IPs in the database—protective domestic subsidies, protective export incentives, and policies that lift import barriers (liberalizing import policies). Thus, in addition to its broad coverage, the Juhász and others (2023) database is useful due to its detailed information about the instruments being used. The data are aggregated at the product/sector, country, and year level.

Juhász and others (2023) data have the advantage of wide country, sector, and time coverage, making it a good source to assess the impacts of IPs across countries. Measuring IPs is challenging due to countries' diverse set of programs, instruments, sectoral targets, and limited data on spending.[3] Moreover, defining whether a policy is an IP is far from a settled matter. Because of these limitations, IP research has primarily focused on specific country (Lane forthcoming, Choi and Levchenko 2024) and sector (Goldberg and others 2024, Barwick, Kalouptsidi, and Zahur 2024) cases. Such targeted focus makes it hard to draw broad principles of successful IPs. More recently, there have been data efforts to record IPs for a broader set of countries and sectors, but they had either a short time dimension or limited country coverage. For example, the New Industrial Policy Observatory (NIPO) database (Evenett and others 2024) comprehensively monitors IPs in a large set of countries in the GTA data. However, NIPO coverage starts in 2023. Thus, the breadth of the Juhász and others (2023) database—which covers 109 countries between 2009–22—makes it an appealing data source, although with limitations. First, as in the case of GTA, it only records a subset of policy announcements—those affecting commercial interests, thereby limiting the scope of the analysis. Second, it starts in 2009, so the stocks of IPs are relative to that year. This may underestimate the stock of IPs in countries that were active before 2008 and introduced a small number of IPs since then. This may be particularly relevant for some large EMDEs with a historical record of state interventions. Third, it misses policies in key countries such as China because of the way these countries implement and record IPs.[4] Fourth, the machine learning techniques used in Juhász and others (2023) may misclassify some policies as IPs or miss some true IPs. Fifth, many policies lack information on the size of the program, thus most of the analysis relies on policy counts. These factors notwithstanding, the features of the data make it unique to study the impact of IPs on key outcomes. Moreover, this SDN tackles some of these concerns, and results are robust.

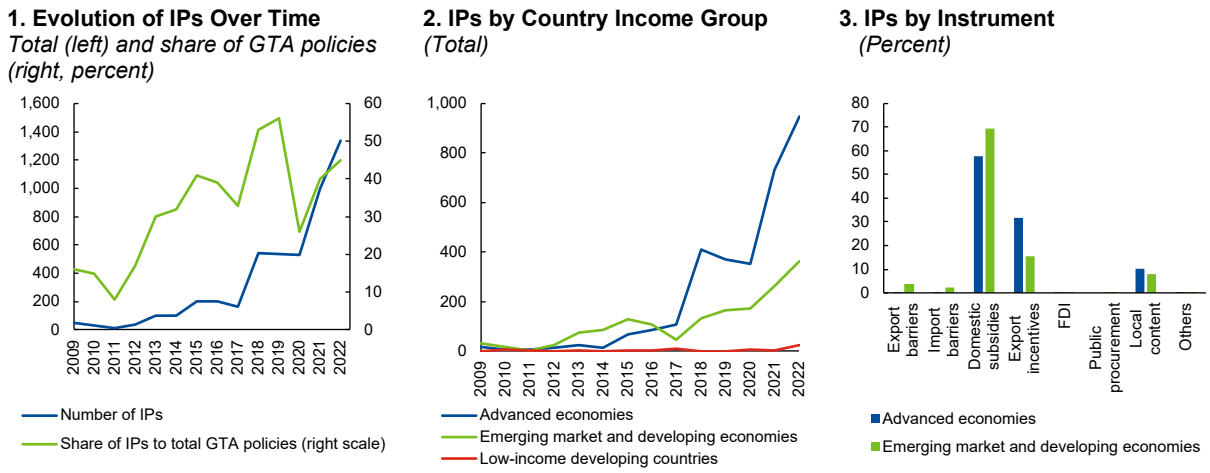
The Rise of Industrial Policies

The use of IPs has been on the rise since 2017 and accelerated since 2020. The total count of IPs stayed below 200 policies in the 10 years following the global financial crisis (Figure 1, panel 1). 2017 marked a turning point—the count of IPs tripled between 2017 and 2018, and by 2022 there were almost 1400 IPs. IPs also account for a larger share of GTA policies since 2017. Before 2017, IPs accounted on average for less than 25 percent of the total count of policies in GTA; this number rose to more than 35 percent in the 2017–22 period. The increasing use of IPs documented in Figure 1 is consistent with rising media coverage on the topic (Evenett and others 2024) and responds to multiple factors, including geopolitical tensions and conflicts (over territory, resources, and leadership in new technologies); the need to support new green technologies to tackle

[2] Broad categories are broken into narrow instruments. For example, export incentives include trade finance, export subsidy, tax-based export incentive, financial assistance in foreign market, and other export incentive.
[3] For example, Korea, which pursued what is perceived as a successful package of IPs, did so in stages, each using different instruments, targeting different sectors, and adapting to the specific needs of each period (Leipiziger and Petri 1993).
[4] Subnational policies are not recorded in the database even though they may be reflected in national plans. Similarly, incentives provided indirectly (for example, through subsidized loans provided by banks) may not be captured in the data.

climate change; and the economic effects of the COVID-19 pandemic, which highlighted supply chains vulnerabilities (Aiyar, Presbitero, and Ruta 2023, Evenett and others 2024).

Figure 1. Trends and Composition of Industrial Policies



Sources: Global Trade Alert (GTA); and Juhász and others (2023).
Note: FDI = foreign direct investment; IPs = industrial policies.

Both AEs and EMDEs have actively implemented IPs. The pervasive use of IPs predates the period of analysis, particularly in some large EMDEs with well-recognized data limitations on subsidies and other state interventions. In recent years, however, the number of IPs introduced by AEs rose substantially—from around 100 in 2017 to close to 1000 in 2022 (Figure 1, panel 2). There was also a continued rise in IPs among EMDEs—adding 350 interventions between 2017 and 2022. Consequently, the share of recently implemented active IPs by AEs rose since 2017.

The composition of IPs is different across country income groups. The GTA database records information on instruments and this SDN further classifies policies into eight broad instruments: export barriers, import barriers, domestic subsidies, export incentives, FDI measures, public procurement measures, localization content measures, and others. Zooming into the composition of IPs by instruments in the 2018–22 period, domestic subsidies were the most common IP, followed by export incentives (Figure 1, panel 3). There are, however, differences across income groups in the prevalence of these instruments. Subsidies account for almost 70 percent of IPs in EMDEs, while in AEs they account for close to 60 percent. Export incentives, on the other hand, are more commonly used by AEs (30 percent of IPs) relative to EMDEs (15 percent of IPs).

The Economic Arguments in Favor of IPs and Potential Pitfalls

The rationales for the use of IPs reflect economic and/or geopolitical arguments. Economic arguments in favor of conducting IPs are not new—they date as far back as the 1790s[5] and were particularly popular in the years after World War II—and can be grouped into six broad, non-exhaustive, categories (Harrison and Rodríguez-Clare 2010, Juhász, Lane and Rodrick 2023):

[5] Alexander Hamilton, then Secretary of the Treasury, argued in favor of industrial subsidies and protecting US manufacturing through tariffs in his 1791 address to Congress (Hamilton 1791).

- The first rationale is externalities and/or economies of scale, which arise when a sector's overall production generates external benefits for firms in the sector. This can occur, for example, when there are knowledge spillovers at sectoral level. One example of a sector displaying knowledge externalities/agglomeration effects is the software industry. When externalities are in place, a sector's productivity is tied to its size and the market yields inefficiently low production levels, which call for government intervention.
- Second, sector-specific fixed costs can make the financing of profitable projects reliant on external financing. This is the case, for example, when activities are R&D intensive. Such conditions, together with limits to access to credit, can lead to inefficient levels of entry, investment, and innovation.
- Third, coordination failures arising, for example, when the profitability of one producer depends on actions taken by other economic agents, can give rise to multiple equilibria, and government action can help the better equilibrium be achieved. For example, demand for electric vehicles (EVs) will depend on access to sufficient charging stations, and the supply of charging stations will depend on the size of the EV fleet (Box 1).
- Fourth, the need for activity-specific inputs (for example, ports, or sector-specific skills) may call for public investment. For example, exporting perishable agricultural products, such as fruits and flowers, requires the construction of refrigerated chambers in ports and airports to preserve the products' quality as they move from the point of production to the final consumer.
- Fifth, IPs can help countries diversify their economies (Harrison and Rodríguez-Clare 2010). Diversification can help countries move up the value chain, to products and processes with higher growth potential. It can also help countries reduce volatility, and as consequence, boost their investment and productivity (Acemoğlu and Zilibotti 1997, Koren and Tenreyro 2013).
- Finally, trading partner diversification resulting from IPs can help shield countries and global value chains (GVCs) from geopolitical risks. In fact, IPs are often justified through geopolitical lenses. For example, Korea's heavy chemical industry IP strategy of the 1970s was prompted by North Korea's military provocations and the partial pullout of the US troops from South Korea in 1971 (Ahn and Kim 1995, Lane forthcoming). More recently the CHIPS Act, an initiative to boost the manufacturing of semiconductors in the United States, was considered a response to the perceived artificial intelligence (AI) race between the United States and China.

However, implementation risks are a concern. Successful IPs require detailed information about externalities and other market failures. Thus, incomplete information can lead to the selection of the "wrong" sectors and/or inappropriate policies (sub-optimal policies). In addition, firms and interest groups could exert influence over the design of IPs, resulting in government resources being diverted to activities that enhance private interest and do not yield societal benefits. Thus, IPs' success is linked to a country's state capacity and bureaucratic quality (see Garcia-Macia and Sollaci 2024, IMF 2023). High-quality bureaucrats were, in fact, key to the success of Korea's export-oriented strategy in the 1965-90 period (Barteska and Lee 2024). A discussion of implementation pitfalls and how to avoid them is found in IMF (2024b).

The fiscal costs of IPs could be high. Most IPs involve financial support by the government, which means that they carry a fiscal cost. These costs may be justified by higher growth in the medium term to the extent that the interventions are successful. But IPs can also lead to wasteful spending, especially when they do not have clearly defined sunset clauses (EBRD 2024, IMF 2024b)[6] and, more broadly, accentuate fiscal sustainability concerns.

[6] EBRD (2024) shows that sunset clauses have been more commonly used in recent years, but IPs including sunset clauses still account for a small amount of all IPs.

IPs can lead to cross-sector spillovers, which can undermine their aggregate benefits. IPs induce the reallocation of factors of production toward targeted sectors and may impact other sectors. If this comes at the expense of more important sectors—that is, if IP is not well targeted—it may not translate into overall welfare improvements for the economy. This could be, for example, the case if IPs target a sector or product where the country is initially less competitive and far from the global frontier. Seeking to increase the lagging sector's competitiveness may require sustained support (which can be fiscally costly) and may come at the expense of other, more competitive, sectors, which may not necessarily be to the country's benefit.

Finally, IPs can spark retaliatory actions by other countries. The introduction of IPs can have adverse effects in other countries (Lashkaripour and Lugovskyy 2023; Hodge and others 2024) and this can lead to retaliatory policies (Lashkaripour and Lugovskyy 2023). For example, Evenett and Fritz (2021) show that the introduction of corporate subsidies in large countries was matched by subsidies in other large countries. Similarly, Evenett and others (2024) shows that IPs in one country are correlated with those in other countries, further reinforcing the evidence on tit-for-tat dynamics. Such dynamics can also take the form of higher tariffs, especially among countries with tighter fiscal space and can ultimately contribute to the ongoing process of economic fragmentation (Gopinath and others 2024).

The above discussion suggests that the appropriate use of IPs hinges on a careful assessment of their benefits, costs, and risks, as discussed in a recent IMF Policy Paper on industrial policies (IMF 2024b). The objectives and case for IPs, that is, for targeted interventions, should be clearly justified by the presence of well-identified market failures, including externalities. IPs should be well-targeted and temporary (with appropriate sunset clauses), and the desirability of IPs should be assessed against alternative policies (for example, structural "horizontal" policies) that could achieve a similar outcome. Design should be carefully thought out, as different instruments may affect different variables and entail different benefits, costs, and risks, and the success of IPs may require complementary structural policies. For instance, high-quality governance frameworks, which limit rent-seeking and political capture, are key to successful implementation. IPs should also be compatible with macroeconomic stability (debt sustainability as well as balance of payments and domestic stability) and with the country's legal commitments (for example, World Trade Organization (WTO) commitments). Based on these considerations, this SDN provides a rigorous empirical assessment of the link between IPs and the economic performance of targeted sectors, examining how it varies with the initial distortions present in the sector, the choice of policy instrument, and the quality of institutions. It also shows a comparison of the performance of IPs relative to alternative policies, namely structural reforms.

The Drivers and Economic Impacts of Industrial Policies

Assessing the risks and benefits of IPs requires detailed information and presents identification challenges. First, IPs' design entails multiple dimensions—targeting the right sectors, using appropriate instruments, and implementing the right levels of intervention, which complicates the empirical assessment of their appropriateness. For instance, while countries target sectors that display externalities, they seem to do so in an excessive degree (IMF 2024c; Garcia-Macia and Solacci 2024). Equally complicated is the evaluation of the economic impacts of IPs because of the endogeneity of IPs. For example, IPs may be pursued when economic growth is weak, or when a sector is ailing, meaning there could be reverse causality biases. There

may also be other factors that are not included in the econometric analysis (for example, the emergence of dominant global competitors), that may both lead to the introduction of IPs and affect sectoral performance. In such cases, econometric results could capture spurious correlations between IPs and sectoral performance.

This SDN relies on several data sources and employs a variety of econometric techniques to assess the impact of IPs on performance. To study the link between IPs and a country's trade patterns, it combines the data in Juhász and others (2023) with detailed, product level, trade data from CEPII BACI. Data to study the link between IPs and firm- and sector-level outcomes are from BvD Orbis, which reports detailed firm-level information for AEs and emerging market economies (EMs). Finally, data on patents come from LaBelle and others (2024). In all cases, the analysis spans the period between 2009 and the last year available for the outcome variable (mostly 2021). Country coverage varies by exercise. For trade and patent data, a large set of both AEs and EMDEs is included in the analysis. In the firm level analysis, country coverage is more limited and will focus mostly on AEs and EMs. The Online Annex provides details on the data and econometric methodology. Note that this SDN does not quantify the direct (fiscal) or indirect (through general equilibrium effects) costs of IPs. Moreover, despite efforts to tackle endogeneity concerns, results should be interpreted with caution as they can still be subject to biases.[7]

Correlates of IPs over the Past 15 Years

IPs target sectors with higher distortions and that are more connected to other sectors, especially in AEs. To study drivers of IPs, this SDN uses the distortion-centrality (DC) index by Liu (2019), which combines a sector's distortions with its interconnections with other sectors using IO tables.[8] The latter is important, as a sector's distortions can be amplified by its connections to the rest of the economy. To construct the DC index, this SDN uses markups within a sector (Ackerberg and others 2015)—a gauge of economies of scale—as the main measure of distortion.[9] The analysis is robust to using the sector's external financial dependence (Rajan and Zingales 1998) as an alternative measure. As discussed earlier, these two measures capture some of the ingredients involved in the conceptual rationales for IPs. In general, the two measures are correlated, and sectors like electricity production and biotech research rank high on both dimensions. The number of protectionist IPs targeting a sector correlates positively with its DC, with this relationship strengthening in recent years (Figure 2, panel 1). This finding is consistent with studies of the economic rationale for IPs (Liu 2019, Garcia-Macia and Solacci 2024). Moreover, the positive correlation between IPs and DC is stronger for AEs. These results suggest a consistency with economic arguments in favor of the use of IPs.

Geopolitical considerations also are at play in IPs. IPs are concentrated in products for which a country relies on imports from geopolitically distant countries, supporting the notion that IPs are also shaped by geopolitical considerations (Figure 2, panel 2).[10] Indeed, many IPs in 2023 have "national security" and "GVC resilience" as their stated objectives (Evenett and others 2024). This, together with the apparent "tit-for-tat" nature of IPs found in Evenett and others (2024) points to risks of IPs accentuating ongoing economic fragmentation (Gopinath and others 2024). The link between IPs and geopolitical distance is driven by AEs.

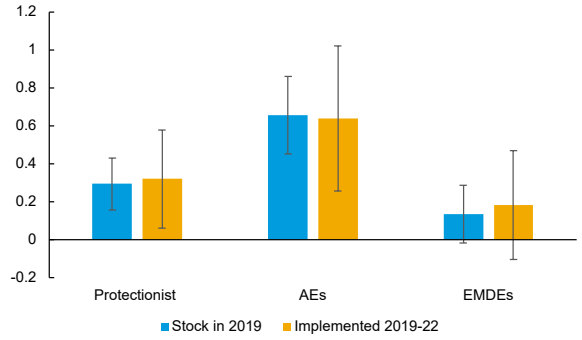
[7] See the Online Annex for a discussion of different strategies to address endogeneity.
[8] This SDN extends the analysis in Liu (2019) to 141 countries using IO data for 65 sectors from the Global Trade Analysis Project.
[9] The use of markups as proxies for economies of scale is consistent with the literature (Bartelme and others 2019).
[10] The analysis uses the geopolitical distance measure proposed by Bailey, Strezhnev, and Voeten (2017).

Industrial Policies and the Competitiveness of Targeted Products

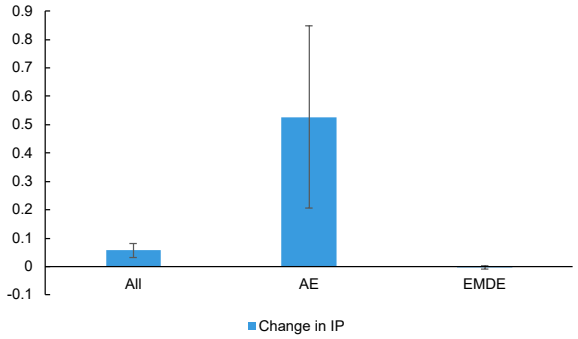
Turning to the relationship between IPs and economic outcomes, the introduction of IPs is associated with an increase in the trade competitiveness of the targeted products relative to non-targeted ones. The introduction of a new IP is associated, on average, with a 5.6 percent improvement in the competitiveness of the targeted product measured by its revealed comparative advantage (RCA)[11] three years after the introduction of the IP (Figure 3, panel 1).[12] Results are in line with recent findings that subsidies are associated with increased exports of targeted products (Rotunno and Ruta 2024). This vindicates a frequent motive stated by governments for pursuing IPs, which is to promote strategic competitiveness (Evenett and others 2024).[13]

Figure 2. Correlates of Industrial Policies

1. IPs and Distortion-Centrality
(Change in IPs)



2. IPs and Geopolitical Distance
(*Change in IPs*)



Sources: Bailey, Strezhnev, and Voeten (2017); BvD Orbis; and Juhász and others (2023).
Note: Panel 1 estimates the link between new IPs and the measure of distortion-centrality proposed by Liu (2019). Panel 2 estimates the relationship between IPs and the geopolitical distance weighted by imports. Whiskers are 90 percent confidence intervals. AE= advanced economies. EMDEs= emerging market and developing economies; IP = industrial policies.

The link between IPs and competitiveness is stronger for products with higher initial competitiveness, suggesting that distance to the technological frontier is key. Previously competitive products experience a large short-term boost in competitiveness after IPs are implemented. This positive association peaks after two years, but then declines and becomes statistically insignificant in four years, though the estimated magnitude remains as high as 9 percent (Figure 3, panel 2).[14] Patterns are reversed for non-competitive products, where competitiveness initially declines and then increases gradually, albeit non-significantly over the horizon considered. These results could reflect that initially uncompetitive products face short-term adjustment costs to become globally competitive. Alternatively, they could reflect that for IPs to be associated with improvements in RCA in products that are initially non-competitive, the country may need a set of fundamentals in place (for

[11] A product's revealed comparative advantage (RCA) is proxied by the Balassa index (see Online Annex for details). Despite drawbacks (Leromain and Orifice 2014), the index is suggestive of patterns of specialization. A value greater than 1 means that the country is a globally competitive producer. Results are robust to using an RCA index that incorporates imports.

[12] A local projection difference-in-differences approach is used, which addresses biases from estimating heterogeneous treatment effects under staggered treatment (Dube and others 2024). This is well suited for the analysis, as country-product pairs could receive multiple treatments at different points in time. For reference, the median number of IPs introduced by countries in a year is about 1, suggesting that the associations in Figure 3 are consistent with the patterns observed in the data. See Online Annex.

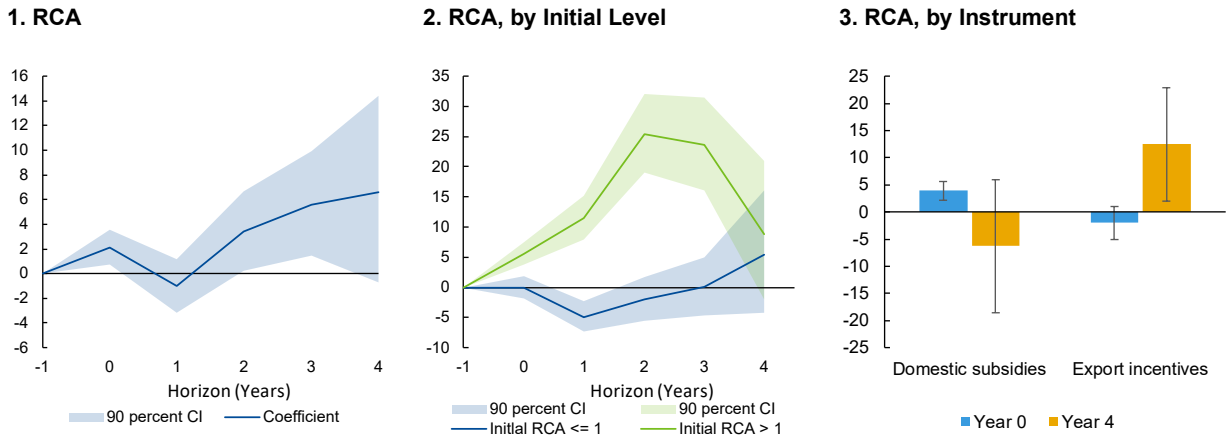
[13] Strategic competitiveness refers to "the promotion of domestic competitiveness or innovation in a strategic product or sector" (Evenett and others 2024). These are policies aimed at enhancing the productivity of a sector that is perceived as being underperforming. It was the most frequently stated motive in 2023 (Evenett and others 2024).

[14] The IP treatment dummy is interacted with a dummy taking value one if the RCA in the previous year was greater than one.

example, high levels of human capital). This would explain why "moonshot" projects may not be replicable in every country. Finally, the results could indicate that supporting uncompetitive products involves a higher risk of failure. These findings may rationalize why countries often target products with high comparative advantage (Juhász and others 2023), as such strategy may yield more immediate results and entail lower risk of failures (Reed 2024). Further, from a welfare point of view, targeting products where there is evidence of distortions and that are not too far from the global frontier may be desirable, as this may require small, time-bound, policy nudges and limit adverse spillovers on other, potentially competitive, sectors/products. However, other factors—such as potential dynamic gains from supporting newer sectors, especially those characterized by a high potential for further innovation and productivity growth—would also need to be considered.

Figure 3. Gauging the Impact of IPs on the Revealed Comparative Advantage of Targeted Products

(Percent)



Sources: Gaulier and Zignago (2010); Juhász and others (2023); and Global Trade Alert.
Note: The analysis is based on a local projection difference-in-difference method proposed by Dube and others (2023), in which the dependent variable is the log difference in RCA over the horizon considered and the independent variable is a dummy variable taking value one if the treated country introduces at least one IP. RCA is added to a small constant to take into account the prevalence of zeroes. See Online Annex for more details on the econometric specification. CI = confidence interval; IPs = industrial policies; RCA = revealed comparative advantage.

The relationship between IPs and competitiveness varies across policy instruments used. Domestic subsidies are linked to a short-term 5 percent increase in competitiveness, which fades over time. By contrast, export incentives yield an initial 1 percent decline in competitiveness, followed by medium-term improvements (Figure 3, panel 3). The choice of instruments thus presents policymakers with a trade-off between short- and long-run benefits. The short-term boost in competitiveness from domestic subsidies may be appealing to policymakers with a short-term horizon. However, both historical evidence and Figure 3 suggest that IPs focused on boosting exports may provide more sustained benefits. Indeed, the successful experience of export promotion strategies in East Asia underscores the importance of foreign orientation in the design of effective IPs (Aghion and others, 2015; Cherif and Hasanov, 2019). Export incentives encourage firms to improve performance to compete in the global market, a strategy that could bear fruits in the medium- to long-term (see Choi and Levchenko, 2024, for the case of Korea). The full assessment of such benefits, however, requires gauging the potential cross-sector, cross-country of such IPs.

Industrial Policies and Industry Performance

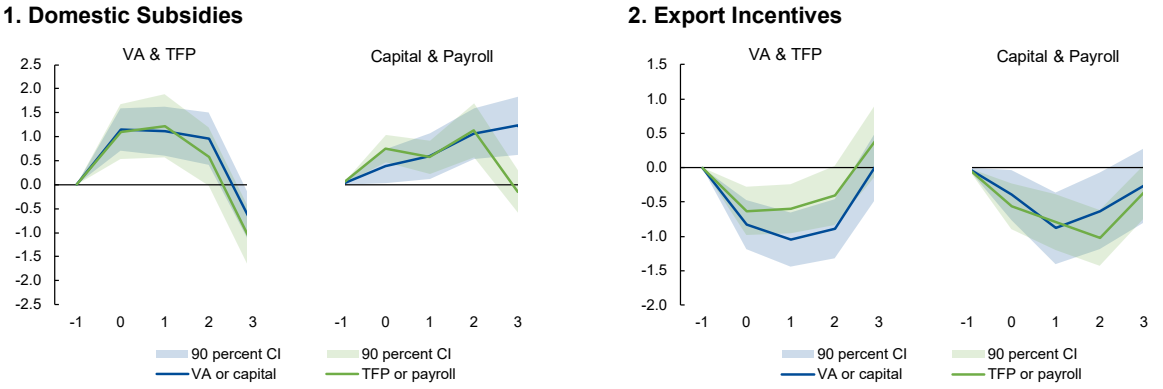
This SDN next studies the link between different IP instruments and economic outcomes at the sectoral level, providing a broader assessment than the product-level analysis. It tracks the response of five key

variables using the local projections method. First, it assesses how value added, investment, payroll and TFP respond to the introduction of IPs, both at the firm-level and at the aggregate sector level. Second, it studies the association between IPs and patents—a gauge of innovation. The main explanatory variable is the count of IPs implemented in a given sector, country and year. The exercise focuses on the targeted sector and includes a rich set of fixed effects and lags of the dependent and independent variables to control for potential omitted variables and to capture past dynamics in both IPs and the variables of interest. Because the analysis does not identify firms that are specifically targeted by IPs, it will capture both the potential direct effect of policies on targeted firms and the second-round impacts on other firms within the sector due firm-to-firm relations, competition in product and factor markets, and other potential externalities. As shown in the Online Annex, results are broadly robust to using a measure of IP that accounts for the share of trade in each sector affected by IPs—an attempt to measure IP intensity, to the exclusion of China, and to three exercises aimed at assuaging endogeneity concerns—an assessment of pre-treatment trends, a local projection difference-in-difference estimation, and an instrumental variables exercise.

At the industry level, domestic subsidies are associated with sustained increases in the capital stock and short-term increases in value added and TFP which turn negative in the medium term. An additional subsidy is associated with a sustained increase in the capital stock for the average firm and in the aggregate, albeit in the case of the aggregate it is not statistically significant (Figure 4, panel 1). In contrast, the links between subsidies and value added, productivity, and payroll are short-lived. At the firm level, subsidies are associated with short-term increases in all three variables which turn negative in the medium term. In the aggregate, value added shows a more sustained, albeit moderate, improvement associated with subsidies whereas productivity and payroll increases are temporary (Figure 5).[15] The short-lived link between subsidies and firm-level outcomes may reflect their short duration (about 3 years) or signal that subsidies are mistargeted and do not generate positive medium-term externalities. Regardless of the explanation, evidence suggests that temporary subsidies do not lead to a self-sustaining virtuous cycle. In fact, IPs have been found to negatively affect non-targeted firms in Europe (Brandao-Marques and Toprak, 2024).

Figure 4. Industrial Policies and Firm-Level Performance, by Instrument

(Percent)

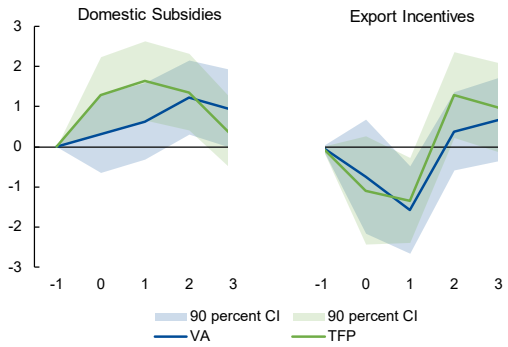


Sources: BvD Orbis database; and Juhász and others (2023).
Note: All panels estimate the impact of IPs using the local projection method. The dependent variable is the log difference of the firm-level variable over the specified horizon, while the key independent variable is the change in the number of IPs targeting a sector in a country. See Online Annex for more details on the econometric specification. CI = confidence interval; IPs = industrial policies; TFP = total factor productivity; VA = value added.

[15] In the medium term, domestic subsidies are associated with 1 percent increase in value added. These are relatively small effects, as the average yearly growth rate of industry value added is about 5.4 percent.

Export incentives are associated with mild improvements in TFP in the medium term, after a period of adjustment in the short term. One common aim of IPs is to help firms access international markets, enabling economies of scale over time that could not otherwise be achievable through domestic markets alone (Reed 2024). Indeed, outward orientation and export growth are considered key ingredients in the seemingly successful IP cases in East Asia (Cherif and Hasanov 2019, Choi and Levchenko 2024). There is a mild positive medium-term association between export incentives and productivity after a period of adjustment (Figure 4, panel 2). However, there are short-term costs—an additional export incentive policy is associated with 0.5 percent lower productivity for the average firm in the first two years after implementation. In the case of value added and capital, the recovery in the medium term does not fully compensate the initial decline, at least at the considered horizon. Aggregate sectoral results point to similar dynamics (Figure 5). Taken together, these results suggest there could be potential adjustment costs firms must undertake in the short term to upgrade product and input quality to compete abroad (Bustos 2011, Bastos, Silva, and Verhoogen 2018). Results may also reflect the fact that export incentives target a small number of highly productive firms (Bernard and others 2007; Fernandes, Freund, and Pierola 2016). Indeed, the short-term adjustment costs of export incentives are accompanied by an improvement in within-sector allocative efficiency (Figure 6, panel 3). Finally, they could reflect that export incentives, by virtue of running counter to WTO rules, may trigger retaliation by other countries, thus affecting sectoral performance. This is an important caveat to the use of export incentives. However, Korea's export-driven IPs improved firms' performance over a much longer 30-year horizon, indicating that outcomes may improve further over the long term (Choi and Levchenko 2024). Export incentives can be combined with "soft" export-oriented interventions, which the literature has found to be effective tools to boost the growth of key sectors, and potentially of the overall economy, without some of the risks of "heavy" IPs (IDB 2014, Harrison and Rodríguez-Clare, 2010). These interventions can be important to alleviate coordination problems and resolve informational frictions, and include investments that lower trade costs, the provision of sector-specific infrastructure, credit and insurance for exporters, or lowering information costs about export markets through the establishment of export promotion agencies.

Figure 5. Industrial Policies and Sectoral VA and TFP, by Instrument
(Percent)



Sources: BvD Orbis database; and Juhász and others (2023).
Note: The figure estimates the impact of IPs using the local projection method.The dependent variable is either the log difference in sectoral value added or TFP over the specified horizon, while the key independent variable is the change in the number of subsidies or export incentives targeting that sector. See Online Annex for more details. CI = confidence interval; IPs = industrial policiesTFP = total factor productivity; VA = value added.

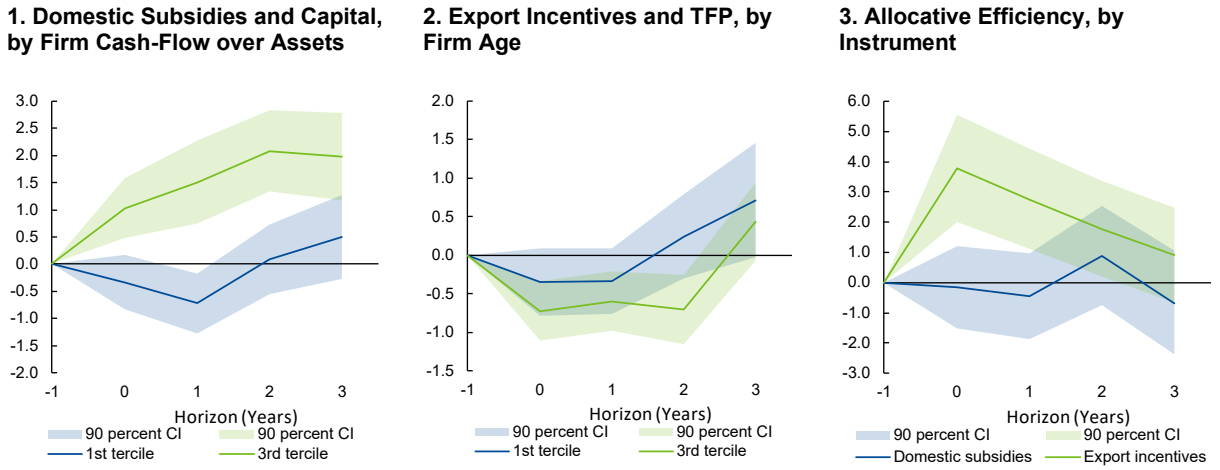
The link between IPs and economic outcomes varies at the firm level, with younger and more financially constrained firms benefitting more, highlighting potential within-sector spillovers. IPs typically target specific firms, especially those that are perceived to face larger frictions (Juhász and others 2023). While the data do not identify targeted firms, firms can be split based on age and financial frictions, two potential targets of policymakers.[16] Capital accumulation responds more strongly to subsidies in financially constrained and young firms: one additional subsidy in a sector is associated with a 2 percent increase in the

[16] Firm-level financial constraints are proxied by the cash flow to assets ratio. Results are robust to using the leverage ratio.

capital stock of firms with the largest cash flow to assets ratio (a measure of financial constraint) and a 3.6 percent increase in the capital stock of younger firms three years after announcement of the policy (Figure 6, panel 1). This suggests that, in the context of IPs, state loans and financial grants can play an important role in alleviating financial constraints of new firms. Similarly, the positive association between export incentives and firm performance occurs faster for younger firms, suggesting that export incentive programs target new firms and potentially reallocate resources away from incumbents in both domestic and foreign markets. In the medium term, one additional export incentive measure is associated with 0.7 percent increase in productivity and value added of young firms (Figure 6, panel 2). These gains take time to materialize as new firms increase scale, establish links to foreign customers and incorporate foreign technology into their production processes. The positive link between IPs and the economic outcomes of younger, financially constrained firms, is consistent with the fact that smaller firms, typically more financially constrained, experience stronger growth after being targeted by IPs in Europe (Criscuolo and others 2019). Taken together, results show there are winners and losers from IPs in the targeted sector, consistent with Brandao-Marques and Toprak (2024). This, in turn, should be an important consideration when assessing the aggregate welfare implications of IPs.

Figure 6. Gauging the Heterogeneous Impact of IPs across Firms and Its Link to Sectoral Efficiency

(Percent)



Sources: BvD Orbis database; and Juhász and others (2023.

Note: The dependent variable is the log difference in the variable of interest over the horizon considered; the key independent variable is the change in the number of subsidies or export incentives targeting a sector in a country. In panels 1 and 2, the coefficient for each industrial policy is allowed to vary by firm characteristics. This is accomplished by interacting the change in industrial policies (IPs) with dummies indicating whether the firm lies in the first, second, or third terciles of the distribution. For simplicity, only the first and third terciles are plotted. See Online Annex for more details. CI = confidence interval; TFP = total factor productivity.

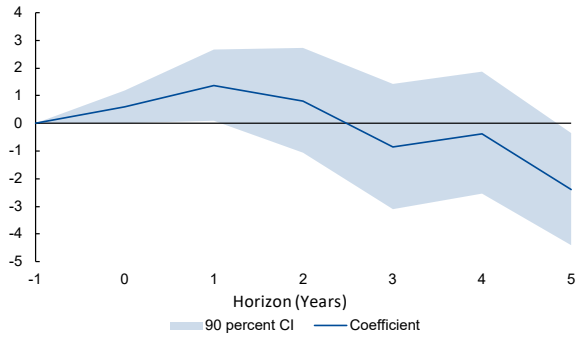
The positive impact of export incentives across firms is associated with improvements in the allocation of resources within sectors. IPs can affect efficiency at the sector level by inducing a reallocation of resources across firms. To the extent that IPs allow a reallocation toward more productive firms that are potentially facing larger barriers and distortions, they can improve efficiency. Indeed, in the short term, new export incentives and allocative efficiency—as defined by Hsieh and Klenow (2009)[17]—are positively associated (Figure 6, panel 3). This could be potentially linked to the fact that, while in the short-term the average firm in the economy loses, high-productivity exporters are benefiting, thus leading to sector-level efficiency gains. Subsidies, on the other hand, are not robustly associated with changes in efficiency. Note that

[17] This notion captures a broader set of channels through which IPs may affect within-sector efficiency compared to those focused on specific observable characteristics of the firm, such as age and financial frictions.

the short-term efficiency gains suggested by Figure 6, panel 3, are only within-sector, that is, they do not reflect changes in efficiency arising from cross-sector reallocations of resources. A full assessment of the aggregate efficiency implications of IPs would need to consider such cross-sector reallocations.

Turning to innovation, IPs are linked to a temporary boost in patenting, mostly through received technological transfers. An additional IP in a sector is associated with a 1.4 percent increase in received foreign patent applications in the short run, followed by a medium-term decline (Figure 7). The association could be driven by foreign inventors seizing the opportunity to benefit from the IP. Moreover, the rapid and short-lived effect suggests that protectionist IPs may accelerate patent applications for innovations already in the pipeline rather than support the development of new innovations. Subsidies and export incentives mainly drive this positive effect. Indeed, an additional protectionist subsidy is associated with a 2 percent increase in the number of received foreign patent applications in the first year which does not last beyond the second year. Export incentives are associated with a temporary effect of the same size that only materializes in the second year. Patents filed by local inventors, on the other hand, do not seem to increase with IPs. This could reflect the potentially long duration of innovation processes, the expected short duration of the subsidies, or the capture of subsidies by incumbent firms which use them to buy out potential competing innovators. In the United States, inventors are increasingly hired by large incumbents who take advantage of subsidies and offer higher wages (Akcigit and Goldschlag 2023). The resulting lower inventors' productivity suggests that inventors may be hired for strategic reasons to reduce competing innovation. Thus, consistent with Figure 6, targeting young, financially constrained firms may be an appropriate IP strategy if the goal is to boost productivity.

Figure 7. Industrial Policies and Sector-Level Count of Patents Filed by Foreign Inventors
(Percent)



Sources: Juhász and others (2023); and Labelle and others (2024).
Note: The figure shows estimates of the impact of industrial policies (IPs) following the local projection method, in which the dependent variable is the log difference of sector-level patents filed by foreign inventors over the horizon considered and the variable of interest is the change in IPs targeting a sector in a country. The specification relies on an instrumental variable strategy to tackle potential endogeneity concerns. See Online Annex for more details on the econometric specification. CI = confidence interval.

Industrial Policies versus Structural Policies

Structural policies provide a good benchmark to assess the economic impact of IPs, as they aim at tackling key frictions, yield sizeable economic dividends and entail lower costs. An important consideration when evaluating the use of IPs is whether alternative policies can yield similar benefits at a lower cost. A good benchmark to compare IPs to are structural policies, especially those aimed at improving the business environment by streamlining business regulations, or those aimed at improving the functioning of credit markets. As with IPs, structural policies aim at tackling key frictions hampering growth and productivity. However, in contrast to IPs, these policies target economy-wide frictions. As such, they do not discriminate across sectors: they change factors (legislation, institutions) affecting the whole economy (horizontal policies), although their effects could be differentiated across sectors. Such policies yield sizable economic dividends, and their effectiveness does not rely on precise information about distortions and other sectoral characteristics (Budina and others 2023; IMF 2019). Moreover, in contrast to IPs, most structural policies likely entail lower fiscal costs, and some can even enhance tax collection, an important consideration at a time when fiscal sustainability considerations are key (IMF 2024d; Aligishiev and others 2023). By not targeting specific sectors,

structural policies are also expected to create lower distortions, thus mitigating concerns about welfare reducing reallocations.

Structural policies expanding access to credit and improving governance by tackling corruption deliver, on average, better results than IPs and entail smaller fiscal costs and lower risks of generating distortions. This SDN compares IPs and selected[18] structural policies by leveraging information on cross-industry measures of distortions and cross-country measures of structural policies, in the spirit of Rajan and Zingales (1998). Structural policies were found to have positive impacts on overall economic activity (Budina and others 2023) and these positive effects are expected to be shared across sectors. Further, some structural policies are more effective than IPs at addressing distortions.[19] For example, improvements in the functioning of credit markets can affect disproportionately sectors which rely more on external financing. To be sure, a comparison of IPs and structural reforms is challenging. The analysis follows Rajan and Zingales (1998) and focuses on the association between the sectoral value added and a large change in the policy variable of interest (equivalent to moving a country from the 25th percentile of the sample distribution to the 75th percentile of each policy variable).[20] Results in Figure 8, panels 1 and 2 illustrate how improvements in financial development and in governance have a disproportionate impact on sectors with high levels of distortions relative to those with low levels of distortions, and this differential impact is larger than the one seen for IPs. The same does not apply to reforms streamlining business regulations, which seem to have a more even positive effect across sectors.

Relatedly, trade-liberalizing IPs—those that reduce trade restrictions—are associated with higher firm productivity and value added in the medium term, with negligible change in the stock of capital. In addition to policies restricting trade flows, the GTA data records policies that are deemed to foster them. This happens, for example, when countries remove trade barriers affecting a product. An additional liberalizing policy is associated with improved medium-term performance of firms: 1.6 percent higher productivity, 1.2 percent higher value added, 0.8 percent more payroll (a proxy for wages and employment), and 0.4 percent more capital stock although the latter is not statistically significant (Figure 8, panel 3).[21] The positive association between liberalizing trade conditions and firm productivity and value added relates to a long-standing literature on how lower trade barriers can strengthen competition in the liberalized sectors, inducing firms to leverage economies of scale, improve efficiency, and innovate (Helpman and Krugman 1985; Melitz 2003, Aghion and others 2005). Differently from export incentives and domestic subsidies, which are targeted in nature, liberalizing trade barriers yield a uniform impact across firms within the targeted sector. The results are in line with the finding that industrial subsidies targeting high-externality sectors yield smaller welfare gains compared to trade liberalizing measures such as broad-based tariff reductions (Bartelme and others 2019).

Lowering import barriers also favors technological transfers in the medium and long term. Although well-targeted protectionist IPs may temporarily boost received technological transfers, lifting trade-restricting policies

[18] The analysis focuses on policies on governance and access to credit. These are tightly linked to the frictions considered in the analysis. Studying other policies, such as labor market regulations, is challenging due to lack of variability in the data.

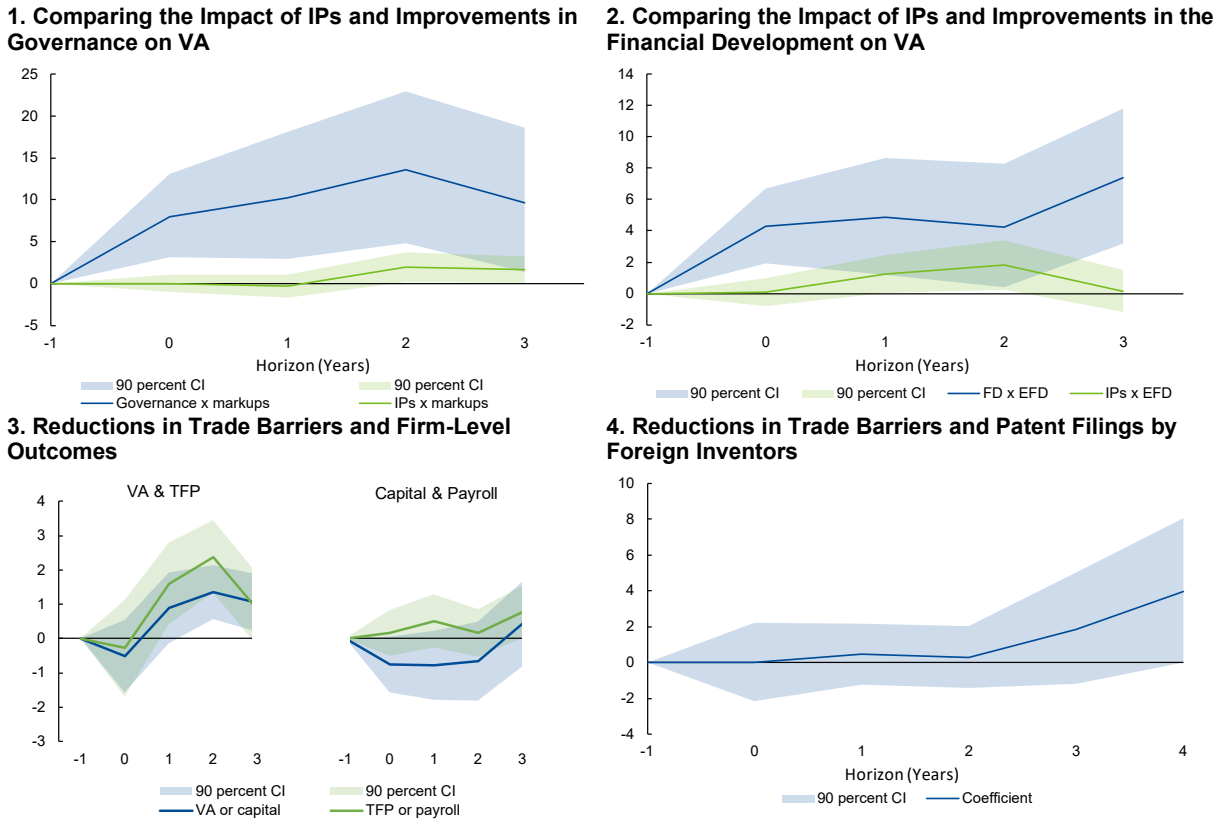
[19] This difference-in-difference approach is used to address the potential reverse link between growth and structural reforms. In such setting, the effect of improvements in structural policies is absorbed by country-year fixed effects. Thus, the analysis compares the differential impact that IPs and structural policies have on sectors with large distortions relative to sectors with low distortions.

[20] Results are qualitatively similar (and differences statistically significant) when comparing a one standard deviation change in each policy variable. Note that the exercise does not assess the costs of implementing IPs versus structural reforms, and the changes in each policy variable considered in the exercise may entail different levels of effort and costs which limits their direct comparability.

[21] Note that there is an adjustment period in the short-term. The same is seen when studying broad-based tariff reductions.

unlocks larger and potentially longer improvements. Lifting an additional import barrier increases the number of received patent applications by 5 percent on average after four years (Figure 8, panel 4). This result highlights the importance of appropriate targeting and trade flows for long-term innovation.

Figure 8. Industrial Policies, Structural Reforms, and Reductions in Trade Barriers *(Percent)*



Sources: BvD Orbis database; Juhász and others (2022); and Labelle and others (2024).
Note: In panels 1 and 2 the dependent variable is the log difference of the sectoral-level value added over the horizon considered and the variables of interest are the interaction between the change in industrial policies (IPs) and sectoral characteristic (markups or external financial dependence) and the interaction between the same sectoral characteristics and the structural variables (business environment or financial development). Panel 3 tracks the relationship between the log difference of each firm-level outcome over the horizon considered and changes in the number of of liberalizing trade IPs. In panel 4 the dependent variable is the log difference of sector-level patents over the horizon considered and the variable of interest is the change in liberalizing trade IPs. See Online Annex for more details. CI = confidence interval; EFD = external financial dependence; FD = financial development; IPs=industrial policies; TFP = total factor productivity; and VA = value added.

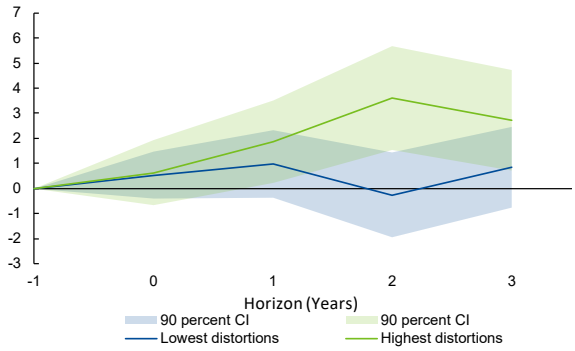
Conditions under Which IPs are Associated with Larger Economic Impacts

IPs targeting sectors with higher levels of distortions are associated with stronger performance. There is a stronger relationship (at the firm and sectoral level) between IPs and value added in sectors with high markups and high external financial dependence (for example, ship building and manufacturing of pharmaceutical products) than in sectors with low markups and low external financial dependence (for example, manufacturing of bicycles or non-electric domestic appliances). An additional protectionist IP is associated with a 4 percent increase in value added of highly distorted sectors in the medium term but no increase in value added of sectors with low distortions (Figure 9). Note that the proxies of distortions used are

sector-level variables, which strip-out country-specific factors, addressing concerns that they are a byproduct of country-specific distortive policies rather than technological characteristics of the sector. [22]

Sectoral distortions are particularly relevant for sectors associated with the green transition, making them more appealing targets of IPs (Box 2). There are two justifications for IPs targeting products associated with the green transition ("green products") in addition to traditional arguments—the need for coordination due to the novelty of these technologies and emission externalities. Evidence shows that IPs targeting green products are associated with a larger increase in competitiveness and innovation than those that target other products. For example, IPs targeting green products yield a larger medium-term increase in RCA compared to IPs targeting non-green products. Similarly, IPs motivated by climate change concerns are linked to a gradual and persistent increase in innovation from local inventors, with effects being larger than those found for other IPs.

Figure 9. IPs and Sectoral Value Added: The Role of Sectoral Distortions
(Percent)



Sources: BvD Orbis database; and Juhász and others (2023).
Note: Results of a local projection estimation where the dependent variable is the log difference in sectoral value added. Industrial policies' (IPs') coefficient is interacted with both sector-level markups and external financial dependence. The figure plots the interactions evaluated at the 75th percentile of each distortion (high distortion) and at the 25th percentile (low distrotion). See Online Annex for details. CI = confidence interval.

Beyond sectoral characteristics, IPs are more strongly associated with economic performance in countries with better policy fundamentals. Structural fundamentals such as governance quality or a good business environment could enhance the link between IPs and firm performance by reducing the risks of rent-seeking behavior and improving the targeting (Cherif and Hasanov 2019, Criscuolo and others 2022, Criscuolo, Lalanne and Díaz 2022, Garcia-Macia and Solacci 2024, IDB 2014). Other structural variables, such as a more educated workforce, can enhance learning-by-doing and innovation sparked by well-crafted IPs. Indeed, firms in countries with a better business environment experience higher capital accumulation in the short-term in response to IPs and those with more developed credit markets experience larger medium-term benefits compared to those in countries with weaker fundamentals (Figure 10, panel 1). Firms in countries more open to trade and capital flows see higher accumulation of capital when IPs are introduced, but differences relative to countries with low openness are not significant. Also, firms in EMDEs with better governance and higher human capital experience higher value-added growth after the implementation of IPs, especially in the short term (Figure 10, panel 2).[23] The complementarity between IPs and structural factors is particularly relevant for EMDEs, suggesting that the introduction of policies to enhance fundamentals may be an important pre-condition to ensure IPs' success, even in cases where they are desirable. This is consistent with Deléchat, Melina, and Newiak (2024).

IPs targeting upstream sectors are linked to improved outcomes in downstream sectors. The effects of IPs are expected to propagate across sectors through IO relations. For example, IPs that improve the

[22] The results are based on local projection methods. This SDN pursues a two-step approach to construct sectoral distortions that are common across countries. This filters out country-specific drivers of distortions. Details are found in the Online Annex.

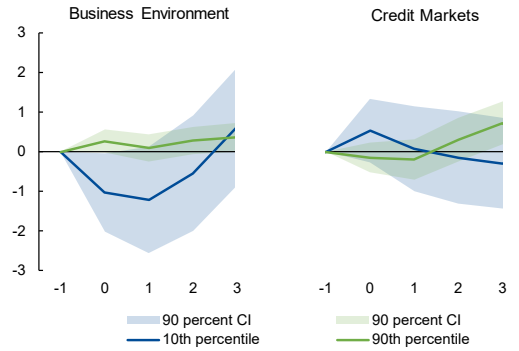
[23] The exercise defines high and low levels as the 90th percentile and 10th percentile of the emerging market and developing economies (EMDEs) distribution of each variable, respectively. These are computed using the full sample of EMDEs; thus, the numbers in Figure 10 show out-of-sample values.

productivity of input suppliers may benefit end users. Potential positive cross-sectoral spillovers are a common reason for the use of IPs (Harrison and Rodríguez-Clare 2010). Targeting upstream activities is particularly relevant in the presence of coordination problems, where investments in downstream activities hinges on the provision of high-quality inputs. IPs targeting upstream sectors, thus, can generate a virtuous cycle and "push" the economy to higher growth (Choi and Shim 2024). To capture spillovers, the firm-level analysis includes a measure of exposure to IPs in upstream and downstream sectors. Results show that the position of IPs along the supply chain affects how they are linked to firm performance (Figure 11, panel 1). Upstream IPs are linked to increases in firm productivity, value added, and capital stock. On the other hand, by potentially increasing the productivity of buyers, which now produce using less inputs, downstream IPs are negatively associated with firm performance. Results suggest that IPs in upstream sectors may benefit the economy more widely than IPs targeting downstream sectors. Note that, in general, some downstream sectors could face distortions and IPs could be desirable. This is the case when network externalities on the demand side are present (see Box 1 for EVs example). Further, both upstream and downstream liberalizing IPs (those fostering trade) are positively associated with firm performance in the medium term, despite short-term adjustments as firms create new relationships with their foreign counterparts (Huneeus 2020).

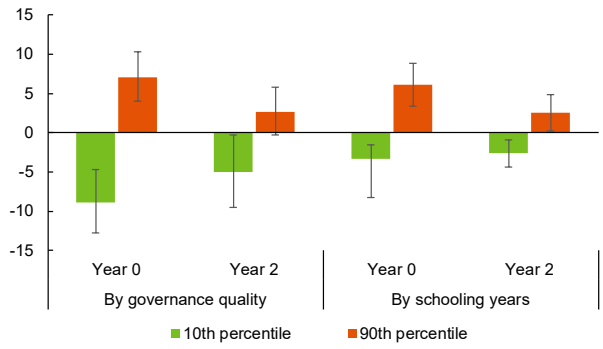
Figure 10. Industrial Policies and Country Fundamentals

(Percent)

1. IPs and Capital, by Business Environment and Credit Market Conditions



2. IPs and VA in EMDEs, by Governance and Education



Sources: BvD Orbis database; and Juhász and others (2023).

Note: The figure estimates the impact of industrial policies (IPs) using the local projection method. The dependent variable is the log difference of the firm-level variable of interest over the horizon considered. See Online Annex for more details on the econometric specification. CI = confidence interval; EMDEs = emerging market and developing economies; VA = value added.

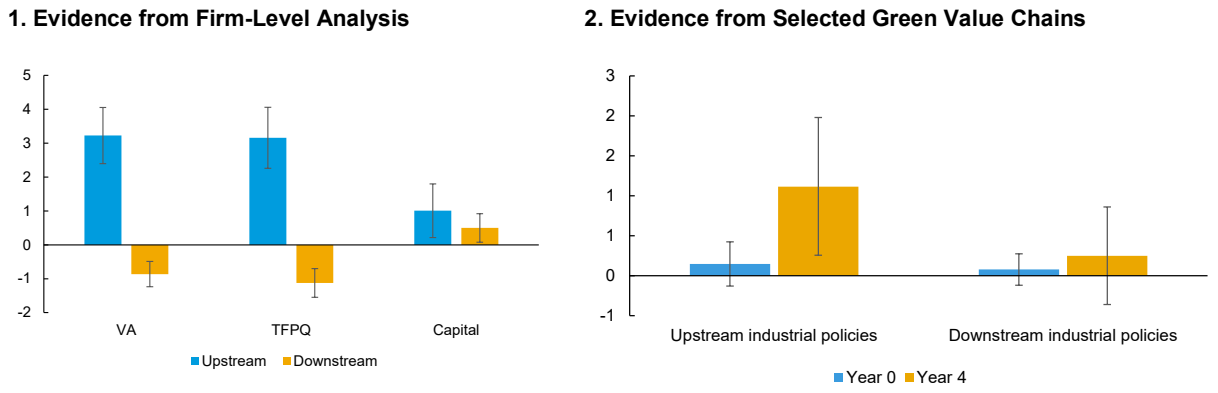
IPs targeting upstream products in the major green value chains (wind turbines, solar panels and EVs) go hand-in-hand with improvements in the competitiveness of downstream products. IPs targeting upstream products, as defined by Rosenow and Mealy (2024), are linked to stronger improvements in RCA relative to those targeting the same stage of the value chain, while downstream IPs show more moderate results that are not statistically significant (Figure 11, panel 2). Intuitively, upstream IPs may alleviate capacity constraints and benefit downstream products through reductions in input costs. This finding is consistent with empirical evidence considering generic IO production networks—for instance, Lane (forthcoming) for the case of Korea, as well as the firm-level evidence in Figure 11, panel 1.

Policy Considerations and Conclusions

IPs have taken center stage in the global policy debate. Growth prospects across the world remain subdued, raising the stakes for searching policies that can accelerate growth. At the same time, the pandemic

and the global value chain disruptions that ensued, sparked interest in seeking vehicles to make GVCs more resilient by diversifying production locations. Ongoing geopolitical fragmentation has also raised the issue of economic security in key sectors. Moreover, countries are trying to take a leading role in the development of new technologies with a large potential for economic benefits (AI, the green transition) or strategic and military value (microchips). Against this backdrop, IPs have become a hot topic in policy circles.

Figure 11. Industrial Policies along the Value Chain
(Percent)



Sources: BvD Orbis database; Gaulier and Zignago (2010); Juhász and others (2023); and Rosenow and Mealy (2024).
Note: Panel 1 shows estimates of industrial policies' (IPs') impact along the value chain following the local projection method, where the dependent variable is the log difference in the variable of interest three years after the policy change. Panel 2 tracks IPs' impact on upstream and dowsntream activities, focusing on the electric vehicle, solar panel, and wind turbines value chains. See Online Annex for more details. TFPQ = total factor productivity quantity; VA = value added.

IPs can improve economic outcomes under certain conditions, but structural policies typically yield larger benefits and entail lower costs, suggesting that the use of IPs should be handled with care. IPs are on average associated with smaller economic benefits compared to economywide policies improving the functioning of the economy (horizontal or structural policies). To be sure, sectoral characteristics could amplify the link between IPs and economic outcomes. IPs targeting highly distorted sectors, as reflected by high markups (a sign of monopolistic competition) and high external financial dependence, are linked to improvements in value added four times as large as those for IPs targeting sectors with low levels of distortions. However, establishing the desirability of IPs, even well-targeted ones, requires a careful assessment of costs (both fiscal costs and through general equilibrium effects) and risks (such as exacerbating geopolitical tensions).

In cases where IPs' desirability is clearly established, the evidence presented in this SDN suggests that the design of IPs should follow six broad principles, consistent with recent IMF guidance (IMF 2024b):

- **IPs should be clearly targeted, carefully assessing benefits, potential cross-sectoral spillovers, and alternative policies.** Policymakers must clearly identify market failures that could make IPs the appropriate policy lever. There are cases, such as green activities, where market failures are clear. In other cases, identifying the problem to be fixed is less clear cut. As a further consideration, the targeting of upstream activities appears to yield larger economywide benefits compared to downstream ones, as the benefits of reducing distortions in upstream sectors propagate through inter-sectoral linkages. Targeting should also consider cross-sectoral impacts through factor reallocation, which could hamper the growth prospects of other sectors. This reallocation could reduce aggregate welfare if IPs are not well targeted, and the reallocation happens at the cost of more productive or promising sectors. For example, targeting products where the

country is already close to the global frontier yields faster and larger improvements while targeting products where the country is not competitive entails more uncertain gains and may require a longer period of government support. Finally, IPs' benefits must be compared to those of alternative policies carrying lower costs and implementation risks. This is particularly important given the potential growth dividends of structural policies.

- **IPs require good governance and implementation capacity. IPs' success requires detailed information on the part of the policymaker.** Collecting and acting upon such information relies on a strong, well-trained, bureaucratic apparatus. For example, capable public servants played a key role in Korea's successful experience. Moreover, IPs are exposed to capture by private or political interests, which can be particularly detrimental if IPs favor firms with low growth potential at the expense of those with high potential. The complementarity between IPs and governance means that policies that yield benefits in countries with strong institutional capabilities may be ineffective or harmful in countries without them.
- **Structural reforms are key to maximizing the likelihood of IPs' success.** The chances that temporary, targeted interventions ignite sustained growth hinge on a well-functioning business environment (with good governance and low entry costs) and a well-developed credit market. Such factors are key for firms to remain competitive and innovative in the aftermath of the intervention. Even when IPs are desirable, they should be accompanied by structural policies and by the development of strong fundamentals. In EMDEs, IPs' impact is found to be larger when countries have a more skilled work force, suggesting that key pre-conditions must be in place for IPs to succeed. Thus, a sequential approach, where countries underpin structural factors first and target sectoral distortions through IPs at a later stage may be appropriate for EMDEs.
- **Not all IPs are equal, and the choice of instruments is crucial.** Subsidies yield only short-term benefits. This could be related to mis-targeting, where the government "picks" the wrong firms in the sense that they cannot thrive without support; it could be the result of subsidies fostering an inward-oriented growth strategy, which limits the potential for scale economies and learning-by-doing; or could be the result of capture. By contrast, export incentives and, more broadly, an outward-oriented strategy, are an important element in successful cases of IPs. A drawback of export incentives: they are forbidden under WTO rules and could spark retaliation, potentially eroding their benefits. In some cases, "soft" interventions such as investments that lower trade costs and export promotion agencies that lower informational costs about export markets have been found to be effective tools to boost the growth of key sectors.
- **The fiscal costs of IPs must be considered in the cost-benefit assessment.** Compared to structural policies, IPs, especially subsidies, may entail significant fiscal costs. These costs can be large when policies lack clear sunset clauses or are captured by rent-seeking firms. In this sense, even when IPs are clearly desirable, implementation should be time-bound. Moreover, amid high debt levels, IPs must internalize the potential risks of exacerbating sovereign risks that could weaken growth prospects.
- **International cooperation could help mitigate the costs arising from spillovers and enhance the benefits of IPs.** By affecting competitiveness and export prices, IPs can inflict economic costs in other countries. This can unleash retaliation, resulting in a costly subsidy race or an escalation of trade tensions, which would ultimately erode the benefits for countries pursuing IPs. From a global perspective, geoeconomic fragmentation would lead to wasteful spending by fostering duplication of production and innovation and undermine the flow of new technologies through trade, reducing global welfare. Thus, IPs should avoid further inflaming current fault-lines, weighing potential negative spillovers, especially the risk of escalating trade tensions, and ensure consistency with international rules. Instead, policymakers are best served by working cooperatively to strengthen transparency and rules around the use of IPs and resolving sources of trade tensions. For example, evidence in the context of the EU shows that the cooperative design of policies yields aggregate welfare gains for the economic bloc while unilateral policies are welfare reducing.

Box 1. Domestic and Global Effects of Industrial Policy: Evidence from Industry Studies

There is a long and growing literature studying the industry-level impacts of industrial policies (IPs), especially subsidies, with evidence pointing to effects of various magnitudes.

- China's policies targeting the **shipbuilding industry** are estimated to have yielded moderate results (Barwick, Kalouptsidi, and Zahur 2023). Although estimates suggest that the policy support from 2006 to 2013 boosted China's domestic investment by 140 percent, the policy's long-term returns (measured as the present value of industry profits over size of subsidies) were more moderate (18 percent). The policy is also found to have attracted a large number of inefficient producers and exacerbated the extent of excess capacity. The study points to the importance of the choice of instruments—production and investment subsidies were associated with a large rate of return, while in this case where the production process is very capital intensive, entry subsidies were estimated to be wasteful.

- Recent examples from the **electric vehicle (EV) market** point to various considerations when assessing IPs' impacts. Allcott and others (2024) find that EV tax credits in the US Inflation Reduction Act improved vehicle electrification and benefited consumers and US automakers. Tax credits—that put money in the pockets of consumers and focused on incentivizing purchases of US-made cars—explain these gains. However, the policy was costly, as estimates suggest that 75 percent of the credits went to buyers who would have bought an EV without them. Results also show that, while improving environmental outcomes globally, the policy, which focused on US vehicles, hampered trade and, as a result, foreign welfare. Similar adverse welfare effects of policies reducing trade in EV markets, through local content requirements, are found by Barwick and others (2024a) for China.

- Since the 1970s, EU countries have invested heavily to develop a continental champion of **commercial aircraft,** leading to positive returns and innovation spillovers to other firms. Governments initially provided subsidized loans, and later reimbursable advances linked to sales, which shared downside risk with the government (Olienyk and Carbaugh 2011). Government action was motivated by the "natural monopoly" features of aircraft production, with scale economies provided by high fixed costs and learning by doing (Baldwin and Krugman 1988). Through successful innovation, Airbus broke Boeing's monopoly. Airbus benefited Europe, earning a rate of return between 6 and 11 percent, and likely generating positive innovation spillovers to other firms (Neven, Seabright, and Grossman 1994).

Industry-level studies also point to large potential (positive and negative) cross-country spillovers. Demand subsidies for EVs are found to have boosted car sales and battery production at the global scale. Moreover, learning-by-doing by global battery manufacturers led to significant declines in battery and, as a result, EV prices, which increased welfare globally. By contrast, policies that limited learning-by-doing—such as local content requirements for batteries—led to negative cross-border spillovers. Turning to semiconductors, government support has been vital for global industry's growth, with subsidies being the primary form of support (Goldberg and others 2024). There is evidence of cross-border technology transfer through foreign direct investment, business and research collaborations, and technology licensing. Some examples, such as the experience of Airbus, point to adverse cross-country spillovers that sparked policy actions from affected countries. Boeing's profits fell by about $100 billion and commercial aviation's production costs rose owing to Boeing's reduced economies of scale and scope. The United States reciprocated the EU's intervention with increased support for Boeing, eventually leading to lengthy trade disputes at the World Trade Organization (Irwin and Pavcnik 2004). For more information, see IMF (2024c).

Box 2. Green Industrial Policies: Arguments and Impacts

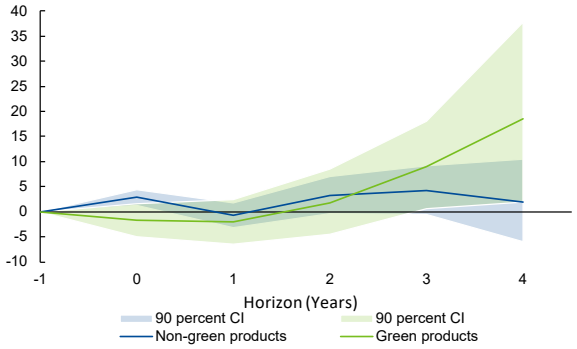
In addition to traditional arguments, there are two additional justifications for industrial policies (IPs) targeting products associated with the green transition ("green products")—the novelty of these technologies and emission externalities. Low carbon technologies (LCTs) are new technologies that compete with established ones. Successfully establishing LCTs thus requires a transition away from old technologies. Such a transition is challenging because it requires coordination by multiple agents, including consumers, producers, and the public sector. For example, the introduction of electric vehicles requires the coordination of many agents, and producers need clear signals about the direction of the industry. IPs could help coordinate actions to accelerate such a transition (Acemoğlu and others 2012; Aghion and others 2016). Second, the emission externality, whereby LCTs' private benefits are lower than social ones, leads to under provision of LCTs which IP could help address, especially when other policy instruments—such as carbon pricing—are initially politically difficult to put in place.

Evidence suggests that IPs targeting green products have a more prominent impact on competitiveness and innovation than those that target non-green products. New IPs targeting green products increase RCA by about 20 percent after four years (Box Figure 1, panel 1). By contrast, IPs targeting non-green products are associated with a short-term increase in the revealed comparative advantage of these products, but relatively smaller and non-significant effects in the medium term. Turning to patents, IPs motivated by climate policies are associated with a gradual and persistent increase in innovation from local inventors, exceeding 1 percent after five years. This is much larger than the effects found for non-green IPs (Box Figure 1, panel 2). Thus, in contrast to the muted effect of average IPs, targeting green sectors increases the long-term benefits for innovation. This is consistent with the positive relationship between IPs and patent applications in the electric vehicle sector (Barwick, Kalouptsidi, and Zahur 2024b) and between environmental subsidies and green patents (Hasna and others 2023). The analysis in this box considers only the individual country's perspective. From a global welfare perspective, it is possible that the implementation of green IPs by countries behind the technology frontier could delay the green transition.

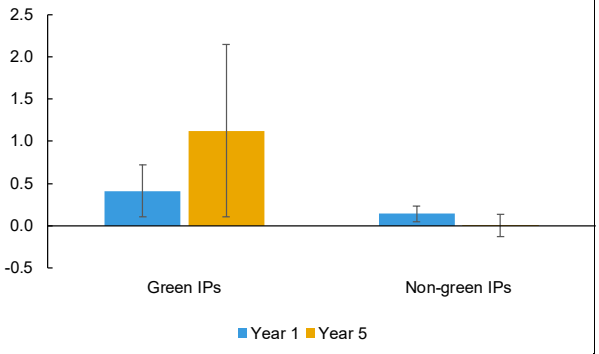
Box Figure 1. Green Industrial Policies, RCA, and Patent Filings

(Percent)

1. IPs and RCA of LCT and non-LCT Products



2. Climate-Related IPs and Patent Filings by Local Inventors



Sources: Howe and others (2023); Juhász and others (2023); and Labelle and others (2024).
Note: Panel 1 estimates the link between new indusrial policies (IPs) and revealed comparative advantage (RCA) of low carbon technology (LCT) and non-LCT products following the local projection method. Panel 2 also applies the local projection method to estimate the relationship between new IPs, either motivated by climate change (green) or not (non-green) and patent filings by local inventors. For more details on the econometric specification and additional controls in each panel see the Online Annex. CI = confidence interval.

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