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**ARTICLES**



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**PRE**

# The Philippine Review of Economics

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# Preface
# Special issue on Industrial Policy

Industrial policy, a term once eschewed in "serious" discussions of development policy and strategy, is back in currency. This renewed interest is evident in the increasing body of both academic and popular literature that explicitly references the term in recent years. *The Philippine Review of Economics* initiated a roundtable discussion to take stock of the current state of knowledge on the subject, particularly as it relates to the Philippine experience. The articles in this issue were first presented during the roundtable discussion on October 17-18, 2024 held at the University of the Philippines School of Economics and revised for publication.

The *Review* thanks the authors of the papers for the revisions done on the earlier drafts and the discussants—Ramon Clarete, Emmanuel de Dios, Raul Fabella, Hal Hill, Felipe Medalla, Mead Over, and Gonzalo Varela—for their incisive comments which have also been included in this issue. We are grateful to the Philippine Center for Economic Development for supporting the initiative.

We hope this issue provokes further discussion and research on the subject of industrial policy and its implications for the future of Philippine development.

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# Philippine industrial policy? Why not?

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Recent changes in trade policies in developed countries are sparking new interest in industrial policy programs. Among developing countries, failures against expected outcomes of structural adjustment programs in Latin America and Africa versus the perceived development successes of East Asia generate lessons about how different configurations of industrial policy can be more effective. This overview paper presents a definition of industrial policy and surveys the arguments for and against industrial policy. In the Philippine context, the consideration of industrial policy is a contravention of the state project since the 1980s to rely on an open trade regime as a key pillar of a development strategy. In the last decade, however, numerous legislative initiatives have sprung up to support industrial policy interventions. The papers in this volume represent updated thinking about industrial policy challenges and opportunities as they apply to the Philippine situation.

**JEL classification**: O25, O24, P11
**Keywords**: industrial policy, development, political economy, trade

"*There's nothing you can do that can't be done*."

Lennon and McCartney [1967]
"All You Need is Love"

## 1. Introduction

The studies in this volume explore the issues in industrial policy as these could apply to the Philippines, in the midst of ongoing distinct shifts in international views and unmistakable redirections[1] of public policy, especially on the part of developed countries. In the Philippines, as illustrated in the comments of discussants, the political/policy contestation over this framework continues. The authors of the papers in this volume are proponents of a more deliberate use of industrial policy in the Philippines, while national policy debaters agonize over whether industrial policy should be considered at all as part of the public policy

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[1] Juhász et al. [2024:221-222] document the unambiguous shift in international policy stances.

toolbox. In the meantime, legislative initiatives and actual legislation which mandate industrial policy motivated state interventions have proliferated.[2]

The Philippine economy emerges from a roughly 30-year effort of relying as faithfully as possible on an open trade regime as the touchstone of its development strategy. Prominent policy experts have been consumed by the need to stamp out vestiges of import-substitution and head off new industrial policy initiatives. The papers in this special issue allow us to consider how new analyses and approaches to industrial policy might be more effective in the current context.

## 2. What is industrial policy?

There is a widespread perception among the global policy elite that the view about the undesirability of industrial policy is being discarded[3] (see, for example, Evenett et al. [2024]; WEF [2023]; Shih [2023]). There is a related perception that economic policymaking, especially in the developed world, has tipped decisively toward a revival of the explicit[4] practice of industrial policy. It is not clear if industrial policy, whether hidden or explicit, as a policy ever ended in developed countries. Given the relentlessly persistent contempt that has greeted developing country measures that are seen to fall into "protectionist" or "de-globalization" schools, it is also not clear if industrial policy ever really ended in developing countries.

Taking off from Chang [1996:60], this discussion classifies as industrial policy state actions "aimed at *particular industries* (and firms as their components) to achieve outcomes that are perceived by the state to be efficient for the *economy as a whole*." Industrial policy must be marked

> by selectivity as far as industries are concerned. Differential tariffs, financial support for specific sectors of industry, and tax and import privileges for specific sectors are examples of selective state policies. State policies that support an increase in capability of the whole economy, such as expenditures on education, are not properly part of industrial policy. [Memiş and Montes 2008:4]

Genuine industrial policy picks not only "winners;" it also chooses "losers", either explicitly or implicitly, the latter if only in general equilibrium terms. General equilibrium models, especially when practiced as the innumerable

[2] For example, the Tatak Pinoy (Proudly Filipino) Act, designated as Republic Act No. 11981 became law in February 2024.

[3] The "revival" literature has proliferated in the last four years or so and will not be reviewed here. Evenett et al. [2024] herald the creation of a data base called the New Industrial Policy Observatory (NIPO) housed in the University of St. Gallen in Switzerland.

[4] In the case of the US, for example, Wade [2017] points to its longstanding, often hidden, practice of industrial policy.

evaluations of free trade agreements, provide some capacity for identifying in advance losing[5] sectors resulting from accession to these kinds of agreements.

The extensive retreat from import-substitution policies by developing countries in the 1980s and its aftermath informs the reconstructions of the concept of industrial policy. In many developing countries, open trade policies, privatization, and deregulation appeared to promise ready-made solutions to political ills—corruption and bad governance [Krueger 1992]. Efforts, often heroic, to apply open trade policies, privatization, and deregulation did not necessarily lead to the end of these sociopolitical ills; in some cases, especially those involving privatization, these programs aggravated national political vices. Disappointing economic results, particularly regarding stronger export performance and lower dependence on external debt financing in Africa and Latin America attended economic reform programs designed according to the open trade paradigm [Cherif and Hasanov 2019; Ainginger and Rodrik 2020]. The onset of another external payments crisis often constituted the aftermath[6] of a trade liberalization program [Montes 2021].

The failures of post-liberalization programs also disinter the macroeconomic malfunctions of industrial policy pre-liberalization. The cumulated cost of tax expenditures and subsidies motivated by industrial policies have often been "singled out" as the source of chronic fiscal deficits and pronounced levels of sovereign debt. Tradeoffs among the fiscal costs for different privileged sectors through time cannot be avoided. Legislative logrolling which can result in a proliferating set of industrial policy supported sectors can prove macroeconomically costly and unwieldy in terms of accountability, even as the space for wider tariff dispersions under industrial policy can potentially contribute more fiscal resources in net terms.

New thinking on industrial policy is also informed by the experiences of the few countries generally regarded as 'successful' in development since the 1980s—the Republic of Korea, Taiwan (China), and the People's Republic of China. Intense attention to exports and the applicability of industrial policy not just to industry but also to agriculture and to services sectors are now generally accepted as "good practice" in industrial policy. Balaoing-Pelkmans and Mendoza [in this

[5] While I have mentioned this issue in a footnote in an earlier piece [Montes 2021], I have yet to find an analytical piece about why the practice of trade liberalization has almost invariably featured (1) minimal Pareto-triggered compensation to the losers and the budgeting of adjustment costs for losers and (2) the absence of new resources—in practice, reduced resources when undertaken within a sovereign debt resolution program—to finance new investment seeking to respond to the new price vectors trade liberalizations is meant to afford. General equilibrium-based evaluations have difficulty incorporating "credible" capital-augmenting investment equations such as in Petri and Plummer [2016], Park et al. [2021], and Capaldo and Izurieta [2018].

[6] In structural adjustment programs, there could be a "time inconsistency" between the speed of trade liberalization as the government chases quantitative targets toward the timely release of the next program tranche. The resulting rapid rise of imports not matched by the projected improvements in export performance which must be built with bricks and mortar needs to be financed externally [Montes 2021; Winters 2004].

volume] seek to throw light on the country's poor manufacturing record, before and *after* liberalization; their paper directly examines the structural interactions among the main economic sectors.

Cases of successful application of industrial policy to agriculture in particular have garnered attention. The emergence of export activities in cut flowers (Ethiopia, among other countries) and out-of-Northern hemisphere season fruits (Chile, South Africa, among other countries) are part of the industrial policy lore. To the extent that fishery is "part" of the agricultural sector, Chile's exports of salmon and sea bass (Patagonian toothfish) are other examples.

In developing countries, agriculture is the sector with the greatest number of private small-scale enterprises and presents itself as a fertile area for productivity and income upgrading. In the Philippines, in the last decade, the reform of government agricultural policies became a prominent feature of debate and political contestation. As in other sectors, protection from imports—too much industrial policy, as it were—was seen as a foremost cause of the stagnation of agriculture productivity and its removal a prime target of reform. The passage in 2019 of Republic Act No. 11203, or the Rice Tariffication Law, in which tariffs replaced quantitative restrictions, has removed this impediment. In theory, the tariff revenues represent new resources for financing programs to raise the productivity of the sector. The debate has mutated into another impediment—the land reform program's restrictions on land consolidation as an obstacle to productivity upgrading and for attracting foreign investment. Any discussion of possibly applying industrial policy tools—government interventions other than tariffs—in the agricultural sector appear to be obstructed by the debate over yet another impediment originating in the blockages over land consolidation.

In countries perceived to be successful practitioners of industrial policy (e.g., Israel), industrial upgrading has been significantly accelerated by state facilitated national innovation systems[7] which stitch together university, private sector, and state research agencies to drive product development and upgrading, with the end in view of introducing commercially profitable goods and services. Aldaba and Aldaba [in this volume] explore the challenges of this important element of industrial policy.

In contrast to earlier periods, there is increased research interest in mechanisms of corruption which could later prove useful for better understanding governance debilities, as constraints over and disablers of industrial policy practice.

### *2.1. Why should a government NOT even try to do industrial policy?*

The costs of protection of domestic production against imports—and industrial policy in general—is an old[8] question and has merited a lot of political

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[7] See Chapter V in UN [2011] for a survey of the elements of national innovation systems.

[8] In 1848, Marx's [1848] "On the question of free trade" characterized the "Repeal of the Corn Laws in England" as "the greatest triumph of free trade in the 19th century."

discussion and analytical methods and empirical estimation. There have been two dimensions to the question of why a state should not even try to make industrial policy: analytical and practical.

The modern **analytical** case against industrial policy builds on Ricardo's theory of comparative advantage updated to modern parlance in the Heckscher–Ohlin-Samuelson (HOS) model. For purposes of this discussion, the following key features of this model are: (1) unfettered free trade permits each trading party to take advantage of resources and production inputs it has on hand in relative abundance; and (2) if other trading partners do not practice open trade, including as a consequence of industrial policies, it is costly directly to them, and other parties can minimize the cost to themselves by continuing to practice open trade. An immediate implication is that the most appropriate response on the part of developing countries to the rise of industrial policy in the North is to maintain their open trade policy stances. Abrenica and Sabarillo [in this volume] examine empirically whether indeed industrial intervention can benefit or hurt the Philippines in the context of the current US-China trade "war."

To reach the equilibria near which the HOS model's beneficial policy impacts are derived, markets must allow the smooth transfer of resources from one sector to another. Otherwise, unfettered free trade will not equalize labor and capital incomes among economies at different levels of development. Diminishing returns to scale is mathematically critical to this result—Samuelson [2004] emphasizes this point. The absence of diminishing returns often has provided arguments in favor of state intervention. Bartelme et al. [2024:1] suggest the "existence of sizable economies of scale across manufacturing sectors . . . opens up the possibility of substantial wedges between private and social costs of production." However, in the same piece, the empirical application of the analytical model does not indicate substantial quantitative gains from industrial policy.

The **practical** case against even attempting industrial policy (and conversely to justify its comprehensive elimination) is broadly presented in Pack and Saggi [2006]. Pack and Saggi perceive industrial policy—if done properly—as a response to informational gaps and uncertainties. They consider industrial policy as quite a complex undertaking, which few governments are capable of managing. Decisions over the use of industrial policy appear to many pundits to demand high caliber state management or upgraded governance capabilities as a precondition. In this view, advances in industrialization on the part of successful countries have been less the result of intentional state intervention—including as measured by the relative proportion of investments in eventually successful sectors—and more a matter of serendipitous outcomes of working relations with foreign producers and foreign buyers.[9] Since industrial policy does "not work"

[9] Successful exploitation of the termination of the WTO Agreement on Textiles and Clothing (ATC) by a few Asian countries were anchored on working with jobber firms (which in turn coordinated the purchasing activities on behalf of international brand name marketers) that controlled the quota allocation system when that system was in place [Montes 2019].

or is "too complex" to make it work and is costly in general equilibrium, i.e., "microeconomic", terms, countries with "weak states" [Fabella 2018] are well-advised not to *even* try industrial policy.

The analytical and practical warnings are consistent with the retreat undertaken by many developing countries from industrial policy in the 1980s. However, seen as a political event—in the case of developing countries, a pivot in development strategies—the retreat itself can only be fully understood in political terms, as would be the case, anyway, in all changes in public policy. While interpretations have been controversial (discussed, for example, in Wade [2013]), there has been a growing perception that some countries in East Asia have been more successful in development terms than others even without a general withdrawal of state industrial intervention [Cherif and Hasanov 2019].

At stake for every country/every society at this conjuncture is whether another policy pivot is timely and whether local politics are aligned for effective industrial policy, effective in the updated or modern sense of industrial policy, of, say, more export-oriented or more selective policies. At this point, most policies embodying a policy pivot back to industrial intervention must contend with international restrictions on such policies, which have been codified in WTO and free trade agreements. Most of the recent infringements on these disciplines are being committed by authorities in economically advanced countries.

Arguably, realigning government policy closer to "dirigiste"—to use a previously loaded term—policies have been sparking new thinking on the part of national policy designers and decision-makers. The HOS model recommends the ideal array of trade policies with unfettered trade as the finish line. International agreements have restricted the space for state policy which, in turn, secures the space for private decisions [Lawrence 1996] and pulls societies closer to that finish line. These obligations—written on the tablets of trade agreements—absolve domestic authorities and politicians from a significant amount of democratic accountability for decisions of commission or omission over policies with society-wide, often long-term, impact.

Irrespective of whether the Philippines can succeed in reaching the holy grail of a truly HOS-grounded policy pathway, Williamson and de Dios [2014:47] suggest that beginning in 1970 and decisively after 1982, the country has strayed from the catch-up path shared with other countries through import-substitution. They find that "political instability, institutional weaknesses, liberalization policy, labor emigration, and Dutch disease"[10] present unmovable barriers to Philippine industrialization. From an industrial policy lens, the question is whether there are state or state-private sector cooperative policies—at costs Philippine society can absorb—that can shatter these barriers.

[10] Osmani [2019] interprets Nepal's growth record and development prospects in a similar vein as being overly dependent on remittance flows.

For the sake of completeness and beyond the classic[11] references, such as List and Hamilton, Thirlwall [1979;2011;2019] makes a macroeconomic argument[12] that has been deployed to advocate the application of industrial policy in developing countries. In an extension of the Harrod-Domar model, this model suggests developing countries must wrestle with their balance-of-payments constraints in the process of growth by moving away from imports with high domestic income elasticities and expanding exports with high international income elasticities. Countries condemn themselves to periodic balance-of-payments crises if the growth process mainly increases imports with high income elasticities. The considerations that emerge from the Thirlwall research agenda are an antidote to the proposition that economies with chronic fiscal and balance-of-payments deficits "cannot afford" to devote scarce resources to industrial policy.

This takes us to the question of the political economy of government intervention in all its forms. Arguments over government intervention pivot over the primacy of private actions over government[13] actions in the matter of economic processes and outcomes. States, most particularly the Philippine state, are seen to suffer from informational and resource infirmities. Debaters deploy anecdotes and case examples to support their side[14] of the argument.

### *2.2. Why consider doing industrial policy at all?*

Aiginger and Rodrik [2020:190] portray many of the political pressures that appear to have triggered the change in course on industrial policy but suggest that the question at hand should be

> what shape industrial policy should take in this period of disruptive political and technological change. How can policy makers craft an industrial policy that is future- and welfare-oriented, which not only mitigates market failure, but also addresses society's most important social and environmental challenges, without stoking national chauvinism.

This approach continues the political pose that industrial policy advocates used to take during the dark days of unfettered free trade dominance. Advocates

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[11] Friedrich List's classic work was entitled the National System of Political Economy in 1837, and Alexander Hamilton's was entitled Report on the Subject of Manufactures, a report to the US Congress in 1871.

[12] Empirical applications of this model have been in applied in many developing countries, most recently, see Lockwood [2022] in Indonesia.

[13] See also Yap and Turla [in this volume] about how an industrial policy lens privileges a relation of cooperation, instead of substitution, between public and the private sectors and the role of feedback loops.

[14] Tendler [1995;2018] is notable for suggesting that the boundaries of capabilities, decisions, and activities between the private and public sectors are quite blurred (and not a matter of Manichean rivalry). One insight that can be gleaned from this writing is that a fully formed private sector, capable and keen to engage in international competition. does not emerge by itself; in many situations, government agencies enjoy a capability advantage over private enterprises. This view is not a mainstream one, especially in "the West." The capabilities of the state itself (including the benevolent content of its choices especially in societies that aspire to democratic ideals) are themselves a work in progress.

sought to outmatch the practical pitfalls of industrial policy with ideas such as government-industry councils and stringent sunset clauses.

In a series of publications from around 2011, Mazzucato [2011] has followed a similar research and advocacy path of presenting solutions to the menace generally identified with the practice of industrial policy (see also Mazzucato et al. [2024]). Economically successful societies have been blessed with "entrepreneurial states" (including local governments) who have shaped private markets, a formulation that stretches beyond state interventions devoted only to resolving market failures. These ideas, derived from historical cases, are comforting and motivational for analysts who detect any possible developmental role for public policy, and have gained traction in some policy circles but have not directly overcome questions about the governance obstacles needed for deliberate industrial policy.

Some of the Mazzucato case examples trade on the view that complexity of operation is not a necessary feature of real-world industrial policy, as suggested by Pack and Saggi [2006] and that informational hurdles are not necessarily insurmountable. To the extent that effective industrial policy introduces new products, new services, new corporate practices, and new types of jobs to the existing, possibly technologically backward, array of commercial markets both in developed and developing countries, ventures of "entrepreneurial states" could be classified as operating in non-diminishing returns-to-scale spaces.

Most developing countries never fully abandoned industrial policy because almost all have maintained foreign investment priorities programs (with the corresponding tax incentives) even in the wake of programs of economic liberalization. In East Asia, the salad days of unfettered trade ideas in the early 1980s appeared just at the time when the hasty realignment of Japan's exchange rate created a surge of Japanese relocations of labor-intensive production to the region. Japan's major currency realignment overlapped with the policy debates in the Philippines over the elements of a thoroughgoing economic reform program occasioned by the collapse of the thirty-year Marcos regime.

Batalla [2011] suggests that one reason the Philippines benefited less than neighboring countries is that Japanese companies, in their urgent decisions to find new locations for production, found the country's array of investment incentives, while quite comparable to those in nearby locations, to be insufficiently secure given the uncertainty over the overall stance of the long-run policy regime under construction (and domestic debate).[15]

[15] One interpretation is that potential domestic losers and local pundits both protest too much, and initiated policy uncertainty [Chikiamco 2022]. But an alternative interpretation which can be drawn directly from the Batalla [2011] analysis of the Japanese viewpoint is that in utility terms, Japanese companies had a strong revealed preference to be part of a host country's long-term development strategy and worried more about ideas that a government presiding over a truly liberalized economy should not have the tools to choose winners and losers through investment incentives.

Open trade is often[16] seen and has been advocated as an all-encompassing development strategy. Under this strategy, industries that arise and thrive through time are those that are internationally competitive without the need for either infant or continuing state support. In the late 2000s, Western researchers (e.g., Hidalgo and Hausmann [2009]), seeking to be able to compare European vs. US industrial capabilities, introduced the concept of "product space" as a means to measure the "distance" countries have to upgrade their domestic production activities. The title of the Hidalgo and Hausmann [2009] piece gave the name to a research program under the umbrella of "complexity economics", a methodology that has been applied most extensively to developing countries and to related aspects—such as export structure and import dependence—of comparing countries according to the complexity of what they produce. Yap and Turla [in this volume] take advantage of the complexity ranking from this methodology to compare the relative success of industrial policy between Philippines and neighboring, more successful, economies.

Because sectoral interventions are already taking place (and perhaps were never truly abandoned)[17] and threaten to proliferate as a result of recent analytical and policy trends, I take the view that use of the standards and benchmarks from industrial policy thinking to evaluate government policies, whether these originate from the executive or the legislative branch, is vastly more appropriate in terms of measuring their social cost and determining whether society should absorb the costs of specific projects and programs. Industrial policy principles supply operational benchmarks to evaluate sectoral interventions.

In the first quarter of the 21st century, the most prominent source of political/policy pressure towards industrial policy interventions is climate action. The urgency of climate action, and their corresponding nationally determined contributions to transition from fossil fuel-dependence on the part of all countries, oblige societies to ignore market "signals." Even as clean primary energy sources, notably solar and wind, have become competitive per unit of generation in most areas of Earth [IRENA 2023], the transition will be "too slow" to avoid irreversibly unfavorable climate dynamics. Canlas and Jandoc [in this volume] explore a transition away from coal through the fossil fuel of natural gas.

The astronomical growth in international trade in services, facilitated by the rise of the digital economy, is another area of interest. With the ebbing of what he calls "hyper-globalization", Rodrik [2024] suggests that developing countries apply industrial policy to building the services sector and the creation of good jobs, including those in non-tradables, instead of seeking to rely on manufacturing in which their proportion of value-added is very small and their competitiveness

[16] For the Philippines, the classic reference is Power and Sicat [1971].

[17] For example, the grant of a subsidy to a hesitant foreign investor to defray the high cost of electricity is a use of a standard tool of industrial policy. A proliferation of such special privileges, even when obtained through contacts with high level officials, without recourse to a selectivity criterion is not industrial policy.

reliant on low wage labor. While the Philippines has provided tax incentives to the business process outsourcing (BPO) sector *subsequent* to its success, should such resources be made available in the future? Would resources be better deployed to open other areas of services exports? How can the sector be developed to better enhance domestic productivity and incomes? Serafica [in this volume] examines the potential and the challenges inherent in this sector.

## 3. The times are a-changing but the international rules are still the same

While interest in industrial policy swells in international circles, Philippine industrial policy thinking[18] and practice are quite modest, despite the ample popular commentary[19] over the adverse role of protectionist policies in a variety of sectors. The Department of Trade and Industry (DTI) for about a decade has explored various means by which limited state resources can be deployed to upgrade productivity and competitiveness in selected sectors.

International trade rules are one clear area where obstacles abound for any increased use of Philippine industrial policy. Tracing the changing views and practice of industrial policy in terms of the actual government interventions that are involved, there are many elements in the industrial policy toolbox. The panoply of well-known industrial policies has included subsidized credit, state support for state-owned enterprises, domestic content requirements in exchange for tax incentives, quantitative restrictions on imports, government procurement, protection for foreign investors, among others.

**Differential tariffs** among industries which evolve through time as protected sectors attain international competitiveness have been practiced since the 19th century [Akyuz 2005;2006]. In developing countries, state policies, since the 1980s, very often under the auspices of World Bank or/and IMF structural adjustment programs, often seek to narrow the range of tariffs among tariff lines; this state policy is interpreted as a renunciation of industrial policy [Pack and Saggi 2006]. A key feature of prominent free trade agreements is the reduction of tariffs on all tariff lines to zero or a low ceiling after an adjustment period.

Beginning in 2018, the US government imposed tariff surcharges[20] on imports of steel and aluminum, after imposing these on solar panels and washing machines. The US government called upon the security exception, a standard but little tested feature of free trade agreements, but also mentioned the need to reduce the level of imports. The surcharges have triggered WTO dispute actions.

In Europe, starting in October 2024, the Carbon Border Adjustment Measures (CBAM) program will impose a surcharge on the carbon content of imports of

[18] See, for example AER [2015].

[19] As an example, see Chikiamko [2022].

[20] Most studies indicate that US resident users have borne almost all the incidence of 2018 tariff surcharges. See, for example, Amiti et al. [2020] and Fajgelbaum et al. [2020].

iron and steel, cement, fertilizers, aluminum, electricity, and hydrogen in order to match the carbon price in the domestic emissions trading system internalized by domestic producers. Competitiveness is a key concern[21] of the program, despite the wink to climate action.

In the case of **foreign investor protections**, there are legitimate questions over their provisions' inclusion in the list of industrial policy tools. Dedicated protection for foreign investors in investment chapters in free trade agreements and in bilateral investment treaties conflicts with the basics, if not the spirit, of a liberalization program. Investor protections conform to the spirit of the liberalization paradigm in one sense: that they have severely inhibited state policies to regulate foreign investment, including policies for social protection and environmental objectives [Montes 2019a]. However, in practice, acceding to foreign investor protections has been an indispensable element of liberalization programs and in free trade agreements.[22] Foreign investors are perceived to be critical to export success and, in a liberalized economy, for raising the investment rate.

In June 2024, EU countries withdrew from the Energy Charter treaty on the grounds that treaty obligations over hydrocarbon-oriented investors tend to obstruct climate-motivated regulatory actions. Earlier, from 2009 to 2012, some developing countries withdrew from the mandatory arbitration process of investor protections; South Africa, which signed onto investor protections wholesale in 1994 at the end of apartheid and as part of its liberalization-based development program, cancelled its investor protection treaties in 2012. With the EU action, investor protections of the type that has proliferated will likely decrease, even though the incidence of dispute cases is not expected to decline because existing treaty obligations have sunset clauses that protect investors for ten to 20 years, depending on treaty provisions.

The United States has been a global leader in international disciplines to curb the use for industrial policy purposes of government procurement; the US has led in the realization of the WTO's plurilateral agreement on government procurement, which meant that existing members of the WTO can voluntarily join the agreement, which stipulates levels of procurement beyond which bidding must be open to foreign suppliers. WTO accession negotiations often feature a discussion of acceding to the plurilateral agreement. Free trade agreements regularly include a government procurement chapter.

The US has noticeably weakened its devotion to and advocacy of **government procurement** disciplines. Beginning in 2017, the US government in word and in deed has been upgrading operational mechanisms of its 1933 Buy American

[21] Draghi's [2024] report identifies the array of causes behind the lack of international competitiveness among European Union countries, even before taking into the account the carbon price factor.

[22] Before the Indo-Pacific Economic Partnership for Prosperity (IPEF), the United States would not be party to any free trade agreement that did not feature an investment chapter.

procurement laws,[23] including hardening the process of granting exemptions for government agencies buying from non-US suppliers and relaxing domestic content standards. A US congressional office study indicated that the new operational practice would require the US to consider renegotiating its procurement disciplines [Congressional Research Service 2024]. A new US administration in 2021 strengthened the operational approach of the previous administration by creating an office and a website based in the White House where requests for US suppliers must be published—to alert domestic suppliers of the business opportunity—and cleared before a grant of a procurement exemption.

Clarete and Pascua [2016] find the Philippines' government procurement law wanting, in terms of meeting the standards enshrined in the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) in particular, by requiring that Filipino suppliers be accorded priority in procurement actions.

**Competition policy** is yet another government policy which restricts industrial policy interventions. Singh [2002] alerts us to the existence of two approaches to competition: the Western and the Japanese styles. Western-style competition policy represents the consumer interest; it places a high premium on free entry into markets and competition through prices, on the presumption that such a process will secure the lowest prices. Japanese competition policy emphasizes the steady upgrading of productivity and efficiency of enterprises to secure low prices for consumers and intermediate input users, and international competitiveness. Japanese competition protects the capital investment of private companies, whilst Western competition views the life-and-death cycle of firms as a natural consequence of competitive pressures, including those introduced by foreign suppliers. Japanese competition policy seeks to restrict ruinous competition while Western competition policy celebrates it.

During the US occupation, military authorities imposed Western-style competition policy in Japan as a policy to weaken the economic prowess of the *zaibatsus* which they viewed as pillars and beneficiaries of Japan's war effort against the West; Japan eagerly reverted to its own style of competition policy at the end of occupation in 1952. While this approach allowed fierce competition among firms within an industry through investment in internal production efficiencies, it regulated the use of price-based competition. This approach secured the continued existence and advance of participating firms, ideally of equal size within a market. Japan managed monopolies for a long time in domestic retail markets and especially in export trade, say, car companies, in export markets.

Free trade agreements enshrine Western-style competition policy and include disciplines facilitating the entry by foreign firms into domestic markets, including

[23] The main law is the Buy American Act passed in 1933 by the Congress and signed by President Herbert Hoover. In 2021, a bipartisan infrastructure law incorporated stipulations in the so-called Build America, Buy America (BABA) Act. BABA establishes a domestic content preference for federal financial assistance obligated for infrastructure projects. The BABA preference applies to three separate product categories: (i) iron or steel products; (ii) manufactured products; and (iii) construction materials.

their ability to initiate monopoly investigations, as is the case in domestic US competition law. Industrial policy tools such as domestic content requirements and balancing of imports against export earnings run afoul of investment measures disciplines of free trade agreements and competition policy disciplines.

Japanese-style competition policy enables the building up of competitive capabilities of national firms. However, it is very demanding of the governance capacity and of independence of the state to referee the demands of competing market participants.

## 4. The contributed papers

If industrial policy needs to be "selective" and choosy among sectors, subsectors, or firms to be accorded state privileges, the contributors to this volume do not take strong positions on which sectors to promote but, instead, deal with question of how industrial policy can be practiced in a variety of economic sectors. Almost all the papers trigger new demands on fiscal resources. Lurking behind the industrial choices are the chronic deficits, both fiscal and external, which must be "husbanded"[24] even more strictly should the proposals contained in the analyses gain technical and political acceptance. It bears reminding, once again, that political initiatives in the Philippine Congress are already underway, not to mention the budget-constrained initiatives in various departments: trade and industry, science and technology, information and communications technology, and others.

Quantitative analysis, applying the data and methodologies suggested in these papers to design, cost, and implement industrial policy is only a first step. However, there is the "uncertainty about both the effectiveness of policies and the location/magnitude of externalities", [Juhasz et al. 2024:218] The next step is the difficult one: how to choose among the variety of proposals within a budget.

In "Industrial policy and complexity economics", Yap and Turla contrast the neoclassical and the structuralist analytical approaches over development. The neoclassical approach places great store in drawing its policy insights from a unique equilibrium, while a variety of structuralist approaches emphasize the centrality of learning both at the firm and the policy levels. The linkage analysis builds on Kaldor's three "laws" (derived from historical patterns) regarding manufacturing growth and GDP growth, real manufacturing growth and manufacturing productivity growth (Verdoon's Law), and manufacturing expansion and the productivity growth of non-manufacturing sectors. The paper tests a proposed model in which the dynamics of structural change is driven by the co-evolution of investment, manufacturing and exports. The cointegration results confirm a necessary condition for feedback loops to exist between the investment GDP ratio, the export-to-GDP ratio of goods and services, and the manufacturing value-added to GDP ratio.

[24] In many Asian families, it is the mother that allocates the household budget.

Yap and Turla apply the feedback loop framework in comparing the effectiveness of industrial policy among the Philippines, Malaysia, and the Republic of Korea. They suggest that low investment rates undermined Philippine efforts to promote manufacturing, which a poor record in latching onto international production chains in the 1980s and 1990s worsened. The authors attribute the superior performance of Korea in comparison to Malaysia to the additional effort in the former to promote domestic innovation activities.

In "Mapping feasible routes towards economic diversification and industrial upgrading in the Philippines", Balaoing-Pelkmans and Mendoza, start with the problematique of how to diversify an economy and the proposition that a more industrialized economy enables economic diversification. The paper uses the term "re-industrialize" to capture the idea that economies must escape the increased domestic concentration of economic activities left over from the trade liberalization era starting in the 1980s. The reported empirical results support the view that an increased contribution to aggregate output by the industrial sector, especially relative to services, promotes economic diversification and widens the distribution of the sectoral sources of growth.

Balaoing-Pelkmans and Mendoza examine three possible routes towards economic diversification, drawing upon the product space literature: (1) leapfrogging, (2) scaling the value ladder through global value chains, and (3) expanding local industries by upgrading the operations of small and medium-scale establishments. Their analyses of the content of each alternative reveal the range of industrial policy tools that would be required to pursue each of them.

Aldaba and Aldaba examine the role of innovation in industrial policy and in an overall development process in general. The paper exemplifies that an industrial policy process is directed at new products, new production methods, new organizational configurations, new collaborations among different professions, and so on (as opposed to civil society/academic preoccupation in blowing up deadweight losses arising from suspected Harberger triangles). The paper proposes two arenas where innovation takes place: (1) value creation through developing new ideas and technologies and (2) fostering entrepreneurship. Aldaba and Aldaba propose nurturing collaboration, "which depends on social capital, trust, and information sharing." Successful innovation requires the collaboration between academia and industry. However, they find that "Philippine universities generally remain detached from problems signaled by the market and often fail to appreciate the importance of commercialization." Research activities in universities lack the personnel with skills in technology transfer and commercialization. The authors advocate specific interventions that foster government-academe-industry linkages and those that upgrade education, human capital development, and workforce training.

In the case of entrepreneurship, the study suggests that the startup system is still quite limited but growing in both real value and volume. The paper provides a window into the ecosystem of startups and entrepreneurship. The authors cite how artificial intelligence (AI) has been exploited to strengthen the operations of business process outsourcing (BPO) firms. If innovation activities are to respond to the perceived needs of firms and local areas, the authors recommend the establishment of Regional Inclusive Innovation Centers (RIICs), a proposal from focus group discussions and stakeholder consultations convened by the DTI.

In "Exploring the prospects of services-led development for the Philippines", Serafica turns the spotlight on the services sector. She examines its status and assesses the challenges and opportunities confronting government strategies to enable the sector to generate more domestic value-added and raise the incomes of workers in the sector. For services to contribute to economic growth (instead of being impelled by the growth in other sectors), it must attain sufficient rates of productivity growth while creating jobs, especially for low-skilled workers. This is the daunting industrial policy challenge in a sector that conventionally absorbs the unskilled and low-skilled through low wages. Where and how will the upgraded skills be learned? She cites literature that, for example, suggests that firms and other places of employment themselves should be sites for skill upgrading.

Serafica identifies the opportunities for upgrading and expanding the services sector in the Philippines. Services are poorly developed outside metropolitan Manila; "classical" industrial policy thinking rightly used regional development to justify government intervention. The paper highlights the opportunity to expand the export of digital services and the need to accelerate digitalization by improving connectivity and the competencies of workers and firms. Serafica also discusses the importance of structural reform to overcome various industry constraints, including the impediments to entry of foreign investors codified in the Constitution.

In the chapter entitled "Natural gas and transitioning to renewable fuels: considerations from industrial-policy economics", Canlas and Jandoc explore the implications of abandoning policy neutrality and, instead, expanding government support for "soft industrial policy"[25] in the natural gas sector. Soft industrial policy involves a "package of economic policies consisting of foreign-trade tariffs, subsidies, tax exemptions and other fiscal and investment incentives." The underlying motivation is the transition to cleaner technology in primary energy generation as part of the country's nationally determined contribution in the Paris Agreement. State support for the Philippine Upstream Indigenous Natural Gas Industry (PUINGI) can draw upon the precedents and lessons learnt from the operation of the Malampaya Fund.

In advocating industrial interventions, the authors recognize two key additional objectives. First, they underline the critical role of affordable and reliable energy in any development effort. They draw on input-output data to illustrate the interdependence of the various industry sectors and their dependence in turn

[25] The terminology is from Harrison and Rodriguez-Clare [2010].

on energy as input to their outputs. Second, recognizing the indispensable role of foreign partnerships and technology in promoting natural gas, the proposed natural gas development program has the potential for learning by doing as part of the development process. The effort will involve the design and awarding of new petroleum service contracts and the drilling of at least five exploration wells.

In "How might China-US industrial policies affect the Philippines?: a quantitative exercise", Abrenica and Sabarillo apply a multi-sector Ricardian trade model with external economies of scale at the sectoral level to the question of how China-US industrial policies, including their trade war policies against each other, affect the Philippines. The paper joins a growing literature of neoclassical models that incorporate scale economies to measure the impact of industrial policies. Chinese and US industrial subsidies decrease scale economies in the Philippines, thereby imposing welfare losses on the country, net of cheaper imports made possible by the said subsidies. The authors then use the model to consider what kind of trade policy tools the Philippines can employ to counter the negative welfare and sectoral effects.

The paper estimates the effect of tariff and subsidy policies on the part of the Philippines which would allow the Philippines to recoup most of the identified losses. With the same model, the authors are able to suggest that if the Philippines had practiced industrial policy before China and the US carried out theirs, the Philippines would enjoy greater welfare gains because of larger domestic scale economies in place. The net welfare effect would be smaller when netted out against tax revenue losses and higher cost of goods. A similar pattern—of higher welfare gains at the price of lower tax revenues and more expensive goods—is also observed if the Philippines targeted the sectors that were directly affected by China's subsidies.

This set of papers provides many useful insights into industrial policy and its application to the Philippine context. Clarete's comment on the paper regarding state intervention to promote natural gas imbeds the issue in the context of alternative renewable and cleaner primary energy sources; this is a natural question that arises from an industrial policy approach.

Industrial policy studies have a particular focus on the long-term—as opposed to the privileging of short-term welfare losses or gains measurable under static models. There is a long tradition of applying static models and these enjoy more credibility in policy debates. *Ceteris paribus*-based policy arguments can be quite compelling, though the economics literature, such as those about the employment effects of minimum wages,[26] have begun to uncover their limitations. Analyses and models with a long-term perspective tend to rely on relatively novel assumptions.

Especially as documented in the Abrenica and Sabarillo paper, but also in the other contributions, industrial policy generates costs and is not a free lunch. There are real costs to industrial policy and welfare reallocations among the population

[26] For the issues, see, for example, Neumark [2017].

which enormously dwarf the relatively free lunch that can be had by removing an administrative regulation, reducing a tariff, or amending a Constitutional provision. Development is not a free lunch.

## 5. Final remarks

The content of the collected papers presented can be read as proposals for government action. Many of the analytical views and suggestions in the papers and the comments merit serious consideration by various agencies of the Philippine state.

To appreciate the context, the ideas presented here will have to contend with the question of whether the Philippine state, with its limited resources and capabilities, is best qualified to respond to them, instead of preoccupying itself with protecting and enhancing the country's neutral economic policy stance in order to keep the space open for private sector action. On the other side, as indicated above, political forces have begun introducing sectoral interventions.

I commend the papers to the kind readers of this journal to consider whether the models, analyses and proposals presented are sufficiently intriguing to pique their interest toward modifying their own approaches for evaluating state interventions, away from one purely in terms of their potential to magnify the distance of actual policies from the neutral policy stance to that of measuring the net costs and benefits of interventions based on benchmarks arising from the new versions and models of industrial policy.

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# Comment on "Philippine industrial policy? Why not?"

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I think that before going into a detailed discussion of what has been referred to as the new industrial policy literature, it is important to ask if it is relevant to the Philippines. For instance, one can argue that from standpoint of the Philippines, it is not very relevant since, as I shall explain later, there is hardly any manufacturing in the Philippines. In particular, it is more important to ask whether policies that are meant to protect or support the agricultural sector and regulate wages in the formal or organized sector have more powerful negative effects on the manufacturing sector than the explicit policies that are meant to promote the sector. In other words, policies that are not mainly targeted at the manufacturing sector but hurt such sector may be more important than the incentives granted to the sector by the government. Moreover, protection from imports of uncompetitive products or subsectors can be seen as a tax on domestic firms that export or compete with imports.

The best indicator that this is a serious problem is that the share of manufacturing to GDP in the Philippines is actually smaller than the share of wholesale and retail trade and repair of motorcycles. Moreover, when one looks at the manufacturing industries that do exist, a significant portion is food processing. This includes processing of agricultural products (e.g., sugar and coconuts) which is not really "hardcore" manufacturing. Taking out food processing industries, manufacturing will account for only four percent of total employment.

A personal experience serves to illustrate the state of manufacturing in the Philippines. When I was buying shirts for office use, I decided to buy only Philippine brands. I found a well-known brand that said "buy local" and I bought them, only to find out later that they were made in China. This turns out to be the general case: even domestic brands sold only in the Philippines are manufactured outside the Philippines. A different but related problem is the fact that big foreign companies that were in the Philippines for decades have left the Philippines (e.g., Intel and Mattel). And we could probably learn more by looking at the case of Texas Instruments, which was thinking of leaving the Philippines. Fortunately, it decided to stay, and many years later, put up new plants in Clark. I asked then Department of Trade and Industry (DTI) Secretary Peter B. Favila (during the time of President Gloria Macapagal-Arroyo) what convinced Texas Instruments to stay.

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He said the President herself met them and addressed their main concern (high cost of electricity) and informed them that they can locate their new factories and offices in Clark.

It is also important to stress that what makes the Philippines a less attractive location for foreign manufacturing firms (e.g., compared to other ASEAN countries) may not be the absence of industrial policy or the failure of government to grant them significant incentives. In other words, improving policies that affect only the manufacturing sector may not have significant effects on the manufacturing sector, unless the government is willing to give huge (and fiscally unaffordable) subsidies to attract investment.

In agriculture, market competition does not apply; weaker farmers are not allowed to be taken over by better farmers, so there is no land consolidation. Moreover, non-tariff barriers and government regulations make it nearly impossible for the private sector to import agricultural products that are much cheaper in other countries that are also trying to attract foreign investment in the manufacturing sector.

Given that food costs are an important determinant of labor cost and the minimum wages set by government are much higher in the Philippines (e.g., measured by the ratio of annualized daily minimum wage to per capita GDP), it is not surprising that the Philippines is not competitive. All these, alongside very poor infrastructure and poor logistics, condemns manufacturing and the producers of tradeable goods. "Progeria" is the term used by Raul Fabella to describe a developing economy wherein services prematurely overtake industry. Can we become a middle income country or a relatively prosperous country by relying completely on remittances and exportable services, unlike other countries that walked on the two legs of industry and services? Will the Philippines prove that progeria is not necessarily a problem? For instance, will there be a larger global market for service exports, or will AI reduce its growth in the future?

On a final note, if we look at the pioneering industries that the Board of Investments (BOI) supported, how many of them actually succeeded? And in cases where critical government agencies are established to promote technological progress (e.g., information and communication technology) or managing important resources (e.g., water), will they be able to justify their budgets? It's very hard to give optimistic answers to these questions, which is another reason why I am doubtful if industrial policy will work. That is why I think it is a wonderful coincidence that we just got the news that Acemoglu, Johnson, and Robinson won the Nobel Prize in Economics. What kind of institutions do we have? Do they get the best out of people or make them more creative and productive, or do they result in less corruption? Or do we have institutions that promote rent seeking which reallocate resources to unproductive activities?

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# Industrial policy and complexity economics

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Mainstream theory underlying industrial policy highlights the neoclassical and structuralist approaches. The discussion on structuralist theories readily segues to complexity economics where industrial policy foments structural transformation by creating reinforcing feedback loops, particularly among manufacturing, exports, and investment. Empirical evidence is provided by applying panel cointegration analysis to investigate coevolution patterns among the following variables: investment-GDP ratio, exports-GDP ratio and manufacturing-GDP ratio. Econometric estimates show that there is indeed a long-run relationship that is bidirectional among the three variables. However, this is only a necessary condition for reinforcing feedback loops to materialize. Idiosyncratic factors in each country determine whether industrial policy has led to growth-oriented feedback loops. In the Philippines, despite interventions to boost manufacturing, no growth-oriented loop was established because of inadequate investment, particularly in infrastructure. Moreover, exports were hampered by the poor record in latching on to regional production networks. The Republic of Korea has had more success than Malaysia because it strengthened its innovation system. The missing link in Malaysia is own-technology creation.

**JEL classification**: L52, L53, O14, O25, O53, O57
**Keywords**: industrial policy, complexity economics, coevolution, feedback loops

## 1. Introduction

Mainstream theory has invariably attributed the malaise of the Philippine economy primarily to protectionist policy (Bautista et al. [1979]; Balisacan and Hill [2003]; ADB [2020]). A similar refrain has been offered for the relatively poor record of the economies in South Asia and Latin America (Nayyar [2019]; ADB [2020]; Coatsworth and Williamson [2004]; Armendáriz and

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Larraín [2017]). Indeed, many practical difficulties and costs have resulted from protectionist policy.[1] One, prices of imports and import-substitutes have exceeded the average world price. The price distortion led to economic inefficiency as the composition of aggregate consumption deviated from optimal. Two, markets became fragmented because of an incentive structure that favored small-scale production. Three, reduced competition from foreign firms conferred monopoly power on domestic firms and lowered consumer welfare. Finally, trade protection opened up opportunities for rent-seeking and corruption which added to input and transaction costs.

Lately, however, industrial policy—of which protectionism is a key component—has been viewed with less skepticism. This is in no small measure attributable to the actions of the administrations of Presidents Trump and Biden, which culminated in the Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act, a law that provides incentives like subsidies and tax concessions to encourage renewed production of advanced semiconductors in the US. While the law has not been without criticism (Dollar [2023]; Hardwick and Tabarias [2023]; Lovely [2023]), and it is too early to evaluate its full impact, the manifest act of protectionism by the largest free-market economy in the world has reduced the stigma associated with industrial policy. The emphasis, of course, is on the recent period since this is not the first time US industrial policy has been critiqued for its double standard [Keller and Block 2015] and the debate on industrial policy has been ongoing for decades (Naudé [2010]; Oqubay et al. [2020]).[2]

Meanwhile, the more important source of support for industrial policy has been empirical in nature. Recent econometric studies have validated the usefulness of industrial policy (Juhász et al. [2023]; Criscuolo et al. [2022b]). Moreover, historical evidence is usually interpreted in favor of industrial policy, particularly with regard to the experience in East Asia (Reinert [2020]; Nayyar [2019]; Cherif and Hasanov [2019]; Felipe [2015]). Box 1 gives a general idea of the complementary side of the discussion. However, the heart of the debate on industrial policy remains to be the variable outcomes. As Nayyar [2019:19] describes it: "Why did some Asian countries perform so well with unorthodox institutions, and why did other Asian countries with very similar institutions not perform well? The puzzle extended beyond institutions to policies. Similar economic reforms did well in some countries and did not perform well in other countries." This enigma extends beyond Asia.

Industrial policy can be defined as "the application of selective government interventions to favor certain sectors so that their expansion benefits the economy's productivity as a whole" [Memiş and Montes 2008:x]. The present study acknowledges that there are theoretical and empirical justifications for the application of industrial policy. At the same time, as intimated in the previous paragraphs,

[1] Lin [2012:18].

[2] See Reinert [2022] for a historical perspective.

industrial policy did not yield the same positive results in the Philippines compared with some of its Asian neighbors. There are various explanations, depending largely on the theoretical framework that is applied. The different theories are outlined in the next section. The main objective of this study is to analyze the mixed record of industrial policy in Asia from the lens of complexity theory. In particular, the co-evolution of sectors and feedback mechanisms between them provide a useful platform to explain both the success and failure of industrial policy. In the process, various country experiences will be highlighted including that of the Philippines. Approaching industrial policy via complexity theory can provide new insights on historical performance and policy prescriptions.

**BOX 1. Countervailing views on industrial policy**

"Whether it is in trade, macroeconomics, labor markets, property-rights, education, or microfinance, there is no unique correspondence, as the Washington Consensus and other general recipes suppose, between policies and outcomes" [Rodrik and Rosenzweig 2010:xvi-xvii].

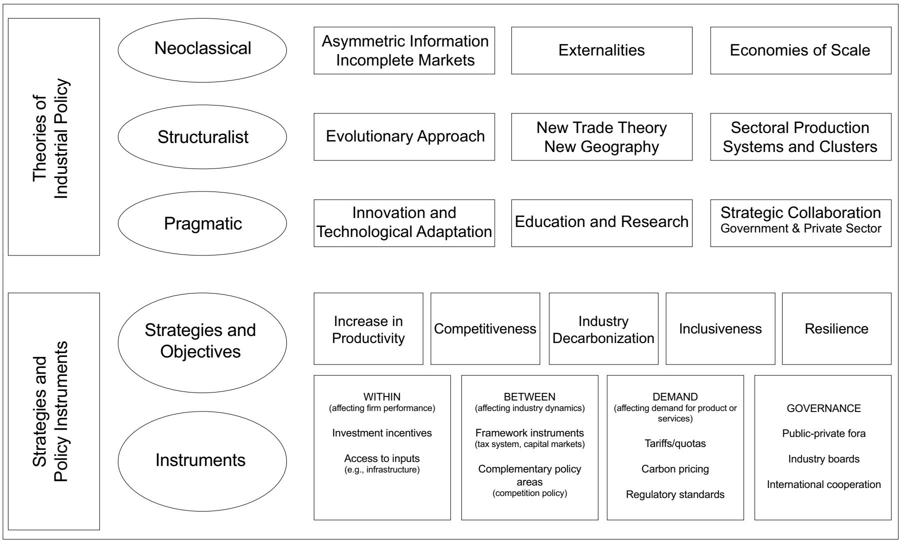
"Countries like South Korea and Taiwan had to abide by few international constraints and pay few of the modern costs of integration during their formative growth experience in the 1960s and 1970s…. So these countries combined their outward orientation with unorthodox policies: high levels of tariff and nontariff barriers, public ownership of large segments of banking and industry, export subsidies, domestic-content requirements, patent and copyright infringements, and restrictions on capital flows (including on foreign direct investment). Such policies are either precluded by today's trade rules or are highly frowned upon by organizations like the IMF and the World Bank. China also followed a highly unorthodox two-track strategy, violating practically every rule in the guidebook (including, most notably, the requirement of private property rights)" [Rodrik 2001:59].

"The real miracle of East Asia may be political more than economic: why did governments undertake these policies? Why did politicians or bureaucrats not subvert them for their own self-interest? Even here, the East Asian experience has many lessons, particularly the use of incentives and organizational design within the public sector to enhance efficiency and to reduce the likelihood of corruption. The recognition of institutional and individual fallibility gave rise to a flexibility and responsiveness that, in the end, must lie at the root of sustained success" [Stiglitz 1996:174].

## 2. Framework: theories and policy instruments

The various theories underlying industrial policy are succinctly summarized by Cohen [2006] and a condensed version is presented in Figure 1. A recent survey is contained in the second chapter of the *Oxford handbook of industrial policy* [Oqubay et al. 2020]. After a brief foray into the neoclassical approach, the discussion focuses on the structuralist theories outlined by Cohen and highlighted by Oqubay [2020]. This allows the analysis to segue to complexity economics (e.g. Arthur [2013]).

**FIGURE 1. Industrial policy framework**




Source: Cohen [2006] and Figure 1 of Criscuolo et al. [2022a].

### *2.1. Neoclassical approach*

Neoclassical theory rationalizes industrial policy through market failures (largely emanating from information asymmetries and incomplete markets), externalities, and increasing returns to scale. Advances in economic theory have justified the potential role of the state. In particular, high development theory[3] has been modeled more effectively (e.g., Murphy et al. [1989]). Despite this expanded structure, neoclassical theory has been unable to explain how, and why, economies

[3] The role of the state in mainstream economics became prominent in the late 1940s to the 1950s with the advent of high-development theory (HDT), described as the nexus among the concepts of scale economies, external economies, strategic complementarity, and economic development [Krugman 1993]. HDT is also labeled by some experts as the structuralist approach to economic development [Lin 2012]. The authors consider it as the interface between neoclassical theory and late structuralism. HDT's zenith roughly covers the period between the advent of the Big Push model conceptualized by Paul Rosenstein-Rodan in 1943 and the publication of Albert Hirschman's "The Strategy of Economic Development" in 1958.

undergo structural transformation over time. As Gabardo et al. [2017] observe, incorporating structural change into growth theory has proven to be difficult. The primary reason is that neoclassical theory is saddled by the requirement to have a unique, stable, and reachable equilibrium. The equilibrium assumption is fundamental to neoclassical theory. General equilibrium theory determines the level of prices and quantity of goods that are produced and consumed that would align or be in equilibrium with the overall structure of prices and quantities in the various sectors of the economy. The outcome should not create incentives to change the aforementioned overall structure.

A strand of the literature on industrial policy—primarily under the rubric of the structuralist approach—has dealt directly with structural change. The approach has been aptly associated with realism [Gibson 2003]. A detailed elaboration occupies the rest of this section. However, these explanations are "developed in an inductive, multidisciplinary fashion, largely driven by common sense and original thought but without a formal general theory backing it" [Cameli 2023:9]. Hence, after the extensive discussion on the structuralist approach to industrial policy, a framework based on complexity economics (CE) is proposed. The main feature is a non-equilibrium approach that readily explains structural transformation over time.

### *2.2. The structuralist approach*

The structuralist theory of industrial policy as defined by Cohen examines the interface of the new theories on the knowledge-based economy, international trade, and corporate behavior on the one hand, and emerging issues about competitiveness, specialization, and regional integration on the other. Renewed interest in industrial policy was spurred by the integration of the European Union. Important issues were raised about incentives to cooperate, how R&D influences the configuration of a production system, and the geographical and sectoral impact of establishing the Single European Market.

Two branches of the structuralist approach that are particularly important to this paper are: i) the evolutionary approach to technological trajectories and national innovation systems; and ii) theories of sectoral production systems and clusters. The Schumpeterian evolutionary tradition emphasizes technical change as the driver of capitalism, highlighting the importance of learning and capability development for firm competitiveness. In an ever-evolving economy, the levels of R&D and innovation do not offer a static explanation of competitiveness. Instead, the real determining factor is the dynamism in the production of knowledge transformed into new products.

That countries which have different policies and institutions are able to achieve similar results indicates that one size does not fit all. The concept of an "optimal" way to achieve a preferred result is not realistic. Evolutionary theory sheds light on the importance of country-specific characteristics for innovation to prosper. In particular, national innovation systems (NIS) that comprise education, R&D, and government support are vital to build absorptive capacity that is required for innovation and technological capability. From this standpoint of national distinctiveness and institutional dynamism, industrial policy acquires new validity, particularly with regard to learning.

Learning, both at the firm and policy level, is central to late development. Successful catch-up involves different strategies at various stages of industrialization, including imitation, learning from forerunners, and developing innovation capabilities. Enhancement of technological and innovation competencies highlights the synergetic and dynamic connection between technological learning, industrial policy, and catch-up. This can be reinforced through a clear and strategic plan that targets critical dynamic industries and new technologies. Such a plan will promote learning through consistent and comprehensive support to R&D, technology commercialization, education, and skills development. Overall, evolutionary theory and the NIS concept underscore the importance of capacities and competences in innovation processes, shaping contemporary approaches to micro- and macroeconomic competitiveness.

Meanwhile, the cluster approach, related to industrial districts and geographical agglomeration phenomena, emphasizes the development of industrial sub-systems around specific factors such as tertiary education systems, financial systems, and the linkages between firms. Recognition of these factors is necessary for designing policy interventions for strengthening firm-level competitiveness. The cluster approach focuses on interdependent relationships between institutions in an industrial system. Effective industrial policy promotes the creation of specific institutional arrangements for each cluster, rather than horizontal national programs that avoid necessary specificity.

Active sectoral policies build competitive advantages through specialization, enabling firms to take risks and adapt. Successful policies depend on companies' actions and collaboration with the policy framework, making bottom-up approaches more effective than top-down policies. Thus, industrial policies based on general instruments are less effective than those attentive to specific industry needs, improving competitiveness through sector-specific support. Policies to support development of clusters include bringing in appropriate human capital, attraction of start-ups, successful spin-outs, and formation of networks.

### *2.3. Structural transformation*

Industrial policy has to be linked to structural transformation and concepts such as nurturing of infant industry and the state-market mechanism. Instruments of industrial policy may vary as shown in Figure 1. The goal is primarily to build technological capability through learning and innovation that enhances firm-level competitiveness leading to structural change. The latter involves significant sectoral shifts, sustained productivity growth, technological spillover, and changes in demand, occupations, income levels, and socio-economic institutions.

Structural transformation entails transitioning from low- to high-productivity activities and sectors, diversifying into new activities and industries, and deepening and upgrading industrial capabilities.

The special properties of manufacturing, which include generating linkage effects, increasing returns to scale, and productivity gains, are critical for long-term economic dynamism. Growth laws associated with Kaldor [1980] emphasize manufacturing's special contribution to economic growth and productivity, highlighting three key relationships:

- strong causal relation between the growth of manufacturing output and GDP growth;
- positive causal relation between manufacturing output growth and productivity growth within manufacturing (Verdoorn's law); and
- positive causal relation between the expansion of the manufacturing sector and productivity growth outside manufacturing due to diminishing returns in other sectors.

Manufacturing enhances economic dynamism through technical change, investment, and the accumulation of technology and capital. Kaldor [1980] emphasizes the role of technology and demand in determining capital intensity and overall economic evolution. Knowledge intensity and technological advancements are key measures of development.

### *2.4. Manufacturing, exports, and structural transformation*

Manufacturing industries complement agriculture and services, fostering strong intersectoral linkages. Early industrialization transforms agriculture through increased productivity and technological advances. Manufacturing also stimulates the growth of services by outsourcing activities and enhancing competitiveness through knowledge-intensive services.

Meanwhile, there are differing views on the role of exports. A market-friendly perspective advocates for liberalization and international competitiveness, while another view emphasizes the strategic importance of how countries engage in international trade. Straddling both views is the argument that exports are critical for overcoming market size limitations, addressing balance-of-payments constraints, and fostering high efficiency and quality standards.

Exports and international trade positioning are pivotal for growth and structural transformation, particularly in manufacturing. A strategic export-led industrialization (ELI) approach, synchronized with import-substitution industrialization (ISI), accelerated industrialization in latecomer economies like Japan, the Republic of Korea, Taiwan, Singapore, and China. ELI, in conjunction with ISI, fosters industrial learning and competitiveness.

Perspectives on structural transformation have significant implications for industrial policy in three key areas:

- reinforcing the strategic importance of export-led industrialization for sustained growth and economic transformation, regardless of market size;
- emphasizing a sectoral approach for targeting specific industrial sectors and activities based on technological intensity, linkage effects, and demand elasticity; and
- aligning instruments to support high-productivity activities and investments, with exports serving as a pressure mechanism for learning and performance monitoring.

### *2.5. Linkages and complementarities*

Hirschman [1992] was responsible for the pioneering work on linkage effects as they relate to industrialization. He argued that linkage is a conceptual tool that facilitates “detecting how one thing (activity) leads or fails to lead to another”, and is the “ more or less compelling sequence of investment decisions occurring in the course of industrialization and, more generally, of economic development” [Hirschman 1992:56]. Recognizing the linkage effect enables selection and support of priority sectors whose interaction would accelerate structural transformation, Hirschman posited that the key constraint in developing countries is not lack of resources but the lack of knowledge and capability to take action to promote investment and generate productive activities. This is directly related to the cluster approach defined by Cohen [2006] and discussed earlier. The concept of linkages also dovetails with the role of feedback loops in the context of complexity economics, which is discussed in the next section.

By encouraging investment that supports interdependencies and complementarities, agglomeration economies can emerge. Agglomeration economies and cluster dynamics promote division of labor and specialization, efficiency gains and rising productivity, innovation and learning, and linkages, performing the role of critical drivers of positive externalities. Three principal issues are relevant in terms of crafting the overall development strategy. First, policymakers have to consider the nexus between export-led and import-substitution industrialization. A second interdependent and complementary relationship is that between manufacturing and agriculture. However, lately the discussion has shifted to a debate between manufacturing and services [Rodrik and Sandhu 2024]. The likely best approach is to search for a framework that maximizes the synergy among manufacturing, services, and agriculture. A third important aspect of industrial policy is the relationship between foreign direct investment (FDI) and domestic firms, particularly in the context of the experience of East Asia with regard to regional production networks.

## 3. Complexity economics, industrial policy, and structural change

The previous section highlighted key elements of the structuralist approach to industrial policy: the process of innovation, the role of the manufacturing sector, the importance of exports, and the ultimate goal of structural transformation. CE allows these elements to be combined in a framework along with the concepts of clustering, agglomeration, linkages, and complementarities. The proposed unifying framework is underscored by feedback mechanisms in systems and the process of co-evolution.

### *3.1. Complexity theory and complexity economics*

Complexity theory is the science of complex systems. According to Serrat [2017:349], "its origins lie in biology, ecology, and evolution as a development of chaos theory. It is the theory that random events, if left to happen without interference, will settle into a complicated pattern rather than a simple one." Complexity theory highlights holism, uncertainty, and nonlinearity as opposed to reductionism, predictability, and linearity.

A reductionist framework or a realist philosophy has underpinned traditional sciences wherein an entity is reduced to its smaller parts. Analyzing the functions of the smaller parts allows the comprehensive understanding of the whole. Complexity science expands on the reductionistic framework by not only understanding the parts that contribute to the whole but by understanding how each part interacts with all the other parts and emerges into a new entity, thus having a more comprehensive and complete understanding of the whole [Turner and Baker 2019]. The spontaneous materialization of macro-patterns from local, nonlinear interactions occurring at the micro level is the broad purview of complexity science.

Meanwhile, Arthur [2021:136] notes that "even before Adam Smith economists observed that aggregate outcomes in the economy, such as patterns of trade, market prices and quantities of goods produced and consumed, form from individual behavior, and individual behavior, in turn, reacts to these aggregate outcomes. There is a recursive loop. It is this recursive loop that makes the economy a complex system." The central idea on which the CE approach is built is the economic system as a complex adaptive system.

### *3.2. Complexity economics and industrial policy*

A novel approach has been to propose CE as the theoretical foundation for modern industrial policy [Cameli 2023].[4] A summary of the relationship between industrial policy and CE is shown in Table 1. Complexity theories have led to significant progress in endogenizing the process of structural change associated with industrial development. Cameli points to the work of Stuart Kauffman, a renowned biochemist and complexity theorist who applied to economics his theory of co-evolution and the idea of the "adjacent possible." This in turn set the stage

[4] Cameli uses the term "21st century industrial policy." This paper prefers the term modern industrial policy following Felipe [2015].

for "economic complexity" wherein the concept of product space is an application (Hidalgo and Hausmann [2009]; Balaoing-Pelkmans and Mendoza [2024]).

**TABLE 1. Aligning elements of complexity economics and industrial policy**

| Approach to policy as derived from complexity economics | Approach to policy as stated in core of modern industrial policy |
|---|---|
| - Radical uncertainty: impossible to know how the system will react to a given stimulus | - Unknowability ex ante of policy outcomes |
| - Solutions to economic problems as evolutionary paths on an unknown fitness landscape | - Solutions to problems in the productive sphere as a search process in an unknown territory |
| - Bounded rationality of public and private actors, impossibility to use deductive logic | - Imperfect information both from the side of government and from the side of private firms and industries |
| - Industrial metabolism as a systemic concept encompassing the whole variety of transformation activities carried out inside an economy | - Industry does not mean uniquely manufacturing, call for a more comprehensive approach |
| - 'Cultivation' paradigm, symbiotic connection between public and private, focus on setting the eco-structure | - Strategic cooperation between government and private industries, focus on designing settings able to implement this |
| - Government, markets and social institutions result from self-organization. Complementarity between state and private actors | - 'Embeddedness' paradigm: Government is not insulated but deeply embedded into a net of social institutions |

Note: Radical uncertainty is characterized by obscurity, ignorance, vagueness, ambiguity, and lack of information. It gives rise to "mysteries" rather than to "puzzles" with defined solutions. Cultivation paradigm is used to contrast with "control." While the control approach focuses mainly on objectives and neglects the process, the cultivation approach, instead, is concerned with getting the process right. This table is reprinted from Cameli [2023].

One advantage of CE is its ability to use more sophisticated models to explain the process of the emergence of new products and the manner in which the socioeconomic milieu is rearranged accordingly. However, in order for policy to get more traction, there has to be an interface of the socioeconomic sphere with a biophysical approach making it possible to have a more complete process that is consistent with the fundamental laws of nature. This would include endogenous evolutionary dynamics and basic thermodynamic processes. Hence, Cameli [2023:174] proposes the following operating definition for industrial policy: "any attempt carried out by the State to modify national industrial metabolism while supporting the process of exploration of the 'adjacent possible' of industrial goods and services." The term "metabolism" links the expansion of the product space in an economy to the biological and chemical reactions in the human body.

Meanwhile, CE also supports the most important feature of modern industrial policy which is the cooperation between public and private actors. Modern industrial policy explains the importance of public-private partnership by adopting from political economy the paradigm of embedded autonomy. An embedded state maintains different institutionalized channels through which the government is able to interact constructively with the private sector in pursuit of economic development. However, there is the risk that an embedded state will be captured by the entities and interests it seeks to guide and promote. Therefore, the state must also be autonomous. This implies that the state should be independent, above the fray and beyond capture by vested interests. Accordingly, Rodrik [2009:20] concludes that "the right model for industrial policy therefore lies in between the two extremes of strict autonomy, on the one hand, and private capture, on the other." Cameli elucidates how this concept can benefit greatly from the complexity approach. One of the most relevant aspects of the complexity approach is its capacity to skillfully manage the discord between state-interventionist and market-fundamentalist positions. In the CE framework, "the public authority itself can be thought of as a result of the self-organization of the socioeconomic system, just like markets and any other social institution. This allows CE to transcend the neoclassical narrative that sees markets as something 'natural' and the government and its interventions something 'external' to the socio-economic system, which threatens its natural functioning with distortionary, i.e. unnatural, interventions" [Cameli 2023:174].

### *3.3. The role of feedback loops and co-evolution*

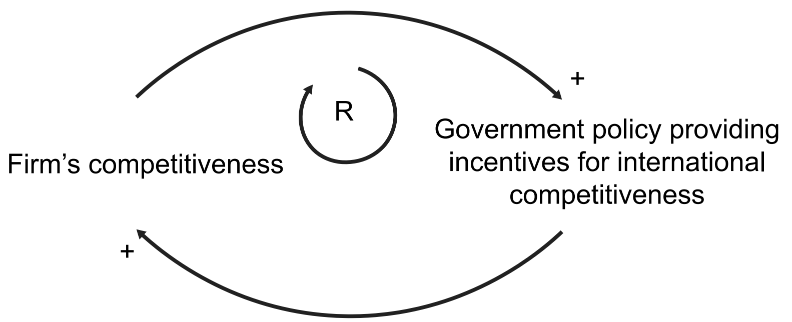
The shift from the reductionist framework to a systems approach and eventually to complexity theory takes into consideration the environment and the feedback information. Two types of feedback processes exist in socioeconomic systems: positive (reinforcing) loops and negative (balancing) loops [Radzicki 2021]. The first type represents self-reinforcing processes and causes the growth or decline of systems. "Economic growth trends, multiplier processes, accelerator relationships, wage-price spirals, speculative bubbles, bandwagon effects, increasing returns, path dependent processes, and anything that can be described as a vicious or virtuous circle can be represented with positive feedback loops" [Radzicki 2021:2-3]. Negative loops, on the other hand, reflect goal-seeking activities and many types of deliberate behavior. They represent mechanisms such as the process of general equilibrium in the neoclassical approach described earlier.

The presence of positive and negative types of feedback in combination is an important component of complex systems. If a system contains only negative feedback, e.g., diminishing returns in economics, it will eventually converge to equilibrium and exhibit a steady-state pattern. If a system contains only reinforcing loops, it expands rapidly and tends toward explosive behavior. With a mixture of both, it shows "interesting" or "complex" behavior.

In the market economies that have developed since the industrial revolution, many of the most important characteristics are due to feedback processes [Joffe 2021]. These common features generate patterns that are essential in trying to explain how the economy works, echoing the perspective of Arthur [2021] on recursive loops. Analyzing the patterns generated by feedback and other system properties provides a dependable basis for systematic study. This is an alternative framework to the traditional one of imposing predictability on human behavior by assuming strict rationality and optimization, which has become unrealistic in view of the conclusions of behavioral economics.

Joffe [2021] examines both positive and negative loops. A type of reinforcing feedback is related to complementarity, an important instance of which is path dependence and technological lock-in, the consequence of increasing returns. This is directly related to the earlier discussion on Hirschman's concept of linkages and complementarities. For this study, the more relevant example of a reinforcing-feedback cycle from Joffe's paper occurs in the policies of different governments in relation to foreign trade, and specifically, international competitiveness (Figure 2). East Asian governments such as Japan, Taipei, China and the Republic of Korea have prominently nurtured their domestic firms to become competitive at a global level, using industrial policy. The firms responded and contributed to high and sustained levels of economic growth. On the other hand, as mentioned in the introductory section, Latin America relied on ISI, reflecting a lesser ability of their firms to address the challenge of international competitiveness—or a lack of governments' confidence in their ability to do this. The complementarity here is between governments and firms, and as discussed earlier, this can be established successfully with embedded autonomy.

**FIGURE 2. Feedback loop: increasing returns and path dependence**

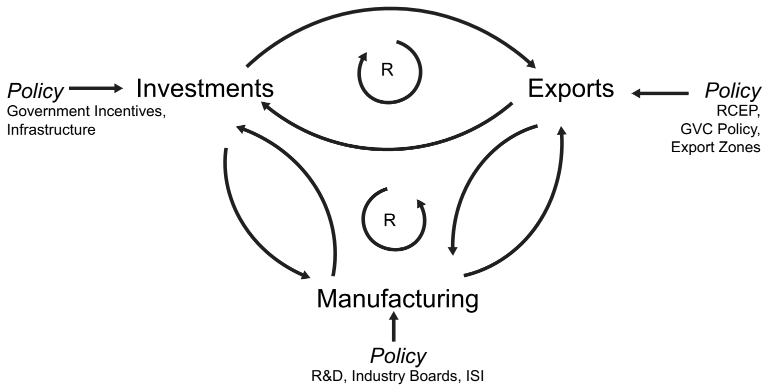



Source: Reprinted from Joffe [2021].

This example can be extended following the concept of co-evolution. In complexity theory, co-evolution relates largely to biological sciences. When adaptable autonomous agents or organisms interact intimately in an environment, such as in predator-prey and parasite-host relationships, they influence each other's evolution. This effect is called co-evolution, and it is the key to understanding how all large-scale complex adaptive systems behave over the long term [Ramalingam et al. 2008]. In general, the evolution of one domain or entity is partially dependent on the evolution of other related domains or entities.

In this study, the dynamics of structural change is considered to be driven by the co-evolution of investment, manufacturing, and exports (Figure 3). In statistical terms, co-evolution means that a set of two-way relationships linking together the set of variables in the vector **Y** of a VAR(p) model can be established. The framework indicates that industrial policy will be successful if it can trigger a reinforcing loop among investment, manufacturing, and exports, specifically one that leads to growth of the system. A necessary condition for a reinforcing loop to materialize is for there to be a significant set of two-way relationships among the three variables, i.e., the three variables co-evolve. However, even if co-evolution can be established, either a negative or balancing loop or a reinforcing loop that leads to the decline of the system may emerge, therefore rendering industrial policy ineffective. The country case studies identify idiosyncratic factors that have led to either reinforcing or balancing loops.

**FIGURE 3. Industrial policy and feedback loops**




Note: Authors' illustration.

## 4. Econometric analysis[5]

The objective of the econometric analysis is to determine the validity of the framework in Figure 3. This paper adopts the methodology by Castellacci and Natera [2013] that employs cointegration analysis to examine the long-run relationship of variables co-evolving over time in a panel data setting. Two variables $X_t$ and $Y_t$ are said to co-evolve if 1) these variables are cointegrated and if 2) there exists a Granger bidirectional causality between $X_t$ and $Y_t$. The variables in the model are the investment-GDP ratio (*INV/GDP*) the exports-GDP ratio (*EXP/GDP*), and the ratio of manufacturing valued added to GDP (*MAN/GDP*).

[5] Only a summary of the data, methodology and results are discussed in this paper. A complete version can be found in Yap and Turla [2024].

### *4.1. Data*

Data for the empirical analysis consist of a panel of eight Asian economies, namely Indonesia, Japan, Malaysia, the Philippines, the Republic of Korea, Singapore, Thailand, and Vietnam. The data were obtained from the UN Statistical Division for the period 1970-2022. China was excluded because of missing data for value added in manufacturing for the period 1970-2003.

### *4.2. Methodology and results*

Castellacci and Natera [2013] follow a four-step procedure to determine whether the data show evidence of co-evolution patterns. The first step is to conduct a battery of panel unit root tests to determine whether the time-series variables of interest are integrated of order one or stationary after removing the time trend by first-differencing. The panel unit root tests by Breitung [2000], Choi [2001], Levin et al. [2002], and Im et al. [2003] are employed. All test statistics for the differenced variables were shown to be significant at the conventional levels.

Following the framework of Engle and Granger [1987], panel cointegration involves testing whether the residuals of a linear combination of nonstationary time-series variables are stationary in a dynamic panel data setting. In this paper, the Pedroni [1999;2004] and Kao [2009] panel cointegration tests are applied. If the residuals are stationary, then the variables of interest are cointegrated. The next step is to estimate a Vector Error Correction Model (VECM). Table 2 shows the relevant empirical results.

**TABLE 2. Panel VECM short-run and long-run causality**

| Dependent Variable | Sources of Causation (Independent Variable) | | | |
|---|---|---|---|---|
| | Short-Run | | | Long-Run |
| | *ΔINVGDP* | *ΔEXPGDP* | *ΔMANGDP* | ECT |
| *ΔINVGDP* | - | 0.254188<br>(0.6141) | 5.913121**<br>(0.0150) | -0.041608***<br>(0.0006) |
| *ΔEXPGDP* | 18.39998***<br>(0.0000) | - | 19.09979***<br>(0.0000) | -0.002296**<br>(0.0321) |
| *ΔMANGDP* | 15.19556***<br>(0.0001) | 6.009840**<br>(0.0142) | - | -0.053310***<br>(0.0000) |

Note: Above values under short-run causation are chi-square statistics. ECT represents the coefficient of the error correction term. Number in parentheses are p-values.
Significance levels: *** one percent; ** five percent; * ten percent

The negative and significant coefficients of the error correction terms show a cointegrating relationship among the three variables. Meanwhile, results from the Granger causality test indicate a bidirectional relationship between manufacturing-to-GDP and investment-to-GDP ratios and between manufacturing-to-GDP and exports-to-GDP ratios (Table 2). The same test shows that there is a unidirectional relationship only between the investment-to-GDP and exports-to-GDP ratios in which the latter Granger causes the former. However, the Dumitrescu-Hurlin [2012] test, which is used to detect Granger causality in a panel data setting, indicates bidirectional causality among all three variables (Table 3).

**TABLE 3. Pairwise Dumitrescu-Hurlin panel causality tests**

| Null hypothesis | W-Stat. | Zbar-Stat. | Prob. |
|---|---|---|---|
| INVGDP does not homogeneously cause EXPGDP | 4.24669 | 2.78651 | 0.0053* |
| EXPGDP does not homogeneously cause INVGDP | 3.62442 | 1.98218 | 0.0475** |
| INVGDP does not homogeneously cause MANGDP | 3.76740 | 2.16699 | 0.0302** |
| MANGDP does not homogeneously cause INVGDP | 3.82929 | 2.24699 | 0.0246** |
| EXPGDP does not homogeneously cause MANGDP | 8.73274 | 8.58506 | 0.0000*** |
| MANGDP does not homogeneously cause EXPGDP | 6.27560 | 5.40902 | 6.E-08*** |

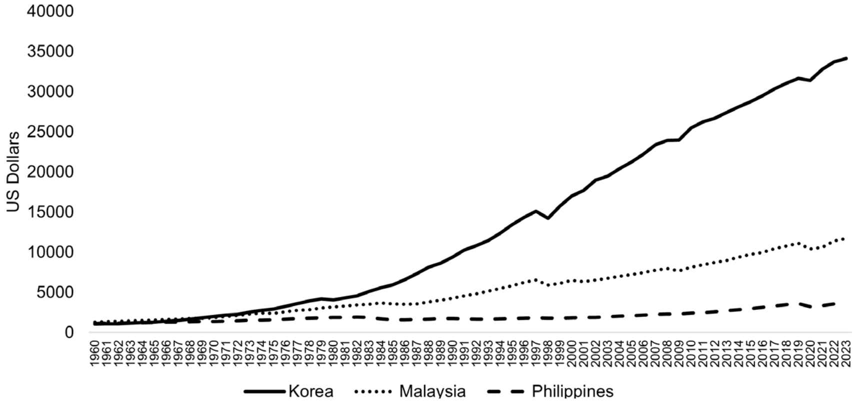
Note: The lag length applied in these tests is two.
Significance levels: *** one percent; ** five percent; * ten percent

The empirical results support the validity of the framework in Figure 3. There is evidence of co-evolution among the three variables. Not only is there a long-term or equilibrium relationship among them, the relationship is generally bidirectional. This is a *necessary* condition for the emergence of positive feedback loops. A question may arise about the inconsistency of the concept of an "equilibrium" relationship and complexity theory which emphasizes non-equilibrium outcomes that are driven by feedback or recursive mechanisms. It should be noted that the empirical results do not provide proof of the existence of positive feedback loops, but merely that conditions for their occurrence are present. Emergence of positive feedback loops is determined through the actual experience of countries with regard to industrial policy as discussed in the next section.

## 5. Country case studies

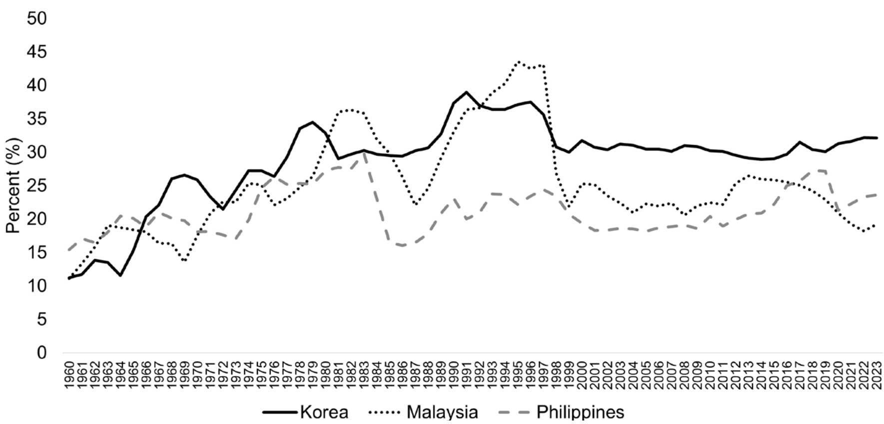
This section explores the experience of three countries to illustrate how industrial policy has led to structural transformation. The role of feedback mechanisms through the three major sectors is emphasized. Figures 4 to 7 compare the economic performance of the three countries using per capita GDP and the three aforementioned variables.

**FIGURE 4. Per capita gross domestic product (constant = 2015 prices), 1960 to 2023**



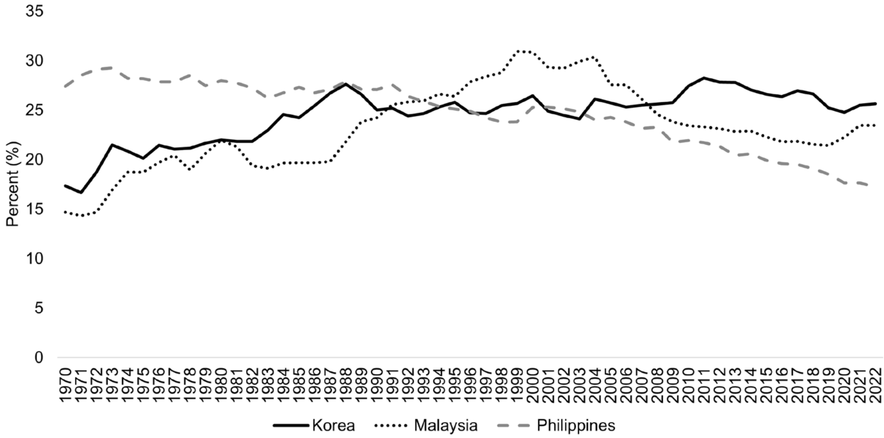

Source: World Bank World Development Indicators.

**FIGURE 5. Gross fixed capital formation as a percent of GDP, 1960 to 2023**



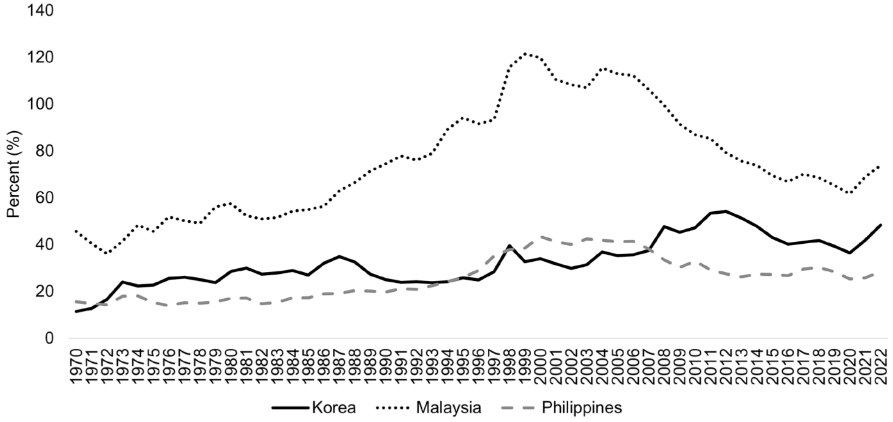

Source: World Bank World Development Indicators.

**FIGURE 6. Gross value added of manufacturing as a percent of GDP, 1970 to 2022**




Source: United Nations Statistics Division.

**FIGURE 7. Exports of goods and services as a percent of GDP, 1970 to 2022**




Source: United Nations Statistics Division.

### *5.1. The Republic of Korea*

The Republic of Korea represents the most remarkable economic transformation in East Asia. In less than two decades after World War II, the country transformed itself from an agricultural economy to a major global manufacturer. Industrial policy was a crucial component of this process.

Much of the discussion in this section is based on Felipe and Rhee [2015a;2015b]. They argue that the progression in Korea's industrial policy is a good example of how the government modifies its role depending on the different stages of development. In the years after the Korean War, government was the primary decision-maker, specifically the president in tandem with the ministers of the various industries and their policy aides. However, private and public enterprises jointly selected specific export industries. The government provided assistance, mainly in the form of subsidies, to the relevant entities if they achieved certain targets. In the 1970s, a government-led industrial targeting policy was implemented to support six heavy and chemical industries (HCIs). But this was carried out only after intensive consultation with private companies. The increasing role of the private sector in the sector selection process persisted after the 1970s. Decisions to move into information and communications technology in response to advances in technology were led by the private sector.

The industrial tools applied by the Korean government also evolved in tandem with the latter's shifting role. Preferential export credits and special export zones were the country's primary policy tools in the 1960s when processing trade was a major target of industrial policy. When the domestic industrial based emerged in the 1970s, the government established special industrial complexes largely through policy loans and this provided modern transportation and energy infrastructure to domestic firms. In the aftermath of the two oil shocks, the government programs in the 1980s focused on industrial restructuring, facilitated by fiscal incentives for corporate reforms, a low interest rate policy, and the depreciation of the won to spur exports.

When Korea reached the threshold of a high-income country, the government shifted the target of industrial policy to the promotion of a knowledge economy. Special funds were allocated for R&D and education in the 1990s. Meanwhile, because of their emerging role as a source of innovative growth, SMEs gained additional support through various credit guarantees. In place of traditional industrial policies, financial tools that supported risk sharing, R&D, education and SME development became more useful.

The experience of Korea belies the pessimism that selective governmental industrial promotion policies can be very costly when applied to capital-intensive or high-technology areas. While it is true that Korea's heavy chemical industries suffered from structural difficulties caused by over-investment, over-leveraging and over-competition, the government was able to launch a huge restructuring drive that involved closing down and merging several large companies [Felipe and Rhee 2015a]. As a result, economic growth of Korea in the 1980s declined only slightly to an average of 8.8 percent from 9.4 percent in the 1970s.

This experience highlights the three crucial characteristics of Korea's industrial policy. First, is the government's decisiveness in abandoning or overhauling interventions that do not yield the expected results. Second, implementation of an effective monitoring and evaluation mechanism that allowed granting of performance-based incentives. For example, if export targets were not met by firms, subsidies were either reduced or import licenses withdrawn. The monitoring and evaluation (M&E) system was instrumental in enabling the government to respond effectively to the emerging crisis in the heavy and chemical industry sector in the early 1980s.

Perhaps the most important component of Korea's success story is the understanding by the government that active intervention is needed to achieve technological development [Felipe and Rhee 2015a]. Technology does not transfer automatically after opening up to foreign trade and capital flows. In other words, technology is non-tradeable [Pack and Westphal 1986]. The government of Korea had a wider array of policies geared toward stimulating market demand for technology, increasing the country's science and technology base, and creating effective linkages between the demand for and supply of technology.

### *5.2. Malaysia*

Malaysia has had a more deliberate industrial policy than other economies in Southeast Asia. This partly explains its higher per capita income, second only to Singapore in the region. Tham [2015] analyzes Malaysia's attempts to diversify its economy and the role that industrial policies played. The structural transformation in Malaysia consisted of a shift from agriculture towards manufacturing and can be partially attributed to measured government policies. The pragmatic approach is consistent with the country's underlying development philosophy of active government support and direction, combined with free enterprise. To implement industrial targets, Malaysia had formulated three Industrial Master Plans (IMP): IMP1 (1986-95), IMP2 (1996-2005), and IMP3 (2006-2020), and the Economic Transformation Plan of 2010.

Malaysia chose to follow the path of Singapore by relying heavily on foreign direct investment (FDI) and to this end it provided significant incentives to multinational companies. Along with other Southeast Asian economies, Malaysia was able to latch on to global supply chains. However, it has not produced any global, Malaysian-owned and -designed products, in the sense of a Sony, Samsung or Huawei. This is a clear indication that Malaysia's indigenous technological capability is relatively low.

Tham [2015] argues that while strategies to become an industrialized economy have had partial success, they fell short of expectations. Because the targets of Malaysia's economic plans were very broad, they had a tendency to be inadequately implemented and were not monitored effectively. Furthermore, the country lacked human capital resources; technology policies overemphasized supply-side public institutions and failed to sufficiently respond to demand for technology from private firms; and linkages between firms and universities have been weak. The rate of technology transfer in Malaysia's economy has not been enough to overcome these weaknesses. Therefore, at that time, Tham considered it unlikely for the country to achieve its goal to become a knowledge- and innovation-led economy by 2020.

Policies implemented in the electronics and automobile sectors are illustrative of the challenges confronting Malaysia. The electronics sector has been a driver of Malaysia's economic transformation. However, it has not been able to graduate into the more knowledge-intensive stages of the electronics value chain. This can be attributed to Malaysia's policy of relying on cheap labor from abroad and the inability to undertake R&D at the domestic level. Meanwhile, Malaysia's failed attempt to develop Proton as a global brand is an example of a failed old-style industrial policy. Ill-targeted subsidies and other privileges granted to the car industry were not able to turn this uncompetitive industry around. Unlike Korea, the Malaysian government did not impose conditions on the subsidies such as sunset clauses or performance requirements.

### *5.3. The Philippines*

Economic development in the Philippines during the post-Second World War period can be described as enigmatic. Despite generally favorable conditions, a decent stock of human capital, relatively abundant natural resources, and a democratic form of government, the economic record of the Philippines has paled in comparison with its neighbors in East Asia. Using per capita GDP measured in constant prices as a metric, the Philippines was overtaken by Korea in 1965, Thailand in 1985, Indonesia in 1994, China in 1999, and Vietnam in 2021 [Yap 2024]. Some experts refer to this disappointing performance as the "Philippine development puzzle."

The country's experience with industrial policy can partly explain the dismal economic performance. Felipe and Rhee [2015a] provide a useful comparison between the Philippines and Korea with regard to the practice of industrial policy. The primary difference is that the Philippines did not have the economic independence to pursue a strategic industrial policy. At that time the Philippines was bound by a dependent relationship with the US that resulted from the Bell Trade Act. This lopsided alliance lasted until 1974. Apart from granting reciprocal free trade, the arrangement prevented the Philippines from adjusting its exchange rate until 1955. As a result, the currency became overvalued and a balance-of-payments crisis ensued due to lack of foreign exchange required to support rehabilitation of the economy shortly after the war. In response to the crisis, and not as a strategic measure, the Philippine government imposed import and exchange controls. Because of the protection bestowed by these trade controls, the share of the manufacturing in terms of value added rose from 12.5 percent of GDP in 1950 to 17.5 percent in 1960.[6] Economic growth was particularly rapid during the period 1950-55 when market value added (MVA) in manufacturing increased by an average of 12.1 percent per annum.

The growth was concentrated in the consumer goods sector which could not be sustained because of the required importation of capital goods. An alternative would have been to move into the second stage of import substitution which involved backward integration into intermediate and capital goods. Or else, like Korea in the 1960s, the Philippines could have embarked on export-led industrialization. Unfortunately, apart from the substantial US presence, economic and political power in the Philippines at that time was concentrated in a small number of wealthy landed families who had little interest in reforming trade and exchange rate policies to support sustained industrialization. In 1962, policymakers abandoned economic protectionism and instituted the decontrol program, which involved the dismantling of the foreign exchange and import controls. As a result, the industrialization of the country was derailed as the government could not prevent the surge in imports and the large repatriation of foreign capital and profits.

Meanwhile, the oligarchic nature of the Philippine economy persisted. During the Martial Law period, industrial policies implemented by President Marcos generally favored a small group of cronies. While export promotion measures were enacted, because of the overall illiberal trade regime, these only encouraged the processing of industries based on imported materials and cheap labor [Abrenica 2013]. The prominent examples of this type of commodities were semiconductors and garments.

[6] Data are quoted directly from O'Connor [1990].

The post-Martial Law period has been described as a double whammy on the Philippine economy [Yap 2024]. The first strand relates to how the Philippines pursued a different path toward an internationally competitive industrial sector compared with its Southeast Asian neighbors. While the six more advanced countries were restructuring their economies through state intervention in the mid-1980s, the Philippines embarked on an ambitious trade and import liberalization program starting in 1984, establishing a new path anchored on the long-running domestic debate on eliminating the disincentives created by protection measures [Montes 2018]. In a series of structural adjustment programs under the direction of the Bretton Woods institutions, the program progressively reduced quantitative restrictions and tariff rates, seeking to encourage private sector involvement.

The Philippine experience can be contrasted with Đổi Mới of Vietnam in 1986 which is an example where policymakers modified, adapted, and contextualized their reform agenda at the same time calibrating the sequence of, and the speed at which, economic reforms were introduced [Nayyar 2019]. This is described as strategy-based reform as opposed to crisis-based reform, which is often initiated following an external shock or internal convulsion, or imposed by conditionality of the IMF and World Bank. Crisis-based reform is more difficult to sustain and less likely to succeed because its preordained template is neither context-specific nor sequenced [Nayyar 2019]. Similar to its experience in the 1960s, the Philippines did not pursue a strategic industrial policy and instead was forced by circumstances to resort to crisis-based reform in 1984.

The second strand relates to outward orientation and structural transformation in Southeast Asia in the period 1985-1995 which were largely driven by the surge of FDI from Japanese companies seeking low-cost labor following the realignment of the world's major currencies in the mid-1980s. Success in attracting FDI depended on state policies to provide these investments with a suitable location to profitably operate production activities for export. From the supply side, the choice to break down the production process into components was prompted by Japan's priorities to protect its growing dominance in global automobile and electronics markets by transferring labor-intensive tasks offshore in the face of an abrupt exchange rate adjustment. Economic and political crises in the 1980s—partly driven by the ill-conceived liberalization program—and a severe power shortage in the early 1990s prevented the Philippines from fully benefitting from the boom in the Asia Pacific driven by regional economic integration.

### *5.4. Comparison from the lens of complexity economics*

A comparison of the economic performance of the three countries can shed light on the effectiveness of the industrial policies that were implemented. Figure 4 shows per capita GDP in constant 2015 USD from 1960 to 2023. Korea overtook the Philippines in 1965 and Malaysia in 1970 and thereafter surged past them. In just six decades, the standard of living of Korea expanded tenfold compared with that of the Philippines. When comparing the effectiveness of policies based on the framework in Figure 3, Korea is therefore a useful benchmark. How policies engendered positive feedback loops among investment, manufacturing and exports will be analyzed.

Korea comes closest to what is considered "true industrial policy" or more precisely technology and innovation policy [Cherif and Hasanov 2019]. It consists of three key principles [Cherif and Hasanov 2019:6]: "(i) state intervention to fix market failures that preclude the emergence of domestic producers in sophisticated industries early on, beyond the initial comparative advantage; (ii) export orientation, in contrast to the typical failed 'industrial policy' of the 1960s–1970s, which was mostly ISI; and (iii) the pursuit of fierce competition both abroad and domestically with strict accountability."

Korea's promotion of technological development underpinned its strategy for industrial development and increased competitiveness. This was complemented by subsidies to spur investment and strong support for exports. An effective monitoring and evaluation mechanism ensured the effectiveness of performance-based incentives. For example, if export targets were not met by firms, subsidies were either reduced or import licenses withdrawn. Figure 5 shows that Korea generally had a higher investment rate than Malaysia and the Philippines. Its manufacturing sector also flourished between 1960 and 1988 when it reached a secondary peak (historical peak is in 2011, but only slightly higher). Meanwhile, the export-GDP ratio of Korea is lower than that of Malaysia but this can be attributed to the latter's higher participation rate in both regional and global value chains. Nevertheless, Korea definitely outstrips Malaysia in terms of volume of exports. The evidence clearly points to positive feedback loops with growth outcomes having been generated by industrial policy in Korea.

After being surpassed by Korea in 1970, Malaysia fell significantly behind. For instance, what took Malaysia more than 50 years to reach about 40 percent of US GDP per capita in 2014, took Korea only about 20 years (Cherif and Hasanov [2019]). The missing link in Malaysia compared to Korea—and also Taipei, China—is own-technology creation. A focus on multinational corporations and technology transfer rather than encouraging domestic innovators contributed to the lack of innovation in Malaysia. As an example, the Malaysian electronics cluster lacked the 'packaging and integrating' capabilities of Singapore and product development and technology management capabilities of Taipei, China.

The limited technological development in Malaysia has constrained the growth component of positive feedback loops. Malaysia also did not have an effective monitoring and evaluation mechanism which would have allowed for restructuring or even termination of an industrial policy if warranted by circumstances. The Proton saga is an example of an industrial policy that outlived its usefulness. The Malaysian government did not have the decisiveness to quickly end the support for the car industry. Thus, even if Malaysia benefited from its participation in regional and global value chains, the manufacturing-GDP ratio experienced a decline since 1999. This has caused exports-GDP to decline, too.

If Korea is the poster child for true industrial policy, the Philippines is the opposite. One major constraint in the Philippines has been the investment rate. Among the ASEAN+3 economies, only the Philippines and Cambodia never reached the 30 percent threshold in any year during the period 1960-2023 [Yap 2024]. The reasons have been discussed extensively elsewhere (e.g., Balisacan and Hill [2003]). Meanwhile, a major reason the export-GDP ratio in the Philippines has faltered is its inability to latch on to regional and global value chains as intensively as many of its neighbors. As explained earlier, the Philippines did not benefit from the surge of Japanese FDI in the mid-1980s and early 1990s. Unsurprisingly, efforts to boost the manufacturing sector did not fare well. It is quite revealing that when Korea reached a secondary peak in the manufacturing-GDP ratio in 1988, the value for the Philippines was slightly higher. Following the framework in Figure 3, feedback loops in the Philippines tapered off relatively quickly—they became negative or balancing loops—because of investment constraints and the inability to shift to greater export-orientation.

Finally, the Philippines can be described as a soft state, wherein governments are not willing or able to do what is necessary to attain development objectives because they can neither withstand nor compel powerful vested interests [Nayyar 2019]. An oft-cited factor for the inadequate economic progress in the Philippines is the lack of collective action, which can be traced to weak institutions [Fabella 2018] or what is essentially a soft state. Hence, embedded autonomy has not been established, which has been an important feature of the Korean experience. Policymakers in the Philippines were hampered in abandoning or overhauling interventions that did not yield the expected results leading to widespread rent-seeking activities.

## 6. Summary and conclusion

Empirical evidence and country experiences have supported the record of industrial policy. Recently, political economy factors emanating from pronouncements of advanced economies have given a boost to the reputation of industrial policy. The sharpest critique of industrial policy has generally stemmed from theoretical debates. Neoclassical growth economists have had a bias towards one-sector growth models and have contended that there are no special properties for any sector. They also argued that industrial policy created “rent-seeking” opportunities [Oqubay 2020]. However, the emphasis of neoclassical theory on the equilibrium condition limited its practicality. Meanwhile, the structuralist approach highlighted industrial policy as a driver of structural transformation and a conduit of technological catch-up, underlining the strategic role of exports and of sectors with higher dynamic efficiency [Oqubay 2020]. However, as argued earlier, these explanations are developed in an inductive, multidisciplinary fashion, largely driven by common sense and original thought but without a formal general theory backing it [Cameli 2023].

Complexity economics has made significant progress in endogenizing the process of structural change associated with industrial development. The process of co-evolution and associated feedback loops of the elements involved are what is highlighted in CE. In this study, the dynamics of structural change is considered to be driven by the co-evolution of investment, manufacturing and exports (Figure 3), which are variables emphasized by the structuralist approach. In statistical terms this means that a set of two-way relationships linking together the set of variables in the vector **Y** of a VAR(p) model can be established. The framework suggests that industrial policy will be successful if it can trigger a reinforcing loop among investment, manufacturing, and exports that leads to growth in the system. Apart from a cointegrating relationship, another necessary condition is that there is a significant set of two-way bidirectional relationships among the three variables.

Empirical evidence based on data from eight countries establishes the necessary conditions. Country case studies are then presented to identify idiosyncratic factors that either bolstered feedback loops or curtailed them. In the case of the Philippines, it had a relatively robust manufacturing sector in the 1960s and 1970s. But this could not be sustained because of relatively weak investment, inability to expand exports, and the absence of embedded autonomy.

Extending the framework can provide pathways for industrial policy to generate more favorable results. For example, a policy option to address emerging constraints to industrial policy is that from Kuroiwa [2016]. He proposes a global value chain (GVC)-oriented strategy in order to overcome two major limitations to the efficacy of industrial policy: shrinking policy space that stems from international agreements like the WTO and the constraints on state capabilities. This is similar to the recommendation that local firms and conglomerates in the Philippines enter the slipstream of large global players in the traded goods sectors, a strategy labeled as "slipstream industrialization" [Fabella 2018].

The GVC-oriented development strategy consists of two phases—participation and an upgrading phase. In the first phase, developing countries seek to participate in GVCs. The general approach is to attract value chain activities that were previously located in developed countries by leveraging their abundant labor force and lower labor costs. Meanwhile, upgrading within GVCs is the essence of the second phase of the GVC-oriented development strategy. There are several avenues by which upgrading can be achieved, but the most practical is to focus on upgrading in value chains at the firm level. This is reflected in the policy instruments available to support upgrading at the firm level. Kuroiwa [2016] highlights the following: the importance of macroeconomic stability; credit at affordable rates of interest; basic education for the workers and education for the engineers and technical staff that are needed in particular for the transition to original design manufacture (ODM);

and addressing the problems of market imperfection, uncertainty, the cumulative nature of investment decisions and path dependency that cause under-investment in upgrading efforts. The GVC strategy dovetails with the framework in Figure 3: there is an investment component (macroeconomic stability and credit); direct support for manufacturing (basic education and cheap labor); and an export component (direct participation in GVCs).

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# Comment on "Industrial policy and complexity economics"

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First of all, I must admit to some unfamiliarity with complexity theory. Secondly, I agree on the importance of focusing on why investment rates in the Philippines are so low: the private investment rate of the country has remained below 25 percent and government capital outlays have remained even lower. Achieving a higher target of eight percent in government capital outlay within the next two years seems unlikely due to overwhelming consumption demands on resources which reduces the share of investment.

I appreciate exploring out of the box and complexity theory is certainly out of the box. Complexity uses a different kind of mathematics. A simple feedback loop can create unmanageable complexity. On imperfect information, we make a distinction between risk and uncertainty. Risk exists in a world with known probabilities and states of the world although knowledge may be imperfect. Risk can be reduced by acquiring more and more data. Uncertainty is something else: where uncertainty is radical, phenomena of interest and their dynamics are not governed by known probabilities. Nor are the states of the world known with certainty as they may be emerging. Emergence may be weak or strong. Strong emergence happens when the collective exerts an influence on the behavior of its parts: strong emergence is not yet governed by known mathematics.

Looking for an understanding of our problems in new math is admirable but also risky. The resort to complexity may just be misguided if, as Joseph Stiglitz affirms, cited by the authors, the failures we face are failures of political economy. I agree with Stiglitz that failures in politics, rather than mathematical economic modelling, are often the biggest obstacles to development. A noteworthy example is the Comprehensive Agrarian Reform Program (CARP), introduced in 1988, which remains in effect and continues to limit agricultural progress by limiting farm acreage growth. One way to create positive economic feedback is through farm consolidation, allowing for larger farm sizes and increased capital investment, similar to the strategies employed by China.

On radical uncertainty: what is the sense of radical uncertainty in this paper? Does this refer to the Knightian radical uncertainty from 1921 or John Kay and Mervin King's *Radical uncertainty: decision-making for an unknowable future* from 2020? Is our lack of knowledge resolvable by acquiring additional

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knowledge? Not in the case of radical uncertainty. The probability distribution or knowledge over the states of the world that is still being created; knowledge may not be built. It is contrary to risk uncertainty where the governing probability distribution is known and thus more data may whittle down the uncertainty.

The discussion on increasing returns to scale is very relevant to industrial policy. However, this is difficult to reconcile with neoclassical economics which assumes convexity overall and thus precludes scale economies.

Government interventions are conceived to correct garden variety market failures, where unaided interactions between self-seeking private actors result in inferior outcomes. Such, for example is CARP. But there is also the idea of meta-market failure: an economic system might function Pareto efficiently according to market principles but still produce socially undesirable outcomes, such as income inequality. In such cases, government intervention may be necessary to correct the system, not because of traditional market failures, but to align market outcomes with social goals. This seems to be the problem raised by Thomas Piketty in *Capital in the 21st century*.

Finally, with reference to the success of South Korea, which had sound underlying policies, and the Philippines where policy mistakes happened: what was the divergence due to? Was the divergence due to noncorrelation among the three variables? Or is the non-correlation due to Stiglitz’s political economic behaviors? In the econometric work, it seems that there is a need for the three variables (investment/GDP, export/GDP, and manufacturing/GDP) to correlate highly throughout the development arena. What if there is no correlation at all? What if the correlation is only among two of them? Are the three highly correlated in Vietnam and Malaysia? How about the Philippines, what was the correlation between these? These questions don’t seem to be satisfactorily answered.

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# Mapping feasible routes towards economic diversification and industrial upgrading in the Philippines*

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Using time series data from 1961 to 2023, we estimate econometric models to answer the following questions: 1) What factors drive economic diversification in the Philippines? 2) What role does industrialization play in broader-based diversification? and 3) What are the benefits of economic diversification in the country? The empirical results suggest that re-industrializing the domestic production base can significantly enhance economic diversification. Strategies that accelerate the growth of local industries, especially to catch up with the dominant services sector, are vital. Effective policies should focus on developing physical and human capital, improving connectivity, and fostering domestic innovation. This push for greater diversification is justified by its potential benefits on output and growth stability, and diversification and growth of exports. The paper also explores various routes towards economic diversification and industrial upgrading in the Philippines using the product space approach. The first route is directed towards leapfrogging to a more sophisticated economic structure in the product space. The second route points at climbing the value ladder within global value chains. The third route leads to the strengthening of the local industrial base that is heavily populated by small and medium-sized establishments.

**JEL classification**: L16, O14, O25, O33
**Keywords**: economic diversification, industrial upgrading, structural transformation, manufacturing, exports, product space, global value chains, SMEs, Philippines

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## 1. Introduction

The Philippines' economic trajectory has been characterized by erratic historical performance, despite being strategically located in a high-growth region.[1] In the 1950s, the Philippines boasted one of the highest per capita gross domestic products (GDP) in Asia, trailing only Japan, the former Malaya, Hong Kong, and Singapore. Despite an early lead in industrialization, the country was soon surpassed by its Asian neighbors—South Korea and Taiwan in the 1950s, followed by Thailand, Indonesia, and China from the 1970s through the 1990s [Balisacan and Hill 2003]. While the country showed stronger performance in the decade following the Great Recession, growth levels were insufficient for a robust catch-up.[2]

Numerous analyses have identified key factors impeding the Philippines' growth and development. A 2007 Asian Development Bank (ADB) study highlighted critical constraints to Philippine economic growth: tight fiscal situation; inadequate infrastructure, especially in electricity and transport; weak investor confidence, particularly due to corruption and political instability; and chronic market failures leading to a narrow industrial base. Specifically, a lack of economic diversification, the focus of this paper, resulted in a service-driven economy without a vibrant manufacturing sector. This failure in structural transformation stifled manufacturing and exports, with services emerging as the primary growth driver. By 2023, the services sector accounted for 62 percent of GDP and 59 percent of total employment.

The connections between growth, productivity, innovation, and diversification are intricate yet intuitive. Hidalgo and Hausmann [2009] previously noted that upgrading and diversification stem from accumulating complex domestic capabilities, essential for developing sophisticated industrial processes and expanding the knowledge base. Growth, as ADB [2007] suggested, is driven by the creation of innovative goods, alongside scaling existing production. Rodrik [2007] enumerated the following stylized facts about industrial development as an engine of growth: i) economic development requires diversification instead of specialization; ii) rapidly growing countries have large manufacturing sectors; iii) growth accelerations are associated with structural changes in the direction of manufacturing; iv) countries that promote exports of more "sophisticated" goods grow faster; and v) some specialization patterns are more conducive than others to promoting industrial upgrading. Usui [2012] also noted that the successful transformation of the Asian Tigers in the 1970s had the following specific dimensions: i) production shifted from low- to high-productivity manufacturing goods; ii) labor moved from the primary sector to modern industrial activities; and iii) the export basket diversified toward more sophisticated products. In contrast,

[1] These historical swings are reflected in the evolving monikers given to the Philippines through the years, from being one of the "New Asian Tigers" to the "Sick Man of Asia" to the "Rising Star of Asia."
[2] As of end-2020, the Philippines had also been overtaken by Vietnam in terms of per capita GDP.

Usui's [2012] diagnosis suggests that the Philippines' poor performance is tied to sluggish productivity due to slow industrial upgrading and diversification.

The empirical literature broadly supports the positive relationship between diversification and growth, particularly in the early stages of development. Imbs and Wacziarg [2003] documented a nonlinear relationship: developing countries diversify across more sectors, but this trend reverses as specialization becomes advantageous at higher income levels. Francis [2016] showed that diversification enhances economic and social welfare, impacting income distribution, innovation, and foreign direct investment (FDI). Theoretically, diversification is driven by two main factors: a general trend to expand production and consumption with increasing domestic income and capabilities [Imbs and Wacziarg 2003], and risk mitigation to reduce vulnerabilities to economic shocks [Acemoglu and Zilibotti 1997]. For commodity exporters, diversifying lessens the impact of shocks from price volatility and uncertainty in global markets. However, Imbs and Wacziarg [2003] rightly observed that entering into new products, sectors, or markets involves huge fixed costs, suggesting better diversification opportunities for countries with greater physical, technological, and knowledge resources.

This paper builds on the broad argument that economic diversification can drive industrial upgrading and growth in an emerging economy like the Philippines. Freire [2019] suggests that long-run growth may be propelled by diversification within the subset of complex economic activities and sophisticated products. This underscores the potential synergy between diversification, technology-driven industrial upgrading, and productivity growth. In light of these insights, this current study analyses the various dimensions of economic diversification in the Philippines through key research questions: 1) What are the historical origins of the Philippines' narrow economic base? 2) What factors drive economic diversification in the country? 3) What role does industrialization play in broader-based diversification? and 4) What benefits does economic diversification bring to the Philippines? Based on the results of this analysis, the paper then explores feasible routes towards economic diversification and industrial upgrading in the Philippines using the product space approach.

The rest of the paper is organized as follows. The second section discusses the empirical analysis of the drivers and benefits of economic diversification in the Philippines. The third section uses the product space to map several feasible routes for economic diversification and industrial upgrading. The final section concludes with policy insights.

## 2. Drivers and benefits of economic diversification in the Philippines

From a balanced and stable sectoral distribution in the 1950s to 1960s, the structure of the Philippine economy experienced rapid changes in the succeeding decades. The 1970s marked a decline in agriculture and rise in manufacturing as the key driver of the domestic economy.[3] While emerging economies in East and Southeast Asia adopted export-led growth models, the Philippines continued with the import substitution strategy established in the 1950s [ADB 2007]. This policy involved foreign exchange controls and trade barriers (e.g., high tariff regimes and quantitative import restrictions) to protect priority sectors and infant industries [World Bank 2013]. However, this industrial surge was fleeting; by the late 1980s, services had overtaken manufacturing, as agricultural productivity continued to deteriorate. Employment data reveal that industrial expansion during the 1970s and early 1980s did not result in a proportional increase in the share of manufacturing in total employment. While there were brief periods of manufacturing resurgence in subsequent decades, these were often disrupted by economic crises, political turmoil, and natural disasters.[4]

The services sector emerged as the main engine of economic growth due to the manufacturing sector's inability to sustain a robust recovery. According to Williamson and de Dios [2014], the Philippines' *deviant manufacturing behavior* after the 1960s and its path towards premature deindustrialization was due to a "perfect storm" of protectionism, political instability, missed opportunities during the surge of FDIs in the 1980s, overreliance on foreign capital, and two financial crises. As Figure 1 illustrates, the intersectoral Shannon diversity index (SDI) for Philippine GDP has decreased overtime, reflecting the economy's increasing focus on services.[5] The data also indicate that the services sector has been contributing more than half of Philippine GDP growth since the 1990s. Moreover, low-skilled and low-productivity jobs became the catch basin of workers, as the industrial sector struggled to create more employment (Balaoing-Pelkmans and Mendoza [2024]; World Bank [2013]).

In the ideal path of industrialization, a developing country should progress with a balanced "two-legged" approach: industry-led growth supported by modern, high-skill services, along with enhanced agricultural productivity and export-driven manufacturing to be able to provide productive job opportunities and achieve inclusive growth [Usui 2012]. However, Balaoing-Pelkmans and Mendoza [2024] documented that the Philippines has been "standing on one leg" (i.e., services), while maintaining the relatively weakest manufacturing leg among emerging ASEAN-6 economies.[6] The stagnation of manufacturing made domestic industries unable to absorb the excess labor coming from less productive sectors, particularly agriculture [World Bank 2013]. This anemic state of manufacturing

[3] However, it should be noted that the share of manufacturing (agriculture) in output had been gradually increasing (decreasing) even before the 1970s.

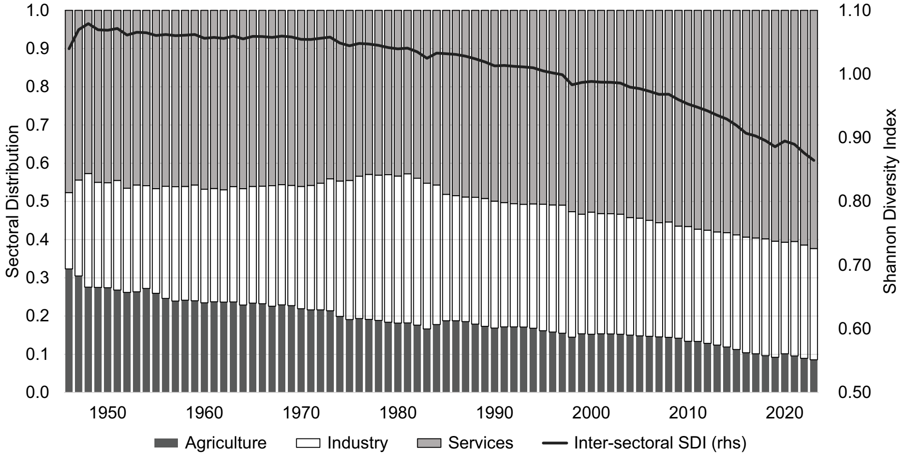
[4] See Balaoing-Pelkmans and Mendoza [2024] for a longer discussion of stylized facts that trace the historical origins of the Philippines' narrow economic base, especially with respect to the regional context in East and Southeast Asia.

[5] The SDI is computed using the following formula: $\sum_{i\in\{A,I,S\}} s_i \ln(1/s_i)$, where $s_i \in (0,1)$ is the share of component $i$ in total GDP; and $\{A,I,S\}$ correspond to agriculture, industry, and services, respectively. A higher index value is associated with greater diversity.

[6] This excludes Singapore which had a different set of initial endowment and constraints.

manifests strongly in the weak diversification of domestic production activities, especially in high-tech sectors [Balaoing-Pelkmans and Mendoza 2024]. As a consequence of this narrow production base, Philippine exports have remained concentrated on a few major products that rely heavily on imported raw materials and technologies. In fact, Hidalgo and Hausmann [2009] classified the Philippines among "non-diversified countries producing standard products." Unfortunately, this does not provide the ideal conditions for achieving sustained growth. Long-run economic success needs aggressive efforts to develop the ability to produce and export a diversified basket of complex goods [Hidalgo et al. 2007].

**FIGURE 1. Sectoral distribution of Philippine real GDP (percent of total), 1946 - 2023**




Source: Philippine Statistics Authority.

The pursuit of long run diversification is a complex process. It requires countries to build capabilities in new and preferably more sophisticated economic activities [Hidalgo and Hausmann 2009]. This aligns with the concept of structural transformation, which involves reallocating resources from low- to higher productivity sectors alongside investments in critical skills, capital, and technology [Brenton et al. 2019]. Such transformation requires innovation to unlock new capabilities to produce new goods and services across a broader range of sectors.

Using cross-country data from Sub-Saharan Africa, an IMF [2017] study found that macroeconomic stability (e.g., stable inflation and manageable external debt), access to credit, infrastructure (e.g., access to electricity), ease of doing business, and human capital development are positively associated with economic diversification. This is broadly consistent with Haraguchi's [2019] findings that the principal constraints to economic diversification are as follows: limited manufacturing capacity, limited access to trade finance, transport infrastructure, limited agricultural productivity, and poor international competitiveness. Industrialization in turn, is highly dependent on technological innovation and capacity buildup.

Empirical studies often focus on export diversification, which is closely linked to domestic economic diversification. IMF [2017] highlighted that countries with limited manufacturing and export diversity experience lower trade flows, suggesting common drivers for domestic production and export diversification. Using data for 79 countries from 1962 to 2000, Agosin et al. [2011] tested three sets of determinants of export diversification: economic reforms (e.g., trade openness and financial development), structural factors (e.g., endowments), and macroeconomic variables (e.g., exchange rate volatility). Their regressions showed mixed results, with some evidence for the positive effect of human capital accumulation on export diversification. On the other hand, trade openness tends to favor specialization, while access to credit and exchange rate volatility are statistically insignificant. The result for trade openness is consistent with the finding Osakwe et al. [2018] that Sub-Saharan African countries more open to trade have less diversified exports. However, they also showed that trade liberalization (i.e., lower tariff) contributes to long-run export diversification in developing countries.

Effective policy is crucial for diversification. Kurul [2023] found that border efficiency and quality infrastructure significantly enhance product and market diversification and that ICT access boosts export diversification, especially in least developed countries. These results are consistent with Agosin and Retamal's [2021] theoretical simulations which showed that subsidizing investments that facilitate knowledge spillovers and easy access to information about useful production technologies may lead to the establishment of new sectors. They argued that the best strategy for infrastructure selection is choosing projects that cater to the growth of skill-intensive sectors, which can generate positive spillovers to the rest of the economy. Agosin and Retamal [2021] model the provision of those investments as being hindered by a coordination problem, which makes a case for an industrial policy that harmonizes the strategies and activities of government and the business sector.

Based on the foregoing discussion, we empirically analyze the drivers of economic diversification in the Philippines using the following regression model:

$$D_t = \beta_0 + \boldsymbol{W}'_{t\text{-}1}\boldsymbol{\beta}_W + \boldsymbol{X}'_{t\text{-}1}\boldsymbol{\beta}_X + \boldsymbol{Z}'_{t\text{-}1}\boldsymbol{\beta}_Z + \varepsilon_t \quad (1)$$

where $D_t$ is a measure of economic diversification at time $t$, $\boldsymbol{W}_t$ is a vector of structural factors (e.g., sectoral shares, productivity growth), $\boldsymbol{X}_t$ is a vector of enabling factors (e.g., human capital development, infrastructure, capital accumulation, innovation), $\boldsymbol{Z}_t$ is a vector of policy-related variables (e.g., macroeconomic, trade, and industrial policies), the $\beta$'s are model coefficients, and $\varepsilon_t \sim WN(0,\sigma_\varepsilon^2)$ is the white noise error.

To estimate Equation 1, we applied ordinary least squares (OLS) regression with autoregressive errors using the time series variables summarized in Table 1, constrained to the period of 1980 to 2021 due to data availability. All variables entered the regression equation in their stationary forms. To analyze the benefits of economic diversification, we estimated additional regressions for these outcome variables: two-year standard deviation (SD) of ln(GDP) as proxy for output volatility, the two-year SD of real GDP growth to measure growth volatility over time, annual growth of merchandise exports, and the Herfindahl-Hirschmann Index (HHI) for export concentration.[7] Data for these outcome variables (except HHI-Exports) are available from 1961 onwards.

**TABLE 1. Variable descriptions and summary statistics**

| Variable description | *N* | Mean | SD | Min | Max | *d* |
|---|---|---|---|---|---|---|
| Shannon diversity index for GDP | 42 | 0.979 | 0.046 | 0.886 | 1.041 | 0 |
| SD of sectoral contributions to GDP growth | 63 | 1.311 | 0.642 | 0.082 | 2.951 | 0 |
| • 1980 to 2021 only | 42 | 1.444 | 0.614 | 0.345 | 2.951 | 0 |
| • 1980 to 2023 only | 44 | 1.493 | 0.645 | 0.345 | 2.951 | 0 |
| Industry value added (percent of GDP) | 42 | 34.996 | 4.040 | 28.400 | 43.113 | 0 |
| Industry/services value added ratio | 42 | 0.744 | 0.216 | 0.478 | 1.229 | 0 |
| Growth of GDP per capita | 42 | 1.537 | 3.835 | -10.978 | 5.418 | 0 |
| Trade openness (percent of GDP) | 42 | 53.785 | 19.221 | 28.792 | 90.542 | 1 |
| Growth of gross capital formation per capita | 42 | 2.187 | 14.853 | -37.918 | 28.130 | 0 |
| Growth of telephone subscriptions per 100 people | 42 | 4.303 | 9.460 | -20.101 | 27.119 | 0 |
| Life expectancy (years) | 42 | 68.316 | 3.048 | 62.499 | 72.119 | 2 |
| Patent applications per capita (ln) | 42 | -10.328 | 0.241 | -11.464 | -9.923 | 0 |
| Inflation | 42 | 7.721 | 7.990 | -0.325 | 46.673 | 0 |
| Growth of real effective exchange rates | 42 | 0.321 | 7.544 | -20.728 | 10.758 | 0 |
| Growth of domestic credit to private sector | 42 | 6.162 | 14.470 | -38.408 | 38.095 | 0 |
| Two-year SD of ln(GDP) | 63 | 0.035 | 0.013 | 0.003 | 0.071 | 0 |
| • 1980 to 2023 only | 44 | 0.034 | 0.015 | 0.003 | 0.071 | 0 |
| Annual growth of merchandise exports | 63 | 8.943 | 15.914 | -24.328 | 71.364 | 0 |
| • 1980 to 2023 only | 44 | 7.240 | 12.624 | -21.684 | 33.984 | 0 |
| HHI – Exports | 29 | 0.331 | 0.068 | 0.223 | 0.472 | 1 |

Sources of data: Bruegel, IMF, PSA, UNCTAD, World Bank.
Note: *d* = number of differencing to achieve stationarity.

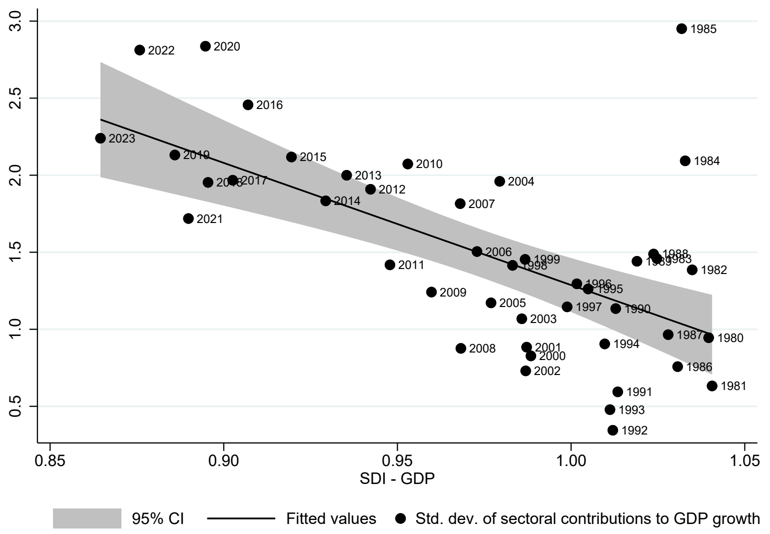
[7] The HHI is computed using the following formula: $\sum_{i=1}^{h} s_i^2$ where $s_i \in (0,1)$ is the share of component $i$, $i$=1,…,$h$. A higher index implies more concentration.

Initial analysis suggests that the SDI for GDP (SDI-GDP) exhibits near random walk behavior despite being stationary.[8] To avoid potentially spurious results, we proxy economic diversification by the SD of sectoral contributions to overall GDP growth ("SD-within"). For each sector $i$, the contribution to GDP growth is calculated as follows:

$$\frac{Y_{it} - Y_{i,t-1}}{\sum_{i\in\{A,I,S\}} (Y_{it} - Y_{i,t-1})} \times \left( \frac{\sum_{i\in\{A,I,S\}} Y_{it}}{\sum_{i\in\{A,I,S\}} Y_{i,t-1}} - 1 \right) \times 100 \qquad (2)$$

where $Y_{it}$ is output of sector $i$ at time $t$. Figure 2 indicates a strong negative linear relationship between SDI–GDP and SD-within ($\hat{\rho}$ = -0.623), suggesting that a diversified economy derives growth from a wide range of sectors rather than relying on a few dominant ones. This aligns with the notion that diversification helps reduce economic volatility and builds a stable path towards equitable growth [Brenton et al. 2019]. Moreover, Francis [2016] also noted that sectoral concentration leads to a higher variance of GDP.

**FIGURE 2. Economic diversification vs. sectoral concentration of GDP growth**




Source: Authors' calculation based on PSA data.

Table 2 summarizes the baseline regression results using SD-within as the dependent variable. Given the relationship observed in Figure 2, factors increasing (decreasing) economic diversification should have negative (positive) coefficients in our regression model. Models 1 and 3 estimate the initial OLS regressions using

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[8] SDI-GDP follows a first-order autoregressive (AR(1)) process with $\hat{\phi}$= 0.99. This is almost like a random walk process which is the limiting form of an AR(1) process when $\phi$=1.

several proxies for industrialization (i.e., share of industry value added to GDP and ratio of industry and services value added). While the OLS models satisfy most regression assumptions (e.g., no specification bias, no multicollinearity, and homoskedastic and normal errors), both models exhibit errors that are serially correlated and not yet white noise. This makes the OLS results potentially biased and spurious. To address this, we estimated regression models with exogenous variables and autoregressive errors (ARX) in Models 2 and 4, obtaining errors that are white noise and normally distributed.

**TABLE 2. Baseline regression results**

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Industry value added (percent of GDP) | -0.088**<br>(0.035) | -0.085**<br>(0.039) | | |
| Industry/services value added ratio | | | -1.356**<br>(0.645) | -1.455*<br>(0.774) |
| Growth of GDP per capita | 0.065*<br>(0.032) | 0.071***<br>(0.025) | 0.061*<br>(0.035) | 0.067***<br>(0.025) |
| Trade openness (percent of GDP) | -0.028**<br>(0.014) | -0.022**<br>(0.011) | -0.030**<br>(0.014) | -0.023**<br>(0.011) |
| Growth of gross capital formation per capita | -0.021**<br>(0.010) | -0.017***<br>(0.006) | -0.022**<br>(0.010) | -0.017***<br>(0.006) |
| Growth of telephone subscriptions per 100 people | -0.019**<br>(0.009) | -0.016**<br>(0.007) | -0.020**<br>(0.009) | -0.015**<br>(0.007) |
| Life expectancy (second difference) | -0.413***<br>(0.079) | -0.336***<br>(0.087) | -0.471***<br>(0.076) | -0.361***<br>(0.086) |
| Patent applications per capita (ln) | -0.076<br>(0.216) | -0.248<br>(0.166) | -0.026<br>(0.227) | -0.264<br>(0.176) |
| Inflation | 0.040<br>(0.027) | 0.040***<br>(0.015) | 0.035<br>(0.029) | 0.039**<br>(0.016) |
| Growth of real effective exchange rates | -0.042**<br>(0.015) | -0.032***<br>(0.012) | -0.039**<br>(0.016) | -0.030**<br>(0.012) |
| Growth of domestic credit to private sector | 0.018**<br>(0.009) | 0.013*<br>(0.007) | 0.019**<br>(0.008) | 0.013*<br>(0.007) |
| Constant | 3.365<br>(2.054) | 1.473<br>(1.975) | 1.874<br>(2.332) | -0.564<br>(1.885) |
| AR(1) coefficient | | 0.487***<br>(0.153) | | 0.534***<br>(0.144) |
| No. of observations | 42 | 42 | 42 | 42 |
| R-squared | 0.450*** | | 0.408*** | |
| Power test on R-squared | 0.963 | | 0.922 | |
| AIC | 78.098 | 72.368 | 81.217 | 73.128 |
| Average VIF | 2.32 | | 2.32 | |
| RESET *F*-stat | 1.16 | | 0.77 | |
| White's test $\chi^2$-stat | 42.00 | | 42.00 | |

**TABLE 2. Baseline regression results (continued)**

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Breusch-Godfrey test $\chi^2$-stat | 8.116*** | | 9.518*** | |
| Shapiro-Wilk test *z*-stat | 0.154 | 0.039 | -0.129 | -0.132 |
| White noise test *Q*-stat | 7.420*** | 0.139 | 8.921*** | 0.094 |

Source: Authors' calculations
*** p < 0.01, ** p < 0.05, * p < 0.10
Dependent variable: standard deviation of sectoral contributions to GDP growth
Note: Models 1 and 3 are estimated using OLS regression. Models 2 and 4 are estimated using ARX regressions. Numbers in parentheses are robust standard errors. All explanatory variables are lagged to reduce reverse causality.

Model 2 confirms that a greater contribution of the industrial sector to aggregate output enhances economic diversification and improves the distribution of the sectoral sources of growth in the Philippines. This makes a case for "re-industrialization" as a potential strategy to achieve a balanced and stable growth path. Francis [2016] argued that while concentration might spur growth initially, industrial diversification can reduce the welfare and productivity losses from sector-specific shocks. Meanwhile, Model 4 suggests that achieving a broader domestic production base is possible if the industrial sector grows faster to catch up with the dominant services sector. This supports "walking on two legs", advocating a sophisticated manufacturing industry backed by a modern services sector. Transforming the economy into a complex structure requires robust supply chain linkages and the complementarity of technology and skills across interconnected manufacturing and services sectors.

In terms of the domestic drivers of diversification, Models 2 and 4 consistently show that rapid capital accumulation, especially of the kind that supports industrial growth, significantly broadens the domestic production base. Francis [2016] noted that increased capital supply boosts diversification and reduces economic volatility through several channels: providing infrastructure required to enter new sectors, supporting education and research and development (R&D) for more sophisticated activities, and shifting the economy away from primary sectors that rely heavily on natural resource endowments. Our proxies for human capital development (i.e., life expectancy) and connectivity (i.e., growth of telephone subscriptions per 100 people) also have significant effects on improving economic diversification in the Philippines. The regressions particularly point to improvements in human capital as having the largest partial effect on economic diversification. Intuitively, developing the domestic production base requires a highly skilled workforce for handling complex tasks; while physical and digital connectivity facilitates efficient flow of resources in the economy, strengthens sectoral linkages, and opens new economic opportunities. These are broadly consistent with the literature showing positive effects of human capital and infrastructure development on diversification (IMF [2017]; Haraguchi [2019];

Agosin et al. [2011]). Interestingly, our proxy for innovation (i.e., ln of patent applications per capita) has insignificant direct effects on diversification, possibly due to limited domestic innovation activities and the inadequate capture of incremental and non-R&D innovations by patent measures in a developing country like the Philippines.

Supply-side competitiveness is essential for diversification. Education enhances workforce skills, enabling sectors to upgrade and diversify into more complex industries. Efficient logistics reduces costs and boosts competitiveness across diverse industries by facilitating supply chains. Trade policy reform can enhance market access and competitiveness by reducing barriers. Remittances increase household income, providing capital for diverse entrepreneurial investments. Finance, when properly allocated beyond traditional sectors, fosters growth in underrepresented industries.

In terms of macroeconomic policies, the regressions suggest that faster inflation results in less diversification, as high and fluctuating prices increase uncertainties and cause distortions in the allocation of resources across sectors. In contrast, real exchange rate appreciation and the growth of domestic credit to the private sector yield counterintuitive results. The positive coefficient for domestic credit indicates a concentration of loans in the services sector, suggesting limited access for agricultural and industrial enterprises.[9]

The negative sign for real effective exchange rate (REER) might be explained by importing, which facilitates diversity-enhancing learning through knowledge spillovers, technology, and inputs. This is consistent with the negative coefficient for total trade openness, which suggests that wider international exposure through exports and imports provides access to products, inputs, technologies, and knowledge that can boost domestic production capacities.

Given the insignificance of the patent variable, we re-ran the ARX models with an additional interaction between our proxies for industrialization and innovation (Models 2a and 4a). As summarized in Table 3, at the mean of industry value added (percent of GDP), the effect of patent applications per capita (in ln) on SD-within is calculated as 22.846 - (0.661 × 34.996) = -0.286. At the mean of the industry to services ratio, the effect of patent applications per capita (in ln) on SD-within is calculated as 8.354 - (12.496 × 0.744) = -0.943. Both interaction effects are negative and statistically significant, implying that innovation can support more diversification when the innovative activities directly support the growth and upgrading of domestic manufacturing sectors, especially to catch up with services. This is consistent with previous findings that reducing barriers to innovation and technology adoption promote diversification and higher growth [IMF 2017].

[9] For instance, data from the Bangko Sentral ng Pilipinas show that as of March 2014, services account for 63 percent of the Philippine banking system's loans outstanding to production activities by residents. Manufacturing only got 16 percent.

**TABLE 3. Interaction of industrialization and innovation**

| | 2a | 4a |
|---|---|---|
| Industry value added (percent of GDP) | -6.898***<br>(0.052) | |
| Industry/services value added ratio | | -130.334***<br>(48.060) |
| Patent applications per capita (ln) | 22.846***<br>(0.095) | 8.354***<br>(3.192) |
| Industry value added (percent of GDP) × Patent applications per capita (ln) | -0.661***<br>(0.005) | |
| Industry/services value added ratio × Patent applications per capita (ln) | | -12.496***<br>(4.659) |
| No. of observations | 42 | 42 |
| AIC | 65.323 | 66.623 |
| Shapiro-Wilk test *z*-stat | 0.462 | 0.121 |
| White noise test *Q*-stat | 0.030 | 0.0978 |

Source: Authors' calculations
*** p < 0.01, ** p < 0.05, * p < 0.10
Dependent variable: standard deviation of sectoral contributions to GDP growth.
Note: The coefficients for other variables are suppressed but are broadly consistent with the baseline results. Numbers in parentheses are robust standard errors. All explanatory variables are lagged to reduce reverse causality.

In the next set of estimations, we analyze the effects of economic diversification using the following simple regression model:

$$B_t = \gamma_0 + \gamma_1 D_{t\text{-}k} + \eta_t \qquad (3)$$

where $B_t$ is a measure of the potential benefits of diversification on domestic production and exports, $D_{t\text{-}k}$ is SD-within at lag *t-k*, $\gamma_0$ and $\gamma_1$ are coefficients, and $\eta_t \sim WN(0,\sigma_\eta^2)$ is the white noise error term. Due to data constraints, we only estimated regression models using the following dependent variables: two-year SD of ln(GDP) for Models 5 and 5a, annual growth of merchandise exports for Models 6 and 6a, and first difference of HHI-Exports for Model 7. The two-year SD of real GDP growth rate was also considered as a dependent variable but the results were not used due to some diagnostic issues. The regressions explored different lags *k* of SD-within to account for the possible medium- to long-term benefits of diversification.

The regression results for Equation 3 are summarized in Table 4. Consistent with the literature, output stability seems to be the most apparent benefit of a broader domestic production base. This is suggested by the results for Models 5 and 5a, which show a positive and significant effect of SD-within on the volatility of output across time. In other words, more sectoral concentration tends to be followed by a higher volatility of production over time (alternatively, increased sectoral diversification leads to more stable production.[10] Models 6 and 6a also lend some support, albeit weakly significant, that diversification of the domestic economy has a positive medium-term effect on the growth of merchandise exports. Finally, Model 7 shows that SD-within has a positive and significant contemporaneous relationship with the change in HHI-Exports. This means that a narrower domestic production base is associated with faster increase in export concentration. Put differently, a more diversified economy contributes to export diversification. This is intuitive given that the margins of trade are partly dictated by the production capabilities of the domestic economy. However, due to the low statistical power of the slope test for exports, further study with larger datasets is recommended.

**TABLE 4. Benefits of economic diversification**

| | 5 | 5a | 6 | 6a | 7 |
|---|---|---|---|---|---|
| lag 0 | | | | | 0.024** (0.011) |
| lag 1 | 0.007*** (0.003) | 0.010*** (0.003) | | | |
| lag 2 | | | -5.692* (2.858) | -5.402* (3.200) | |
| No. of observations | 63 | 44 | 63 | 44 | 28 |
| R-squared | 0.102** | 0.197*** | 0.299** | 0.067* | 0.101** |
| AIC | -369.109 | -253.752 | 508.106 | 347.923 | -97.238 |
| RESET *F*-stat | 1.80 | 2.57* | 2.75* | 2.39 | 0.27 |
| White's test $\chi^2$-stat | 0.02 | 0.26 | 0.79 | 0.07 | 2.38 |
| Breusch-Godfrey test $\chi^2$-stat | 1.110 | 0.030 | 0.412 | 0.017 | 0.531 |
| Shapiro-Wilk test *z*-stat | 1.715 | 0.637 | -2.526 | -0.688 | -0.630 |
| White noise test *Q*-stat | 0.972 | 0.019 | 0.422 | 0.018 | 0.584 |
| Power of slope test | 0.747 | 0.894 | 0.410 | 0.414 | 0.401 |

Source: Authors' calculations
*** p < 0.01, ** p < 0.05, * p < 0.1
Note: For all regressions, various lags of the SD of sectoral contributions to GDP growth were used as the sole explanatory variable to proxy for domestic economic diversification. Model 6 adds a year dummy for 1973. Models 5 and 6 used available data from 1961 to 2023, while Models 5a and 6a used data from 1980 onwards. For Model 7, data are available for 1996 to 2023 only. Numbers in parentheses are robust standard errors.

Even with GDP growth rates of five to six percent, diversification is still crucial for the Philippines because it enhances the sustainability and robustness of economic growth. While current growth is strong, a narrow economic base increases vulnerability to sector-specific shocks, which can destabilize overall growth. Diversification reduces output volatility, as demonstrated in Models 5 and 5a of our study, by mitigating the adverse effects of relying too heavily on the services

[10] The initial estimates using the two-year standard deviation of real GDP growth rate as dependent variable provide some evidence that sectoral diversification also reduces the volatility of growth over time.

sector. In the context of recent global uncertainties, such as trade wars, economic sanctions, supply chain disruptions, and pandemics, diversification becomes even more important. A diversified economy can better absorb and adapt to external shocks, minimizing negative impacts. Moreover, diversification may promote export growth (Models 6 and 6a) and reduce export concentration (Model 7), which can enhance international competitiveness and increase resilience to global market fluctuations. Overall, diversification not only sustains growth but also contributes to a more stable economic environment, supporting long-term development goals and improving welfare and productivity across sectors.

## 3. Routes towards economic diversification and industrial upgrading

The preceding section made a case for re-industrialization and the active use of policy to build a broader domestic production base. This section builds on that analysis by exploring three potential routes for economic diversification and industrial upgrading, supported by industrial policy (IP). Balaoing-Pelkmans and Mendoza [2021] outline these routes given that purely market-led diversification and upgrading are often insufficient to generate the kind of growth needed by a developing country to catch-up. Table 5 summarizes the three routes, which though distinct, often overlap due to shared challenges across domestic industries. The framework and methodology underpinning these routes use the Product Complexity Index (PCI) and the concept of "proximity" in the product space developed by Hidalgo et al. [2007], as well as the analysis of Revealed Comparative Advantage (RCA) indices.

**TABLE 5. Three routes towards diversification and industrial upgrading**

| | Route 1 | Route 2 | Route 3 |
|---|---|---|---|
| Approaches to diversification | Leapfrogging: upgrading towards high-productivity, more sophisticated goods | Climbing the value ladder: upgrading in global value chains (GVCs) | Sustaining the local industrial base: ensure survival and expansion of local firms (especially SMEs) |
| Industrial policy (IP) | Active, cohesive, and targeted IP | Open-economy IP; direct engagement with GVC lead firms | Local firms-centric IP |
| Target sectors | High-technology, achievable in medium to long term | Top exports in GVCs | Top traditional exports; firm- and labor-populous sectors |
| Policy guide questions | What is the structure and density of the product space? How to jump to nearby, more complex products? | Which sectors are in GVCs? Which lead firms in key GVC sectors should be targeted? | What are the major constraints in the competitiveness of local firms? |

**TABLE 5. Three routes towards diversification and industrial upgrading (continued)**

| | Route 1 | Route 2 | Route 3 |
|---|---|---|---|
| Broad policy goals | Target productivity- and complexity-enhancing sectors | Make the country an attractive host for GVC lead firms; stimulate GVC linkages with local suppliers; upgrading of local firms | Increase competitiveness of local firms in domestic and foreign markets |
| Timeframe | Long run (ten to 15 years) | Short run to medium run | Continuous |

Source: Balaoing-Pelkmans and Mendoza [2021].

Route 1, the leapfrogging strategy, aims to directly upgrade to more sophisticated production activities, bypassing intermediate steps. This ambitious approach requires significant government intervention to support technological advancements and necessary skills development, overcoming the "quiescence trap" where low growth and limited diversification reinforce each other. The strategy's success hinges on breaking this path dependency through targeted government support for technology and skills accumulation—a "juggernaut" activating self-sustaining growth dynamics. Although costly and prone to errors, inaction is costlier due to resulting technological stagnation.

The empirical evidence shows that developing comparative advantage in complex products without prior experience in similar products is difficult [Mehta and Felipe 2014], highlighting the need for proactive capacity building. Successful leapfrogging, as demonstrated by newly industrialized Asian countries, requires a coherent long-term vision, massive upskilling investments, effective technology acquisition strategies, strong coordinating government agencies, continuous policy learning and adaptation, a high-quality bureaucracy, close monitoring of firms, and robust collaboration with the private sector. To identify the targets in Route 1, our approach prioritizes products with comparative advantage, potential market size, and high opportunity gains, even if distant from the country's current capabilities. This necessitates a "big push" towards high-quality skills and aggressive technology acquisition. The challenge lies in incentivizing skill development ahead of high market demand.

Another important consideration for leapfrogging is the pragmatic reckoning of what could be achieved in the medium to long run given the country's comparative advantage, as well as a strategic long-term vision that looks beyond the natural limits of current capabilities.[11] As in the experiences of early industrializers in the 1970s and 1980s, it typically takes ten to 15 years before leapfrogging

[11] In targeting a sector for industrial policy, Singapore set its sight on producing products that would otherwise not have been produced in the country on the basis of comparative advantage alone.

projects produce visible results. While the detailed contour of industrial strategies is designed in a step-by-step learning-by-doing policy-making approach, the identification of target sectors can help kick-start the process. Having target sectors creates the imperative to reach a broad-based consensus on what kind of competencies would be needed, as well as how priorities could be ranked in terms of urgency and feasibility. The targeted sectors may evolve over time, depending on how agile policymakers are in evaluating firm performance and correcting policy errors.

The second route looks at climbing the value ladder within GVCs. A GVC-driven open economy IP is considered a pragmatic and less interventionist approach since the value ladder provides a natural trajectory for functional and intersectoral upgrading. However, GVC participation per se does not provide a straightforward path towards upgrading and export diversification [Mendoza 2023]. While some local firms are able to shift to more complex functions within the value chain, other suppliers are trapped in low value-added segments of production where the resources and incentives for upgrading are scarce. It would normally appear that GVCs can serve as a catalyst for leapfrogging, especially when they facilitate the production of sophisticated goods using international frontier technology. But the sourcing strategies of GVC lead firms are based on exploiting the comparative advantage of their hosts to attain greater efficiency and scale. Therefore, developing countries that attract GVC firms based on low-cost labor or natural resource endowments will naturally be assigned labor- or resource-intensive tasks. Hence, while GVCs bring productive employment and provide potential stepping stones for economic upgrading, they give no guarantee of meaningful industrial diversification if local firms participate on the basis of undynamic comparative advantage (e.g., cheap labor or natural endowments). In this case, governments may intervene through regulations or incentives to induce GVC lead firms to invest on upgrading, and to improve the global competitiveness of local suppliers.

Route 2 explores the product complexity index (PCI) and the product space structure, targeting products within the GVC core characterized by high complexity, strong comparative advantage, and extensive linkages with other complex products. The approach recognizes that while GVCs can serve as catalysts for leapfrogging, particularly when employing frontier technologies, their inherent sourcing strategies often exploit host countries' comparative advantages, potentially leading to stagnation in low-value-added activities.

The third route makes a case for sustaining the local industrial base that is populated by small and medium-sized establishments (SMEs). In 2022, SMEs accounted for 99.6 percent of all firms in the Philippines. This means that the seeds of the country's industrial champions can be sown in this vast field of promising firms that potentially include innovative start-ups, new export entrants, and new GVC participants. Broad-based industrialization entails not only the birth of new firms and new products but also the survival and expansion of existing sectors with strong comparative advantage.[12] Yet, the intensely competitive global environment threatens to drive small and newly emerging producers out of the market which can further shrink the narrow industrial base in developing economies. In the Philippines, nine sectors with more than 20 years of comparative advantage have disappeared from the roster of strong traditional export sectors; while those that remained have stagnant or falling RCA indices [Balaoing-Pelkmans and Mendoza 2021]. The global competition has been particularly felt in the textiles and garments sectors, where RCA indices have been consistently falling since 1995, resulting in the disappearance of 33 out of 44 product lines with comparative advantage. The struggle to compete with countries or GVCs with enormous scale advantages is also driving local firms to downgrade into lower cost but also lower quality product niches, use cheaper but environmentally harmful technologies, and/or further push down labor costs in order to survive.

Fast-growing SMEs are crucial for inclusive development and employment, yet their sheer number cause poorly targeted government resources to be spread thinly across thousands of firms. Middle-sized firms, in particular, are considered big enough to survive on their own; yet these firms are precisely the most vulnerable to competition and other supply shocks as they begin to traverse the more perilous open seas of domestic and foreign markets. Middle-sized firms play a critical role—they are strongly linked to local supply chains populated by micro and small-sized firms and they are also suppliers to large local and foreign firms. Populating this "missing middle" is key to a robust, inclusive industrial base, but requires clear targeting guidelines, enforceable timelines, and a cohesive strategy involving local government units. Analysis of falling RCA indices and revenues can pinpoint sectors facing pressure and prioritize support for large employers with strong local value chain linkages. The approach acknowledges that even established exporters of bananas and electronics—facing competition from Ecuador and Vietnam, respectively—require support to weather intensified global competition.

The rest of the section explores the product space developed by Hidalgo et al. [2007] to identify target HS4 products for each route.[13] (See Balaoing-Pelkmans and Mendoza [2024] for the location of these targets in the product space.) Hidalgo et al. [2007] developed the PCI which measures the level of complexity required to produce a certain product. They also defined the concept of proximity in the product space based on the principle of relatedness; i.e., the probability

[12] Balaoing-Pelkmans [2017] documented progressive shrinking of the mass of Philippine exporters due to a declining entry rate alongside an increasing permanent exit rate of firms in the export market, resulting in decreasing survival rates of manufacturing exporters since 2001.

[13] The Harmonized System (HS) is a standardized system of nomenclature and number codes to classify traded products. At the four-digit level of the codes (HS4), specific product descriptions can already be identified (e.g., "T-shirts, knit" (HS6109 in the 1992 classification) which falls under "Articles of apparel and clothing accessories, knitted or crocheted" (HS61). However, we note that at a high degree of aggregation (e.g., HS4), the heterogeneity of the subcategories in terms of complexity and value creation is not fully observable. Policymakers may access more granular product level data to fully disaggregate the existing exports under these broad categories.

of producing a new product increases with the number of related items that a country already manufactures. Nearby goods in the product space often have similar capability requirements which means that skills and technologies used in a particular product can be easily repurposed for the manufacturing of neighboring products. The strength of the connection between two products (i.e., their degree of proximity) will influence the speed with which a country's product space grows. Products that are well connected (i.e., those near the core) provide greater opportunities for sophisticated diversification and growth. Using the concept of proximity, one may also quantify the relatedness between a country *c* and particular product *p*; i.e., how compatible country *c*'s current export structure and complexity is with what is required to export a new product *p*. The opposite of relatedness is called distance. Information on proximity and product-level complexity may also be combined to calculate $OG_{cp}$ or the opportunity gain of developing a particular product; i.e., the potential contribution of producing a new product *p* to country *c*'s overall complexity.

It should be noted that relatedness and opportunity gain are strongly negatively correlated; that is, products with high opportunity gain tend to have very low relatedness to the country's current export structure. In fact, goods with the highest relatedness values are associated with negative opportunity gains. This implies that developing these products will not significantly contribute to the complexity of the Philippine product space. The danger of diversifying based only on relatedness is that the Philippine product space is sparse and still concentrated in relatively simple products. In this context, path dependence dictates that the direction of diversification, at least in a short-run scenario without a conscious effort to leapfrog, would be towards similarly unsophisticated sectors. Moreover, the diversification will be most likely slow and limited to the periphery where Philippine exports are concentrated. On the other hand, upgrading based on potential gains in complexity may require massive and fast-tracked investments in technology and skills. The challenge for policy is how to strike a balance between the two such that exploring new products is both feasible and complexity-enhancing.[14]

For a leapfrogging IP with a time horizon of at least a decade (Route 1), the top ten promising products are identified based on the opportunity gains of triggering diversification towards complex products, the potential size of these opportunities as indicated by the size of world trade, and tempered by distance and comparative advantage considerations (see Table 6). These products are actually outliers in the sense that they are highly complex and far from the cluster of the country's current

[14] Bayudan-Dacuycuy and Serafica [2019] previously analysed the Philippine export basket in 2014 and identified 26 targets for a short-run diversification strategy that used proximity, relative sophistication, import intensity, and RCA as screening criteria. The products identified for short-run diversification "have RCA, are relatively sophisticated, and are close to the current products in the country's export basket." In the current study, some of the products identified by Bayudan-Dacuycuy and Serafica [2019] fall under Routes 2 and 3 targets.

major exports; yet, display huge potential for comparative advantage (they are all in the top 30 percent of Philippine exports in terms of RCA). This shows that firms active in this sector are already developing a set of sophisticated skills very much different from what most Philippine exporters possess. Route 1 is partly supported by our earlier econometric results which imply that industrialization backed by innovation targeted towards key sectors can boost economic diversification and its potential benefits in terms of reducing output volatility and boosting export growth.

**TABLE 6. Profile of Route 1 products, 2021**

| Product description | 1992 HS4 Code | PHL Exports (million USD) | World Trade (billion USD) | RCA | Distance | PCI | OG |
|---|---|---|---|---|---|---|---|
| 1) Machines n.e.c. | 8479 | 69.45 | 145 | 0.242 | 0.869 | 2.04 | 1.22 |
| 2) Screws & similar articles (iron/steel) | 7318 | 142.69 | 46.1 | 0.67 | 0.879 | 1.62 | 1.22 |
| 3) Transmission shafts | 8483 | 132.31 | 63.3 | 0.39 | 0.878 | 1.31 | 1.06 |
| 4) Appliances for thermostatically controlled valves | 8481 | 142.83 | 100 | 0.306 | 0.864 | 1.72 | 1.16 |
| 5) Instruments for physical or chemical analysis | 9027 | 11.59 | 54.6 | 0.132 | 0.87 | 1.77 | 1.15 |
| 6) Equipment for temperature change of materials | 8419 | 67.55 | 44.8 | 0.608 | 0.867 | 1.32 | 1.04 |
| 7) Instruments for measuring properties of liquids or gases | 9026 | 32.85 | 21.3 | 0.798 | 0.872 | 1.44 | 1.08 |
| 8) Parts and accessories for metal working machines | 8466 | 68.20 | 19.5 | 0.58 | 0.874 | 1.51 | 1.15 |
| 9) Ball or roller bearings | 8482 | 25.41 | 35.1 | 0.24 | 0.867 | 1.41 | 1.05 |
| 10) Electrical lighting equipment used for motor vehicles | 8512 | 102.34 | 34.8 | 0.997 | 0.856 | 0.962 | 0.781 |

Sources of data: UN Comtrade and Growth Lab [2024].
RCA = revealed comparative advantage; PCI = product complexity index; OG = opportunity gain
Data for HS4 9026 are for 2020.

The main challenge for a leapfrogging IP is how to incentivize the buildup of skills that might not yet have a critical demand. In this sense, leapfrogging IP is primarily a big push towards the overall quality skills needed to accumulate productive knowledge, as well a push towards more aggressive technology acquisition strategies. This is consistent with our econometric results which suggest that human capital accumulation can have the largest impact on high-tech diversification. The fact that most countries failed to leapfrog shows how exceptionally difficult it is to assemble a critical package of interventions [Mehta and Felipe 2014]. Overcoming this challenge is not impossible, but the experience of successful late industrializers suggests that this requires strong leadership and a long-termist bureaucracy, resources, and the establishment of long-term partnerships and collaboration with key stakeholders. The industrial policies of Singapore, Taiwan, and South Korea in the 1970s to the 1980s were based on the premise that rapid industrialization will not take place without a deliberate leapfrogging policy. For instance, Singapore pursued well-calculated strategies to transition away from labour-intensive products to products with higher technology content to generate higher-paying jobs. This was implemented through a long-range economic development strategy which includes, among others, fiscal, infrastructure, and institutional support.

Given the difficulties of leapfrogging, integration in GVCs has been seen as a relatively easier way towards industrialization as developing countries can participate in the large-scale global production architecture of high-technology products by specializing in the labor-intensive segments of production. The idea is that the tighter relationships that bind foreign and local firms within GVCs will eventually facilitate the transfer of technology and skills. However, this is usually not an automatic process. Similar to Route 1, local firms still need to build absorptive capacities and improve technical capabilities for further technological, skills, and functional upgrading in GVCs [Mendoza 2023]. In Table 7, the Philippines' top GVC sectors are items 1-4, 6-8, and 10. Almost all of these major exports are clustered together in the periphery of the product space. The specificity of the skills required in manufacturing these products partly explains why forward and backward linkages with other local firms are difficult to establish. For these sectors, the most practical aim for industrial policy is to stimulate process upgrading with an emphasis on skills training for the workforce.

The products of interest for Route 2 diversification are those situated in the core (i.e., items 5, 9, and 11-14 in Table 7) because of the higher opportunities for expansion to sectors that require similar skill sets. Products such as electrical apparatus for less than one thousand volts, electric motors and generators, automatic regulating instruments, vulcanized rubber plates, and parts for use with electric generators, have the good properties of extensive linkages with other complex products, high complexity indices, and strong comparative advantage. Consistent with our econometric results, innovation-driven diversification along Route 2 will help broaden the domestic economic base through its direct expansionary effect on local production as well as through the possible learning effects of GVC transactions. The ongoing reorganization of Factory Asia, driven in part by the outmigration of GVC firms from China due to rising costs, geopolitical tensions, and trade conflicts, presents a significant opportunity for the Philippines.

Diversification along Route 2 can enhance the country's resilience and overall trade performance in this evolving landscape. By strategically targeting products within the GVC core , the Philippines can attract lead firms seeking more stable alternative locations for their vulnerable GVC segments. This targeted approach, coupled with proactive government engagement to improve the country's locational advantages and foster direct engagement with GVC lead firms, will be critical to capitalizing on emerging GVC opportunities.

**TABLE 7. Profile of Route 2 products, 2021**

| Product description | 1992 HS4 Code | PHL Exports (billion USD) | RCA | PCI |
|---|---|---|---|---|
| 1) Electronic integrated circuits | 8542 | 27.4 | 8.29 | 1.133 |
| 2) Parts and accessories for office machines | 8473 | 11.0 | 9.22 | 1.256 |
| 3) Computers | 8471 | 3.74 | 0.07 | 1.050 |
| 4) Semiconductor devices | 8541 | 2.75 | 4.72 | 0.993 |
| 5) Electrical transformers | 8504 | 2.43 | 4.49 | 0.912 |
| 6) Electrical machines with individual functions n.e.c. | 8543 | 0.06 | 0.58 | 1.404 |
| 7) Electrical capacitors | 8532 | 1.69 | 10.2 | 1.209 |
| 8) Sound storage media | 8523 | 1.04 | 4.42 | 1.604 |
| 9) Electrical apparatus for < 1k volts | 8536 | 1.08 | 2.07 | 0.696 |
| 10) Parts of radios, telephones, and TVs | 8529 | 0.51 | 1.66 | 0.591 |
| 11) Electric motors and generators | 8501 | 0.84 | 2.81 | 0.882 |
| 12) Automatic regulating instruments | 9032 | 0.19 | 1.15 | 1.137 |
| 13) Vulcanized rubber plates | 4008 | 0.02 | 0.92 | 0.856 |
| 14) Parts for use with electric generators | 8503 | 0.11 | 1.08 | 0.866 |

Sources of data: UN Comtrade and Growth Lab [2024].

What does it entail to pursue a diversification strategy with GVCs as a linchpin? There are two approaches that can be deduced from Table 7. The first addresses the problem of weak capabilities which traps local firms in "captive" value chains where lead firms wield more power and control over their suppliers. Understandably, foreign lead firms need to exercise this control to ensure that strict quality parameters and technical specifications are met by suppliers. Lead firms must also ensure that their knowledge assets are protected. In this captive environment, suppliers themselves must exert purposeful efforts to demonstrate that they are capable of performing more complex GVC functions. However, suppliers in this captive relationship usually have weak capabilities. Horizontal industrial policies that enhance the country's locational advantages (e.g., infrastructure, ease of doing business, upskilling) will also improve the bargaining position of local firms. Some elements of these policies are already in place in export processing zones (EPZs) since the 1990s. The challenge is how to replicate this ideal climate for GVC production in the rest of the domestic supply chain.

What differentiates a GVC-driven industrial strategy is the second approach that is characterized by more direct engagements with GVC lead firms. The government can make a difference by lending its various powers to strengthen the bargaining position of local firms vis-à-vis the foreign multinationals that organize the largest GVCs. In this case, the government not only regulates but also proactively negotiates with lead firms in order to obtain the conditions that can ensure progressive upgrading of local production and employment and more opportunities for linking with the domestic economy. However, promoting domestic linkages through legal requirements may raise production costs or expose GVC firms to supply risks that could induce them to go around the rules or move to alternative locations. Hence, effective use of bargaining power also entails a realistic assessment of the cost implications of local industrial policies on GVC lead firms.

Broad-based industrial diversification entails not only the creation of new sophisticated exports (Route 1) and upgrading in GVCs (Route 2) but also the survival and expansion of existing sectors with strong comparative advantage. Unfortunately, the Philippines has been unable to preserve its international presence in many traditional sectors despite having accumulated competitive production capabilities in the 1990s. The openness of the Philippines to global markets means that local firms, regardless of size and market orientation, must compete with foreign firms that can deliver quality products at a competitive price. While the domestic market is being flooded by cheaper and higher-quality goods, many local manufacturing firms are challenged by deteriorating quality and eroding competitiveness. Route 3 emphasizes that the survival and eventual expansion of SMEs in traditional export sectors will create a more organic path to industrialization. The growth of domestic demand for locally manufactured goods relies on the steady flow of incomes for workers employed in these sectors. Rising income may also generate a demand for innovation due to the increasing sophistication of domestic preference for new and higher-quality products. Likewise, a stronger earning power of these traditional export sectors will help support a healthy current account position that can finance the country's import requirements.

To sustain the country's domestic industrial base, Route 3 targets the biggest export earners that have experienced increasing competitive pressures as reflected by their falling RCA indices and /or gross revenues over time (see Table 8). While these sectors are very low on the product complexity scale, our econometric results suggest that diversification along this route is still beneficial since it targets the export sectors that are emptied out by extreme competitive pressures. These sectors are traditionally large employers and have strong linkages to local value chains, especially upstream agricultural industries. There is a tendency to regard established exporters of traditional products (e.g., bananas, coconut oil) as already big enough to be receiving policy support. However, the heightened global competition has exposed local exporters to substantial market share pressures. Banana exports, for instance, have been experiencing market share challenges from countries like Ecuador, which has been aggressively expanding their reach through active government policies. Electronics exporters have likewise been facing growing competition from countries such as Vietnam, which registered a 39 percent growth in that sector in the last decade. Garment exports such as men's and babies' garments saw more than a 50 percent drop in earnings between 2013 and 2018, as RCAs fell below one, turning them into products of comparative disadvantage.

**TABLE 8. Profile of Route 3 products with falling competitiveness**

| Product description | 1992 HS4 Code | RCA 1995 | RCA 2013 | RCA 2021 | PHL Exports in 2021 (million USD) | PCI 2021 |
|---|---|---|---|---|---|---|
| 1) Bananas and plantains | 0803 | 22.7 | 27.8 | 19.9 | 1,320 | -1.921 |
| 2) Coconut & palm kernel oil | 1513 | 130 | 48.1 | 42 | 1,580 | -2.059 |
| 3) Electronic integrated circuits | 8542 | 6.51 | 12.2 | 8.29 | 27,400 | 1.133 |
| 4) Cashew nuts & coconuts | 0801 | 16.2 | 10.6 | 8.1 | 388 | -2.395 |
| 5) Seaweeds & edible vegetable products | 1212 | 12.5 | 6.23 | 0.08 | 14.7 | -1.719 |
| 6) Fruits and nuts, otherwise prepared | 2008 | 13 | 6.47 | 5.93 | 534 | -1.197 |
| 7) Solid vegetable oil and fat residues | 2306 | 14.7 | 5.55 | 1.63 | 74.9 | -1.082 |
| 8) Wood marquetry, ornaments, etc. | 4420 | 12.9 | 2.34 | 1.13 | 13.4 | -0.861 |
| 9) Basketwork | 4602 | 34.9 | 6.7 | 4.52 | 58.8 | -1.505 |
| 10) Men's shirts, knit | 6105 | 10.5 | 1.88 | 1.01 | 33.6 | -1.534 |
| 11) Babies' garments, knit | 6111 | 15.9 | 1.15 | 0.27 | 5.8 | -1.591 |
| 12) Babies' garments | 6209 | 31.2 | 2.31 | 0.82 | 8.1 | -1.521 |
| 13) Hats, knit | 6505 | 13 | 0.676 | 1.12 | 34.4 | -1.021 |
| 14) Unrefined copper | 7402 | 17.2 | 0.0009 | 1.81 | 131 | -2.515 |
| 15) Cigarette lighters | 9613 | 10.4 | 4.49 | 2.55 | 24.8 | 0.328 |

Sources of data: UN Comtrade and Growth Lab [2024].

## 4. Concluding remarks

Philippine policymakers have long recognized the need to move away from a one-size-fits-all strategy for industrial development. In some sectors, a liberal foreign sourcing approach is warranted; while in others, policymakers might need to exercise more proactive interventions to support growth. Active accumulation of skills and productive knowledge are crucial for leapfrogging policies; building long-run collaborative relationships with local and foreign lead firms is key in exploring feasible trajectories for GVC upgrading; and context-dependent strategies must be developed in an environment of constant policy learning and experimentation with various stakeholders. Table 9 lists the most urgent vertical policies identified by Balaoing-Pelkmans and Mendoza [2021] for each diversification route. Given the complexity of issues in domestic industries, a cohesive overarching policy strategy is necessary to avoid fragmented, duplicating, and potentially conflicting interventions, programs, and projects. Vertical policies focus on targeted interventions within specific sectors. For leapfrogging, this includes technology development, skilled labor attraction, and strategic collaborations; for GVC integration, it involves direct engagement with lead firms and enhancing local suppliers' bargaining power; and for sustaining the local industrial base, vertical support includes promoting SMEs, shared services, and innovation.

Horizontal policies, on the other hand, are important in addressing economy-wide challenges and laying down the pillars of broad-based industrialization. Horizontal policies create a supportive environment across the economy. These policies include enhancing the country's locational advantages (e.g., infrastructure, ease of doing business, upskilling) to improve the bargaining position of local firms, establishing a cohesive overarching policy strategy, and fostering collaboration among various stakeholders to avoid conflicting interventions. The most critical of these is a robust educational system and skills buildup that are indispensable prerequisites for industrial catch-up. This is perhaps the most challenging area of industrial policy because of the quiescence trap where the paucity of high-skilled jobs discourages households, workers, and firms to invest in skills. The lack of diversification and upgrading therefore creates the kind of conditions that perpetuate low-trajectory growth. Escaping this trap would require a clear long-term vision that aligns public and private investment incentives. The chicken-and-the-egg problem of higher wages and higher skills and productivity cannot be solved simply by increased investments in upskilling. The large gap between foreign and local wages will continue to draw trained Filipino workers towards overseas job opportunities, so that the rise in expenditures for training and education will translate into de facto subsidies for firms abroad. This highlights the need for increased prospects for higher paying local jobs on one hand, and simultaneously, a credible commitment to build up the quality of the local workforce in order to attract investments in higher-skilled industries.

**TABLE 9. Possible policy interventions for each route**

| | Route 1 | Route 2 | Route 3 |
|---|---|---|---|
| Vertical policies | • Technology access and buildup (reverse engineering; patents; R&D)<br>• Need for a strong coordinating agency (with mandate to ensure implementation)<br>• Active labor policies to attract highly-competent engineers & technicians<br>• Proactive collaboration with engineering & technical knowledge institutions for patent development & commercialization<br>• Explore policy space for (time-bound) use of local content & trade policy instruments | •Identify GVC and local lead firms for direct and strategic engagement; customize incentives to attract GVC lead firms with large impact for upgrading and generation of productive employment<br>• Proactive measures to help local suppliers increase bargaining position with GVC lead firms<br>• Establish Linkage (and supplier search) Program<br>• Facilitate setting of concrete (social, process) upgrading in collaboration with stakeholders, esp. workers and employers' groups | • Profiling of key Filipino-owned SMEs; target strategic firms for close collaboration<br>• Strengthen and customize shared services facilities<br>• Incentivize frugal innovation in green tech /products<br>• Use EPZ benchmarks in strategies to lower production costs for local firms<br>• Surveillance mechanism to monitor survival, exit, new entry rates of local SMEs (especially in export markets); assistance for distressed local firms |
| Horizontal policies | • Identify strategic firms & societal partners (e.g., workers and employers' associations, knowledge associations) for collaborative action; regularly review sector & firm selection<br>• Big-push in R&D spending (towards tripling of current expenditures) and investments in skilling and re-skilling (target technical professions)<br>• Facilitate workers' access to labor market, as unemployed and new labor market entrants will need to be effectively (re-)integrated<br>• Targeted financing strategies in collaboration with selected public & private financing institutions<br>• Review tariff structure (bound vs. applied) for possible temporary adjustments<br>• Set concrete 'ease of doing business' targets that can be evaluated and monitored by stakeholders<br>• Facilitate integration of green technology/products strategies in firm business models<br>• Fast-track establishment of standard certification bodies & implement plans to enable compliance of local SMEs | | |

Source: Balaoing-Pelkmans and Mendoza [2021]

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# Comment on "Mapping feasible routes rowards economic diversification and industrial upgrading in the Philippines"

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The paper is very rich empirically and adds to our understanding of Philippine industrialization.

My first general point is that the Philippines is home to some really high-quality analysis of industrialization, most of it, of course, within the University of the Philippines School of Economics itself. These volumes of works provide a rich intellectual narrative that the paper does draw on and arguably could draw on more.

The second general point is that the paper should try to further put the story in some kind of comparative international context. I like the way the authors have drawn out quite a lot of comparative stories, statistics, and policy in the analysis. I have a couple of other observations on situating the analysis in a regional and global context which may be important to consider. First, I think that it is important to remember when discussing industrialization that manufactures are mainly tradable, and so the global context matters. The big global industrial story over the past 20 to 30 years is the emergence of China on a massive scale, initially producing labor-intensive products, and now products that are much more skill-intensive. The scale is such that it has lowered the global price of manufactures. For countries like the Philippines who are, in a sense, in the same game, the relative cost factors are important. That is, China has lowered the global price of manufactures, and so it is actually harder in some ways to compete in the international marketplace.

Another point to keep in mind is the international organization of global manufacturing production. Here, I suggest that the authors make a bit more of the fact that so much of industrial output, especially in East and Southeast Asia, is occurring in what is sometimes called global production networks or global value chains. More than half of intra-ASEAN and intra-East Asian trade occurs within these networks. In that sense, for rapid industrialization, countries inevitably have to be in that game. I think the authors can emphasize that the Philippines has somewhat missed out on these opportunities. Prema-Chandra Athukorala's chapter in the book *Pro-poor development policies: lessons from the Philippines and East Asia (essays in honor of Arsenio Balisacan)* calls the performance of

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the Philippines a case of "arrested industrialization." It is striking what a minor participant the Philippines is in these global production networks compared to the countries that the authors mentioned. So when the authors discuss upgrading and diversification, I think they need to think about it at least partly in this context.

It is not rocket science how to get into these production networks. In fact, if I understand correctly, the Philippines participated quite strongly in them during the reforms of the 1990s, but it has somewhat dropped since. This relates to my next point. In the regional-global context, the star currently in these networks is Vietnam. Vietnam's share and participation in these networks is rising rapidly; the Philippines, by and large, is not. Furthermore, amidst the global trade and economic uncertainty, concerning whether countries are going to be forced to be in either a China- or a US-dominated world, firms are diversifying. Vietnam has been the first country to which risk-averse firms are diversifying, which tells something about the opportunities that Vietnam seized through its attractive policy reforms. This is despite Vietnam being a latecomer, one that was historically way behind the Philippines. I think part of the story links to "route two" in the schema presented in the paper presented but I think that this general story should be brought out more clearly.

Several other points need to be mentioned. In the case of sectoral analysis studies, I think it is important to stand back and also look at the aggregate story for the economy as a whole. It comes out quite clearly in the latest ADB *Asian Development Outlook* that the Philippines is doing pretty well comparatively. The authors have rightly emphasized that the Philippine service sector has been performing strongly. So, the general question needs to be posed, if the economy is growing at five or six percent, does it really matter which sectors are leading and which sectors are lagging?

Next, I think it is implicit in the analysis—but I suggest making it more explicit—that when we are talking about competitiveness, which is a pathway to diversification and upgrading, it is important to go back to the basics. In this light, I think it is worth unpacking some of the variables used in the econometrics. For example, just to highlight some important factors on the supply side, indicators for education suggest that the Philippines is lagging somewhat. Another is logistics performance indicators such as port competitiveness, and also the costs of utilities. In this area, the Philippines, while it has improved, still lags in the region. Lastly, a discussion on basic competitiveness indicators such as access to financial instruments may be added since these are foundations for diversification and upgrading, particularly for SME operations.

A few additional points could also be referred to in the paper. First, since we are talking about tradable goods, it would be useful to discuss whether trade policies and exchange rates are a constraint. Second, sometimes case studies can be illuminating because they are illustrative of some of the issues discussed in the paper, and it would be interesting to briefly make reference to them. A classic case in Southeast Asia would be the automotive industry, where Thailand moved pro-actively to become the regional hub, even though the Philippine auto industry was established earlier. Thirdly, care must be taken in classifying activities as “low-end” or “high-end’ using old factor-intensity classifications. Multi-product industries like electronics, which are fairly low-end in lower-wage economies, can also be highly R&D-intensive in advanced economies. Fourth, the paper could also touch on another opportunity that Philippines probably missed out on, or at least it could have grown much faster in, which is the traditional labor-intensive products like footwear (e.g., the Marikina footwear industry). Fifth, the question of how minimum wage regulations might have affected the competitiveness of some industries might deserve mention.

Lastly, in an era of heightened uncertainty and volatility, it may be worth saying a little bit about how this connects to the authors’ story. It does, for example, connect to diversification. We learned during the pandemic that countries cannot just rely on international markets for supply, and that there may be a case for thinking about how to ensure that there is at least some industrial capacity in certain strategic sectors. Moreover, supply chain disruptions have occurred well before and even after the pandemic due to wars and climate issues and other factors. One current example is how China could (and has) imposed economic sanctions on the exports of trading partners with which it has disagreements. In the current circumstances of strained bilateral relations, and given China’s massive scale, is this an issue that Philippine policy makers should worry about, and if so, what should be done? This is another diversification issue to contemplate.

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# Industrial policy for innovation: why does it matter?

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This paper explores the relationship between industrial policy, innovation, and productivity in the Philippines. It argues that strategic industrial policies can promote innovation by incentivizing market-oriented research and development and commercialization, developing necessary innovation infrastructure, and fostering a skilled workforce equipped to work with new technologies and adapt to changing market demands. The paper also focuses on the importance of connecting innovation and entrepreneurship ecosystems, highlighting the challenges facing the Philippines in this area. It specifically analyzes the country's startup ecosystem and recommends the establishment of Regional Inclusive Innovation Centers (RIICs) to facilitate collaboration among various stakeholders. Finally, the paper discusses the adoption and adaptation of artificial intelligence and Industry 4.0 technologies and their potential to drive productivity gains and transform the Philippine economy.

**JEL classification**: O31, O32
**Keywords**: industrial policy, innovation, entrepreneurship, start-up ecosystem

## 1. Introduction

In recent years, artificial intelligence (AI) has emerged as a transformative focus within the broader realm of technological innovation, reshaping industries, business practices, and economic landscapes. AI, with its capacity to process vast data sets, recognize complex patterns, and automate sophisticated tasks, is being seen as a driver of innovation across diverse sectors. The technology's versatility enables applications ranging from predictive maintenance in manufacturing to personalized recommendations in e-commerce, streamlining operations while enhancing customer engagement.

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Thus, countries around the world are investing in AI infrastructure, education, and regulatory frameworks, aiming to harness the economic potential of AI and position themselves at the forefront of the digital economy. Recognizing the importance of AI, Southeast Asian countries are focusing their efforts on building a robust foundation for AI-driven growth. AI is expected to add USD one trillion representing around ten to 18 percent increase in gross domestic product (GDP) across the region by 2030 [EDBI 2020]. Singapore announced that is investing more than SGD one billion into AI in the next five years focusing on securing access to advanced chips that are crucial to AI development, working with global leading companies to establish AI centers of excellence and boost AI innovation. It will also invest SGD 20 million in scholarships for its students planning to pursue a career in AI.

Malaysia is establishing its National AI Office (NAIO) to enhance the country's capabilities by fostering innovation. Indonesia's strategy called 2045 AI National Strategy (Stratnas AI) aims to strengthen the AI ecosystem and ensure that it is not left behind by other economies that are making extensive use of AI, and drive technological innovation to achieve Indonesia's target of becoming a developed country in 2045. Thailand's national AI strategy and action plan aims to prepare essential infrastructure for AI development and promote economic growth and increase the country's competitiveness. Vietnam's National Innovation Center is tasked with establishing a center for AI training, research, and application and training 7,000 AI experts and support 500 AI startups by 2030. The Philippine Development Plan 2023-2028 emphasizes the strategic adoption of AI and digital technologies as central to advancing economic growth, productivity, and competitiveness. The Philippines also launched its National AI Roadmap as well as the Center for AI Research.

This paper seeks to define how industrial policy can strategically promote innovation to maximize productivity gains across various sectors, address challenges, and support sustainable economic growth and competitiveness. It is structured into four sections. The following section will focus on innovation and how it contributes to productivity gains. Section 3 will evaluate the existing innovation ecosystem highlighting the importance of connecting innovation and entrepreneurship. Finally, Section 4 will present recommendations aimed at enhancing innovation and entrepreneurship within a supportive industrial policy framework.

## 2. Innovation and productivity

Based on the Oslo Manual [OECD and Eurostat 2018], innovation refers to the implementation of a new or significantly improved good or service, or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations. The minimum requirement for an innovation is that the product, process, marketing method, or organizational method must be new or significantly improved to the firm. This includes products, processes, and methods. A common feature of an innovation is that it must have been implemented. A new or improved product is implemented when it is introduced in the market. New processes, marketing methods, or organizational methods are implemented when they are brought into actual use in the firm's operations. The definition suggests that innovation is not mainly about generating ideas—the traditional focus of science and research policies—but about putting those ideas into practical use to improve competitiveness and address emerging problems and challenges.

The Oslo Manual highlighted two major reasons for using new-to-the-firm as a minimum requirement of an innovation. First, adoption of innovations involves a flow of knowledge to adopting firms. The learning process in adopting an innovation can lead to subsequent improvements in the innovation and to the development of new products, processes, and other innovations. In other words, adoption of innovations is important for the innovation ecosystem. Second, the main impact of innovation on economic activity stems from the diffusion of initial innovations to other firms. Diffusion is the way in which innovations spread, through market or non-market channels, from their very first implementation to different consumers, countries, regions, sectors, markets and firms. Without diffusion, an innovation has no economic impact. Diffusion is captured in the definition by covering innovations that are new to the firm.

There are four types of innovation:

- *Product innovation*: introduction of a good service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness, or other functional characteristics. Product innovations can utilize new knowledge or technologies or can be based on new uses or combinations of existing knowledge or technologies. A new product can be a source of market advantage for the firm allowing it to increase demand and mark-ups.
- *Process innovation*: implementation of a new or significantly improved production or delivery method which includes significant changes in techniques, equipment and/or software. Process innovations can be undertaken to decrease unit costs of production or delivery, to increase quality, or to produce or deliver new or significantly improved products. Production methods involve techniques, equipment and software used to produce goods or services. Productivity-enhancing process innovations allow the firm to gain a cost advantage over its competitors leading to a higher mark-up at the prevailing prices or, depending on the elasticity of demand, the use of a combination of lower price and higher mark-up than its competitors to gain market share and increase profits.

- *Marketing innovation*: aims to better address customer needs, open up new markets, or newly position a firm's product on the market, with the goal of increasing firm's sales. The new marketing method can either be developed by the innovating firm or adopted from other firms or organizations. Marketing innovations include significant changes in product design that are part of a new marketing concept. Product design changes refer to changes in product form and appearance that do not alter the product's functional or user characteristics.
- *Organizational innovation*: implementation of a new organizational method in the firm's business practices, workplace organization or external relations. Organizational innovations can be undertaken to increase a firm's performance by reducing administrative costs or transaction costs, improving workplace satisfaction and labor productivity, gaining access to non-tradable assets (codified external knowledge) or reducing costs of supplies. Organizational innovations could be a necessary precondition for technical innovation [Lam 2005]. They are not only a support factor for product and process innovations; they can also have an important impact on firm performance on their own.

Economists widely agree that innovation, particularly through sustained research and development (R&D), is a powerful catalyst for economic growth [Gilbert 2006]. As Aghion and Howitt [1998] argued, innovation is fundamental to long-term economic growth. Their theoretical framework suggests that innovation fosters economic expansion by enabling continuous productivity improvements and resource efficiency gains, which become crucial as economies evolve and traditional growth drivers diminish. Furthermore, empirical research underscores the high social returns on investment in R&D—returns that typically exceed private gains [Griliches 1992]. This discrepancy underscores the public good aspect of R&D, as innovations yield spillover benefits that enhance productivity and welfare across the broader economy, justifying the importance of supportive policies for innovation. Consequently, investment in R&D becomes not only a driver of firm-level competitiveness but also a cornerstone of national economic resilience and growth.

There exists a huge number of empirical studies measuring the effect of innovation (product and process) on productivity. While earlier studies focused on the use of production-function models that estimate how innovation inputs like R&D expenditures and patent counts impact productivity, the more recent literature shows a shift from innovation input activities[1] to innovation output

[1] Based on the Oslo Manual, innovation activities refer to all scientific, technological, organizational, financial and commercial steps which, or are intended to, lead to the implementation of innovations. These include R&D and non-R&D activities that can be part of innovation such as identifying new concepts for products, processes, marketing methods, or organizational changes; buying technical information, paying fees or royalties for patented inventions, or buying know-how and skills through engineering, design or

activities. Hall et al. [2008] pointed out some limitations in relying on extended production-function methodologies which include R&D (or alternative measures of innovation effort) as another input to production. R&D as an innovation measure does not capture all aspects of innovation which frequently occur through other channels and often leading to an underestimation of the impact of innovation on productivity. These innovation output activities are indicators of the outcome of the innovation process or results of R&D investment like training, technology adoption, and sales of new products new to the market or the firm.

Crépon et al. [1998] introduced a new structural model that links innovation input (mostly R&D), innovation output, and productivity which provides insights into how these elements interact to drive firm performance. The Crépon-Duguet-Mairesse (CDM) model is a multistage econometric framework that sequentially links a firm's R&D investment to innovation output, and subsequently connects innovation output to productivity growth. This framework represents a significant advance in innovation studies, as it moves beyond simple input-output measures to offer a comprehensive view of the pathways through which R&D and other innovation efforts contribute to productivity growth.

The CDM study showed that the probability of engaging in R&D for a firm increases with its size (i.e., the number of employees), its market share and diversification, and with the demand pull and technology push indicators. It also notes that the research effort of a firm measured by R&D capital intensity increases with the same variables, except for size. Furthermore, the firm's innovation output, measured by patent numbers or innovative scales, rises with its research efforts and with demand pull and technology indicators. Finally, the study finds that firm productivity correlates positively with a higher innovation output even when controlling for the skill composition of labor as well as for physical capital intensity.

Hall and Mairesse [2006] reviewed empirical studies on the relationship between innovation and productivity: they found a consistent positive relationship between R&D, innovation output (product and process innovations), and productivity. Innovation activities, especially when supported by R&D investments, are associated with productivity gains at the firm level. They noted that product innovations tend to boost market performance and revenues by differentiating products, while process innovations are more directly linked to cost savings and efficiency, which enhance productivity. They also highlighted the importance of R&D spillovers, where firms benefit from the R&D efforts of others. These spillovers amplify the social returns to innovation, which are often greater than the private returns to individual firms.

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other consultancy services; internal training to develop human skills, tacit and informal learning—learning by doing; investing in equipment, software or intermediate inputs that embody the innovative work of others; reorganizing management systems and overall business activities; and developing new methods of marketing and selling goods and services.

Using the CDM model, Parisi et al. [2006] examined innovation patterns in Italian firms and their impact on productivity, revealing that process innovations have a more substantial effect on productivity than product innovations. This holds across different measures of productivity, with process innovation effects not fully explained by traditional inputs like R&D intensity. Interestingly, R&D spending is closely linked to product innovation but less so to process innovation, which instead correlates strongly with capital investment, suggesting that new technologies are often embedded in new equipment. R&D also enhances a firm's absorptive capacity for external innovations, supporting previous findings at broader levels. Cash flow significantly affects innovation introduction, with persistent effects observed for product but not for process innovation.

Hall et al. [2008] modeled how R&D decisions and innovation outcomes impact firm productivity, particularly in Italian firms, adapting the CDM model. Findings reveal that larger firms are more likely to innovate but invest less intensively in R&D, while subsidies boost R&D, especially in high-tech sectors. Process innovation, often requiring investment in machinery, has a stronger effect on productivity than product innovation. Italian firms show similar innovation levels to other European firms but invest less in R&D, likely due to high capital costs and market structure limitations. A unique aspect in Italy's bank-centered system is that larger firms face high R&D costs, while family-owned firms may prioritize non-profit objectives, limiting overall R&D investment.

Providing a developing country perspective on these dynamics, Benavente [2006] examined the relationship between R&D, innovation, and productivity among Chilean firms using firm-level data and CDM model. He finds that firm size influences the likelihood of engaging in research activities, though it does not impact the amount of resources allocated to these activities after accounting for sectoral differences, thus suggesting a constant return to scale in research investment. Technological opportunities, especially when integrated into machinery and output, significantly affect research activities. Productivity also shows a constant return to scale, with both engineering and administrative labor positively influencing it. The study's econometric methods address data-specific issues like truncation and selectivity biases. However, unexpected findings show that research spending and innovation do not significantly impact innovation sales or productivity, possibly due to assumptions about immediate productivity effects or measurement limitations tied to value-added per worker. This may also indicate that in developing countries like Chile, traditional R&D investment alone may not be sufficient to drive innovation. Broader policy measures, such as improving access to finance, enhancing infrastructure, and addressing skills gaps, are crucial to fostering a more productive and innovative business environment. This indicates the need for tailored industrial policies that support both R&D and other innovation drivers in developing country contexts.

In analyzing the diffusion of AI technologies, Rammer et al. [2021] examined the contribution of AI methods (language/text understanding, image/pattern recognition, machine learning, knowledge/expert systems) and applications (products/services, automation of processes, interaction with clients, data analysis) to product and process innovation outcomes. Using German firm-level data and employing an innovation production function, their findings showed that (i) firms that developed AI by combining in-house and external resources obtained significantly higher original innovation results, i.e. market and especially world first novelties, than firms that mainly used externally developed AI methods; and (ii) firms that apply AI in a broad way and have several years of experience in using AI tend to yield higher innovation outputs.

## 3. Innovation and entrepreneurship ecosystem

The Philippines has put innovation at the heart of its industrial strategy. This is crucial to propel industries forward, enhance competitiveness, and unlock new opportunities for industrial growth. In implementing an innovation-driven industrial policy, it is important to understand the context that fosters and enhances innovation and entrepreneurship outcomes, particularly ecosystem[2] conditions and the interactions between the innovation and entrepreneurship ecosystems that encourage entrepreneurial innovations and high potential entrepreneurship.

An innovation-driven entrepreneurship enables people and enterprises to pursue global opportunities based on innovative processes, products, or services [Rosiello and Vidmar 2022]. Entrepreneurship is essential in amplifying innovation, creating jobs, satisfying customer demands and other economic impacts. The process of commercializing an idea involves numerous parties and the creation of entrepreneurship and innovation ecosystems has been considered an effective way to nurture and support this process.

Ianioglo [2022] defines entrepreneurship and innovation ecosystems as complex systems representing self-organization, complex components, interdependent relationships between different actors, non-linearity, dynamic nature, and adaptability. In an ecosystem, firms do not just compete with each other using their own resources, but cooperate, interact, and use shared resources, knowledge, networks, infrastructure and support to co-create value. As Figure 1 shows, innovation is central to both innovation and entrepreneurship ecosystems. In fact, innovation is one of the major motivations of entrepreneurship ecosystems. In a successful innovation ecosystem such as Silicon Valley, innovation outputs are commercialized.

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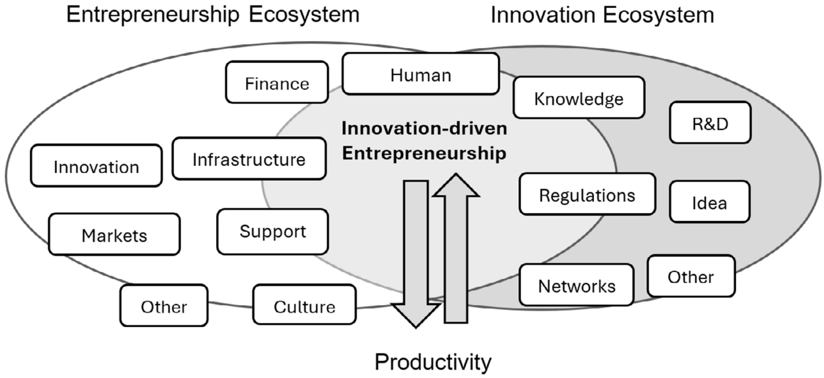
[2] Natural ecosystems are defined as communities of living organisms interacting with their environment through unique networks and interdependencies as part of a system. Just as nature's interactions can be defined as an ecosystem, so too can regional and national economies. Much like natural ecosystems, innovation ecosystems are living, changing, evolving; connected and interdependent; and shaped by and shape their environment [RTI International 2017].

**FIGURE 1. Innovation-driven entrepreneurship**




Source: Adapted from Ianioglo [2022].

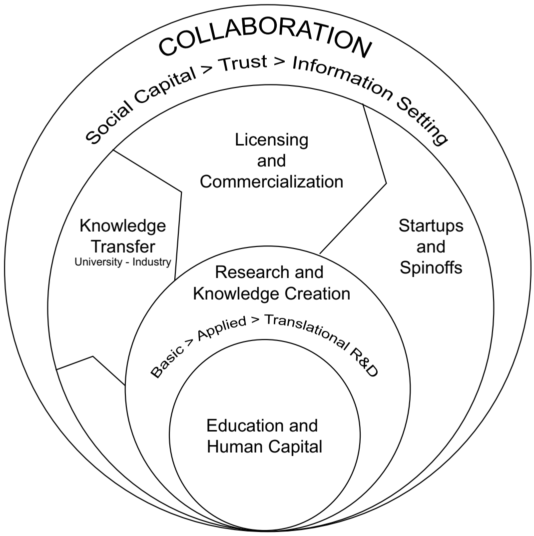
Figure 1 also shows the unique components of an innovation ecosystem including ideas and R&D, and innovation and markets for entrepreneurship ecosystem. Common elements for both innovation and entrepreneurship ecosystems are human capital, knowledge, infrastructure, regulations, finance, support services, networks, and culture. While these ecosystems share common participants, they differ in focus. The innovation ecosystem emphasizes value creation through the development of new ideas and technologies, whereas the entrepreneurship ecosystem centers on nurturing entrepreneurial ventures [Chaudhary et al. 2024].

In Figure 2, research and innovation stem from a strong core of education and human capital. A robust innovation and entrepreneurship ecosystem has four critical components: human capital, research and knowledge creation, knowledge transfer and intellectual property (IP), and infrastructure and culture of trust and collaboration. As the figure shows, academic institutions and research organizations serve as the bedrock of innovation, generating groundbreaking ideas and conducting cutting-edge research. For the ecosystem to function, the knowledge created in the country's colleges and universities must be transferred into commercial applications which could be in the form of direct service agreements, licensing, or startups and spin-offs. This is important to ensure that the potential benefits of R&D investments are not confined within the academia but diffused in the broader economy.

For these dynamic processes to effectively and efficiently take place, there must be an atmosphere of collaboration, which is dependent on social capital, trust, and information sharing. Successful innovation requires the collaboration between academia and industry. The triple helix framework underscores the dynamic interplay between universities, industry, and government, which drives innovation within ecosystems. The knowledge spillover theory suggests that entrepreneurial behavior is fueled by opportunities arising from these spillovers.

The entrepreneurship ecosystem, therefore, thrives on knowledge dissemination and close collaboration between universities, R&D labs, and individual actors. The success of the entrepreneurship ecosystem is measured by its ability to commercialize knowledge and transform it into tangible innovations.

**FIGURE 2. Innovation framework linking innovation and entrepreneurship**




Source: RTI International [2017].

Within the context of a competitive environment, innovation fuels productivity gains, which, in turn, stimulate economic expansion. This relationship is dynamic and reciprocal with higher productivity growth further fostering innovation. Both the innovation and entrepreneurship ecosystems are composed of largely similar players who interact with one another to foster innovation-driven entrepreneurship. This collaboration contributes to productivity growth and, ultimately, economic expansion.

Tables 1 and 2 provide innovation input and intellectual property rights indicators, respectively. A strong intellectual property rights system is important in facilitating innovation and commercialization. In general, for both sets of indicators, the Philippines ranks low vis-à-vis its neighbors in Southeast Asia. In terms of researchers per million inhabitants, the Philippines is the lowest followed by Indonesia while Indonesia is at the bottom in terms of R&D expenditure as a proportion of GDP. The two countries are investing far less than other countries on activities that drive innovation. Moreover, their base support for innovation and commercialization remains comparatively weak. Their patent applications are also low, the two countries have the lowest patent applications per million inhabitants. The Philippines is the lowest in terms of trademark per million inhabitants and industrial design per million inhabitants. For utility model applications, Indonesia and Thailand are the highest while Malaysia followed by Vietnam registered the lowest.

**TABLE 1. Innovation input indicators**

| Country | Researchers (in full-time equivalent) per million inhabitants | | Research and development expenditure as a proportion of GDP | |
|---|---|---|---|---|
| | 2018 | 2020 | 2018 | 2020 |
| Philippines | 172.0 | … | 0.32 | … |
| Indonesia | 217.5 | 399.6 | 0.23 | 0.28 |
| Malaysia | 2,139.5 | 726.5 | 1.04 | 0.95 |
| Singapore | 6,786.7 | 7,224.7 | 1.81 | 2.16 |
| Thailand | 1,718.5 | 1,699.1** | 1.11 | 1.21** |
| Vietnam | 765.5* | 779.3** | 0.42* | 0.43** |

Note: * 2019; **2021
Source: UNESCO [n.d.].

**TABLE 2. Intellectual property rights indicators, 2023**

| | Philippines | Indonesia | Malaysia | Singapore | Thailand | Vietnam |
|---|---|---|---|---|---|---|
| Total patent applications | 927 | 1,727 | 1,649 | 9,313 | 1,308 | 1,119 |
| Resident applications per million inhabitants | 6.7 | 6.1 | 24.6 | 273.9 | 10.5 | 10 |
| Trademark applications | 37,832 | 120,883 | 27,616 | 54,958 | 40,544 | 87,038 |
| Resident applications per million inhabitants | 312.7 | 424.5 | 584 | 2,244.3 | 469.9 | 831.7 |
| Industrial design applications | 874 | 4,949 | 778 | 1,982 | 4,219 | 2,168 |
| Resident applications per million inhabitants | 7.3 | 17.3 | 15.3 | 81.5 | 55.5 | 20.2 |
| Utility model applications | 1,968 | 4,368 | 156 | 1,769 | 3,836 | 602 |

Source: WIPO Statistics Database [2024].

The development of the ecosystem requires the collaboration between the knowledge economy (driven by research) and the commercial economy (driven by the marketplace). It is in this intersection that most countries, like the Philippines, are facing difficult challenges [RTI International 2017]. In assessing the country's innovation and entrepreneurship ecosystems, Aldaba [2018], RTI International [2017], and RTI International [2014] identified the constraints faced by the country in building the connections and linkages between the innovation and entrepreneurship ecosystems. Academe-industry collaboration continues to be limited and in general, universities do not see research collaboration as part of their core mission, as opposed to teaching and publishing journal articles. University faculty seem to have a sense of aversion to consulting services or work for hire due to issues with IP ownership. To exacerbate these issues, financial gains from academe-industry collaboration do not accrue quickly to faculty members, as these are highly taxed and are relatively small when compared to the financial gains from independent consulting arrangements.

There are prevailing perceptions from industry that dealing with the academe is too complicated. With limited public information about their expertise, research interests, and innovation projects; businesses commonly do not perceive the academe as potential partners. The lack of a legally sanctioned payment mechanism for financial contributions also erodes the interest of companies to support government-funded research. The academe's desire for full control of IP and their lack of familiarity and trust on legal mechanisms for licensing likewise discourages companies to pursue such collaboration. Overall, relations between the academe and industry are characterized more by competition rather than collaboration. This limits the commercialization of potentially useful research outputs and seriously impacts the overall innovation performance of the country.

With some exceptions, Philippine universities generally remain detached from problems as signaled by the market and often fail to appreciate the importance of commercialization. Some institutions are also unable to respond in a timely manner to the commercialization intent of some businesses because of their lack of mechanisms or preparedness to deal with such. University researchers normally do not consider commercialization as part of their core mission because their performances are evaluated based on the number of their research publications.

Moreover, research activities in universities usually do not end up being commercialized due to the lack of personnel with the capability to deal with technology transfer and commercialization. Researchers are also not well-versed with business plans, conducting market research and feasibility studies, and valuing technology. Additionally, financial constraints limit the commercialization of university technologies because IP registration entails high transaction costs and consumes much time due to the complexity of the process and requirements.

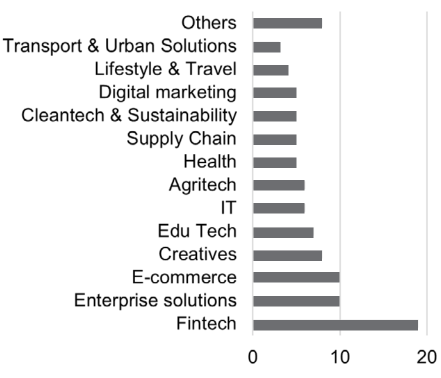
### *3.1. Philippine startup ecosystem*

Startups are ventures led by founders with an idea, invention or research that has a potential for significant business opportunity and impact. Startups have two important characteristics: their potential to grow and expand rapidly and their capacity to disrupt the market through innovation. Globally, the startup sector has created significant, sustaining companies that generate high-value jobs and drive economic growth. Startups support the growth and development of innovative ideas, technologies, emerging high-impact business and a huge pipeline of startups is important to catalyze disruptive innovation and foster inclusive growth and development.

With a valuation of around USD 6.4 billion, the country's startup ecosystem is still young with over 1,000 startups, 60 incubators and accelerators, 50 angel investors, 200 co-working spaces, and 50 venture capitalists. Startup Genome [2024] ranked Manila among the top 81-90 emerging ecosystems in the world, top 20 for funding in Asia, and top 15 for Bang for Buck among Asian ecosystems, which measures the amount of runway tech startups acquire.

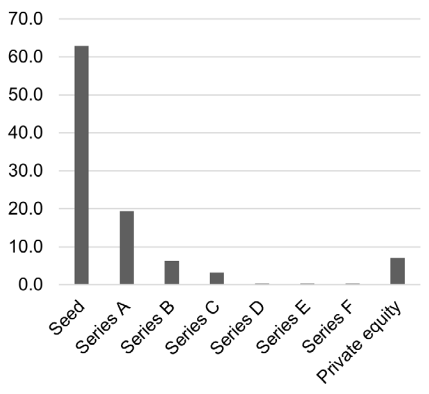
Figure 3 shows that fintech (with share of 19 percent), e-commerce (ten percent), and enterprise solutions (ten percent) are among the ecosystem's sub-sector strengths. Eight percent of local startups are engaged in the creative industries and seven percent in edu tech. IT-enabled services also account for a share of seven percent. As a young ecosystem, majority of local startups are still in seed-level funding accounting for about 63 percent of the total. Startups in Series A level account for 19 percent, those in Series B represent six percent, three percent in Series C, while those that exited through merger or acquisition account for 20 percent (see Figure 4). [3]

**FIGURE 3. Startups by industry (in percent)**




Source: DTI-CIG.

**FIGURE 4. Startups by funding stage (in percent)**

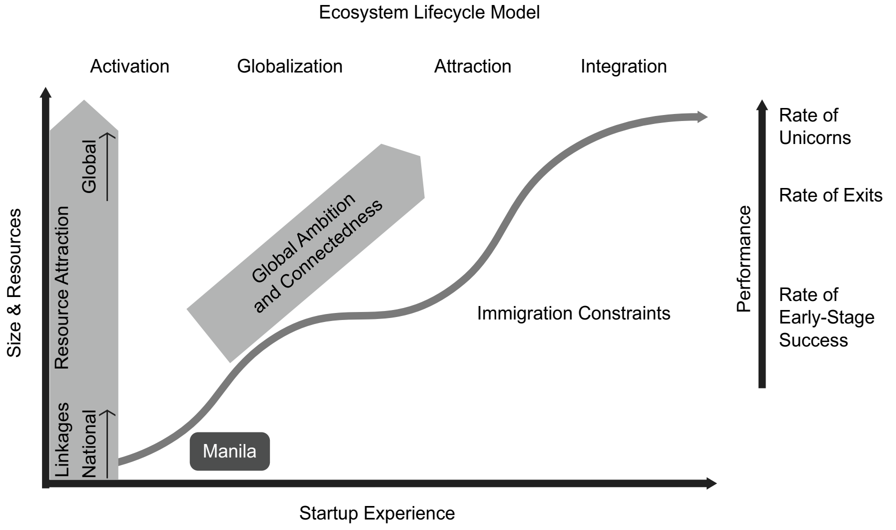



Source: DTI-CIG.

[3] Startups gain funding for their companies through funding rounds beginning with a seed round and continue with A, B, and C funding rounds. The earliest stage of funding a new company is known as pre-seed funding with funders consisting mostly of the founders, close friends, and supporters.
Seed funding: first official equity funding stage which helps a company finance its first steps including market research and product development.
Series A: raise approximately USD 2 million to $15 million, Series A investors are looking for companies with great ideas and strong strategy to turn the idea into a successful, money-making business
Series B: companies undergoing a Series B funding round are well-established, have substantial user bases, and with valuations between around USD 30 million and USD 60 million
Series C businesses that raise Series C funding are already quite successful and are looking for new funding to develop new products, expand into new markets, or acquire other companies [Reiff 2024].

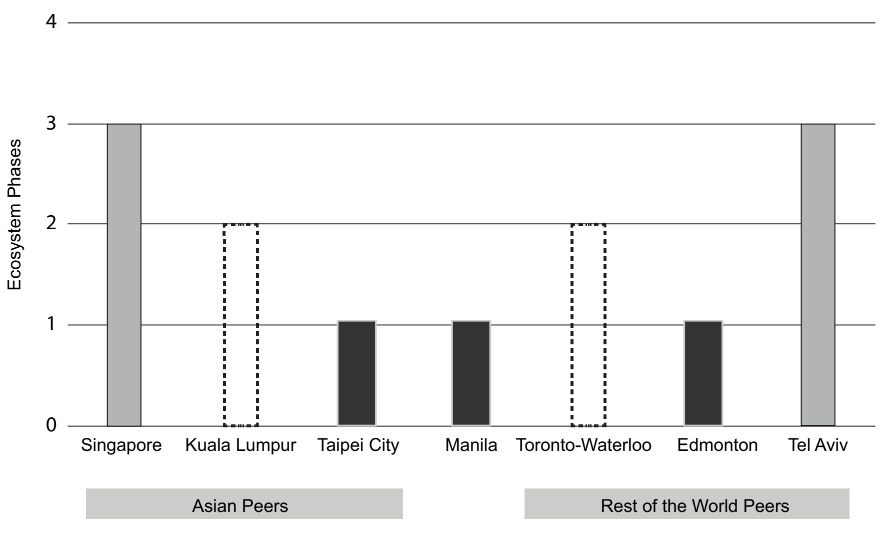
Startup ecosystems are seen as a new type of industry cluster. The Startup Genome ecosystem lifecycle model covers four stages: activation, globalization, attraction, and integration which are determined by the ecosystem's size and resources, startup experience, and performance. Figure 5 shows that based on the Genome classification, Manila is in the initial stage or the activation phase.

**FIGURE 5. The Philippine startup ecosystem**




Source: Startup Genome [2024]

**FIGURE 6. Benchmarking with peers**




Source: Startup Genome [2024]

Within Asia, Manila and Taipei are both in the activation phase (see Figure 6). The Philippines is behind Malaysia which is in early globalization stage as well as Singapore which is already in the attraction phase. Outside of Asia, Edmonton is also in the activation phase like Manila and Taipei. Toronto is in early globalization while Tel-Aviv is in the attraction stage like Singapore.

In 2021, the Philippine startup ecosystem had grown in both deal value and volume amounting to USD 1.03 billion [Foxmont and BCG 2022]. Composed of almost a hundred deals, this amount represented a 179 percent increase compared to the funds raised in 2020. In terms of deal value by sector, fintech contributed the largest accounting for a share of 65.7 percent with Mynt (GCash) emerging as the country's first double unicorn in November 2021. This is followed by media and entertainment with a 13.45 percent share with a deal value amounting to USD 142.5 million. Blockchain contributed a share of 8.88 percent while e-commerce registered a share of 8.51 percent and a deal value of USD 88 million. Food and beverage tech accounted for 0.85 percent while logistech contributed a share of 0.8 percent.

Amid the pandemic, both fintech and e-commerce startups increased their volume of transactions and raised funding for expansion. Three Series B funding rounds were announced in 2021: media entertainment company Kumu and e-commerce companies Great Deals and GrowSari. Kumu thereafter became the first startup to raise Series C funding amounting to USD 73.6 million in October 2021. Great Deals was able to raise USD 12 million funding in a Series A round in 2020 and USD 30 million in a Series B funding in 2021, while GrowSari raised USD 77.5 million.

The fast-growing use of mobile banking, an enabling regulatory environment, and the high number of unbanked and underserved Filipinos allowed the growth of more fintech startups. Other notable fintech deals include companies such as PayMongo which secured USD 12 million in a Series A financing round; Squidpay secured USD two million also in Series A while NextPay raised USD 1.6 million in a seed round of funding. Tonik Digital Bank rasied USD 17 million, Uploan raised USD ten million, while crypto platform Philippine Digital Exchange Asset raised USD 12.5 million. Data driven logistics company Inteluck was able to secure more than USD five million in a pre-Series B funding round. For the first two months of 2022, the total capital raised totaled USD 310 million. After raising USD 210 million, fintech company, Voyager Innovations (PayMaya) became the country's second company with unicorn status.

With the COVID-19 pandemic, 2020 was a challenging year for startups as the crisis affected their financial stability, market dynamism, and talent productivity. Despite this, many Filipino startups were able to quickly pivot to new activities and using new technologies provided solutions to help government in addressing issues arising from the public health emergency. Based on a PWC [2020] survey, 49 percent of Filipino startups explored new products/services and more than 20 percent of the startups said that they experienced an increasing demand for their services and products particularly in logistics, education technology, enterprise services, financial technology, and healthcare.

Table 3 provides a list of Filipino tech-startups that provided support to government through contact tracing apps, personal and community health monitoring, chatbots, along with apps for social distancing and online marketplaces. Innovative startups also emerged to provide tech solutions to address issues in health, agriculture, education, finance, multimedia, supply chain and logistics issues.

**TABLE 3. Startup companies that emerged during the pandemic**

| Startup Company | Description |
|---|---|
| RC 143 | a contact tracing app developed for the Philippine Red Cross |
| DWARM AI | uses drones as non-contact thermal scanners at expressway checkpoints; originally these were designed for search and rescue operations in calamities |
| DATOS | uses geographic information systems, remote sensing, AI and data science to provide maps and other information for disaster risk reduction applications |
| Dashboard Philippines | uses Google Cloud and Google Maps platforms to show relevant COVID-19 information |
| RapidPass | system that facilitated vehicle inspection along checkpoints through QR code scanning |
| Senti AI | developed an AI knowledge management tool with the Department of Health (DOH) and Google; Senti AI fed inputs to chatbots being utilized by the DOH to answer questions related to COVID-19 |
| AIDE | a home healthcare platform providing services like e-consultations, vaccinations, nursing care, laboratory tests, and diagnostics |
| Hybrain, Medcheck | provides hospital information system; Medcheck offers telemedicine, electronic medical records, and data analytics |
| Farmwatch | offers IOT solutions to farm owners |
| Cawil | uses AI to automatically record fishermen’s catch and location |
| InsightSCS, Inteluck | a platform that provides real time digital shipment records; Inteluck is a logistics optimization platform |
| Zayls, FAME | provides warehouse inventory management system services, and FAME provides vehicle tracking solution |
| Kumu | entertainment platform |
| CloudEats, Mad Market, CloudSwyft | cloud-based platforms |

While the country’s startup ecosystem continues to grow and evolve, the following issues and challenges have continued to affect the growth and development of Filipino startups:

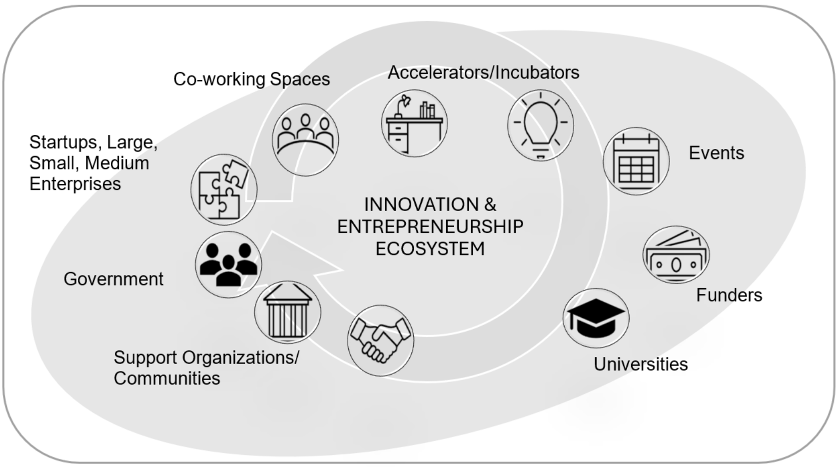
- Startup quality has three main dimensions: founder know-how, customer access, and talent access. Filipino founders have limited knowledge on high potential technologies and business models as well as on latest business models and technologies preventing them from building access or connections to global knowledge. The lack of global connections creates gaps in founder knowledge of leading and failed products and business models. As a result, startups in Manila are not creating globally leading products compared with peers.
- In terms of talent access, despite a strong presence of tech talent in the country, experienced engineers working in startups are few. The percentage of experienced engineers and percentage of growth employees are below the activation average for both 2019 and 2021. The technical talent pool also needs to improve to match other countries in the region.
- Appropriate mentors and extensive networks are necessary for startups to scale up and acquire new opportunities. In the Philippines, experienced mentors are still lacking.
- Lack of early-stage funding and small number of angel investors and venture capitalists.

Addressing the above challenges must be prioritized to strengthen the Philippine startup ecosystem, especially initiatives and programs to build quality startups, strengthen founder know-how, deepen their market reach, and increase talent quality along with increasing early stage funding and expanding the global connectedness of startups. With the passing of two important innovation legislations, the Philippine Innovation Act (PIA) and the Innovative Startup Act (ISA), more comprehensive innovation and startup support is expected to be provided to accelerate the growth and development of startups and address the gaps in the innovation and entrepreneurship ecosystem. PIA is creating an innovation fund of USD 20 million while ISA focuses on supporting startups through the following measures: implement ease of doing innovation initiatives to remove barriers to innovation; establish innovation centers and business incubators; provide financial subsidies for startups (tax breaks, grants, exemption from registration and application fees); startup visas; creating startup grant fund and innovative startup venture fund; and building startup ecozones.

### *3.2. Regional Inclusive Innovation Centers*

The establishment of Regional Inclusive Innovations Centers or RIICs has emerged as top recommendation of the focus group discussions and stakeholder consultations that were conducted all over the country by the Department of Trade and Industry (DTI).[4] As Figure 7 shows, the RIICs are envisioned to be at the core of the country's economic transformation and serve as the linchpin of productive collaborations between and among industries, universities, government agencies, local government units, startups, micro, small, and medium enterprises (MSMEs), R&D laboratories, science and technology parks, incubators, fabrication laboratories, shared services facilities, business centers, and investors, among many other local players.

**FIGURE 7. Regional Inclusive Innovation Centers**




The RIICs will constitute an innovation network or platform of creative communities in various regions of the country, propelled by innovative and entrepreneurial Filipinos, who are driven by their desire to do things better, provide solutions, make better products, and address market demands. The RIICs will focus on market-oriented research providing solutions to societal issues and industry needs through the development of new products and services.

RIICs will be nurtured by policies, programs, and projects that continuously develop human capital; ensure access to funding and other sources of financing; and provide the needed support mechanisms and services for commercialization.

[4] During the 2016 Manufacturing Summit, stakeholders agreed to foster a dynamic innovation ecosystem through government-academe-industry collaboration. In the 2017 Inclusive Innovation Conference, the Department of Trade and Industry and the Department of Science and Technology signed a Memorandum of Understanding to pursue inclusive innovation dialogues. In the 2017 MSME Summit Round Table Discussion on Innovation, stakeholders recommended fostering an innovation culture through the educational system. Through the 2018 Gearing Up the Regions for Industry 4.0, a series of consultations and seminar workshops was conducted with stakeholders from government, academe, and industry across different regions in the country. Recommendations focused on steps to strengthen government academe industry linkages, human capital development towards innovation and entrepreneurship, enabling environment to accelerate innovation and commercialization of research, entrepreneurial culture and support for MSMEs and startups, funding and financing, and industry clusters.

All these activities, interactions, and partnerships will be fostered in an environment in which institutions, infrastructure, intellectual property rights system, culture, and customers enable more and better innovation and entrepreneurship throughout the country.

The RIICs initiative was piloted as a virtual platform connecting stakeholders from government, academe, and industry in Cebu, Legaspi, Cagayan de Oro, and Davao. The DTI and the Department of Science and Technology have worked together with community stakeholders such as startups, industry, farmer cooperatives, and researchers to build the capacity of stakeholders in R&D ideation and design-thinking process and carry out studies and adapt new technologies to address socio-economic problems in the pilot areas. Cebu has focused on advanced manufacturing, particularly in electronics and semiconductor. Legaspi has targeted pili nuts to find ways to add value to the product, while Davao and Cagayan de Oro have prioritized coffee, cacao, and fruits and nuts. In Davao, an interactive application has been developed to help MSMEs access government services and innovation programs. To support these agricultural areas, researchers and other stakeholders are focusing on providing technology solutions to problems such as low productivity, insufficient postharvest facilities, lack of quality of planting materials, pests and diseases. In Cebu, R&D in advanced manufacturing will be crucial to leapfrog to Industry 4.0. To pursue this, Cebu-based companies are partnering with academe to conduct joint R&D and formulate training programs to improve worker capabilities.

### *3.3. AI and other Industry 4.0 technologies*

Traditional manufacturing is being disrupted as operations are undergoing digital transformation using AI, machine learning (ML), big data analytics, cloud computing, 3D printing, and other technologies towards smart manufacturing. To successfully move up the innovation ladder, latecomer countries should take into account factors such as capabilities, endowments, organizational characteristics, technological efforts, and infrastructural and institutional conditions [UNIDO 2019]. One important historical insight is that latecomers need not invent new technologies; instead their main entry point could be to rapidly adopt emerging technologies or adapt them to local conditions through innovation.

New technologies could serve as drivers to achieve an inclusive, resilient, and sustainable industrial development. Through the use of AI, for example, new products and services can be created leading to jobs and income opportunities, as well as new activities. Adopting smart manufacturing could increase productivity; new technologies could reduce material and energy use. The use of Internet of Things (IOT) for asset management could generate the following benefits: increase operational efficiency and productivity, more efficient safety and compliance checks, automation of maintenance and repair operations, more efficient use of resources, better control over the sales lifecycle, easy identification of growth opportunities, and a responsive smart ecosystem [Incisiv Inc. and Siemens 2021].

Innovation is a complex and systematic phenomenon. New knowledge is created and diffused through innovation, expanding the economy's potential to develop new products and more productive methods of operation. By automating routine processes, enhancing data-driven decision-making, and enabling novel product development, AI has spurred productivity gains and opened new frontiers for economic growth.

Moreover, AI's potential as an innovation catalyst lies in its ability to support and augment R&D efforts. AI-driven tools can accelerate research processes by identifying promising avenues in scientific research, optimizing experimental designs, and simulating outcomes, thus reducing the time and cost associated with traditional R&D. This accelerated innovation cycle allows businesses to bring products to market more rapidly, fostering competitive advantage and market responsiveness. Additionally, by enabling data-driven insights, AI provides companies with a deeper understanding of consumer behavior, operational inefficiencies, and emerging trends, facilitating agile, informed decisions that further enhance productivity and innovation.

For instance, in the IT-business process management (ITBPM) sector, which has long been feared to be displaced by machines, the business process outsourcing (BPO) sector is already on the cusp of digital transformation from automating simple tasks to applying big data and analytics [Aldaba forthcoming]. The BPO industry has been adopting new technologies like metaverse which is applied in call centers to enable quick and efficient response to customer inquiries. Companies have also been adopting hyper-automation, a strategy which uses not only robotic process automation (RPA)[5] but also AI, machine learning (ML), integration platform as a service (IPAAS) and other automation tools and software. The industry is also utilizing remote and cloud-based call centers which enable BPO employees a seamless transition to remote work. To achieve a successful digital transformation process, the industry has also been providing total experience (TX) which requires innovative technology focusing on a strategy to improve all the outsourcing players and stakeholders from employees to end-users. According to Gartner [2020], organizations that provide TX are more likely to outperform their competitors.

The case of Concentrix, a customer experience solutions company established in the Philippines in 2007, demonstrates the successful journey of a BPO company. Concentrix has grown remarkably with about 100,000 workers and a total of 50 sites located in 20 cities. It provides support services to more than 40 countries across six continents and ten industry verticals: automotive, banking and financial services, insurance, media and communications, consumer electronics, retail and e-commerce, technology, travel and transportation, energy and public sector, and healthcare. The company requires its employees to have qualifications in business and management, engineering and mathematics, IT and computer science, teaching

[5] Robotic process automation is used by companies to streamline their workflows and reduce the burden for employees who are performing repetitive and tedious tasks.

and education, creative arts, humanities, arts and social sciences, law, legal studies and justice, medical and health sciences, property and built environment, and sciences. In 2021, it partnered with the University of the Philippines to conduct a massive open online course on contact center services.

Its Philippine operations evolved from BPO call center services to providing technology-infused, omnichannel customer experience management, marketing optimization, digital, consulting, analytics, and back-office solutions. As it moved towards offering high value-added services, its business process methodologies also shifted towards the more optimized application of AI, IOT, robots, cloud computing, smart machines. Its adoption of RPA reduced average handling time by 20 percent, rework by 50 percent, increased their return on investment by 11 to 15 percent while AI speech analytics led to ten times increase in quality assurance (QA) coverage, 20 percent increase in QA cost efficiency, and 20 percent increase in productivity.

## 4. Developing effective industrial policy for innovation

Industrial policy plays a pivotal role in promoting innovation, which in turn drives productivity gains essential for sustainable economic growth. By strategically targeting resources and support towards high-potential sectors, industrial policy can create an environment where innovation thrives. One way industrial policy achieves this is by incentivizing market-oriented R&D and commercialization through more effective measures beyond generic instruments such as tax credits or income tax holiday and more towards targeted and transparent grants and subsidies, including the use of government procurement and regulations to affect the demand for innovative solutions and reduce financial barriers. These incentives encourage firms to invest in new technologies, processes, and products that can enhance productivity and competitive positioning, particularly in sectors where initial costs might otherwise hinder innovation.

The creation of the National Innovation Council under the PIA underscores that innovation policymaking is a collective responsibility involving all relevant government agencies at every level. This will require building capabilities among policymakers, particularly in developing a deep understanding of systemic bottlenecks that impede the generation and diffusion of innovations. Simultaneously, the roles of Council members should be clearly defined, with program implementation delegated to other government agencies. This structure will enable the Council to maintain its strategic role as advisor and facilitator within the national innovation ecosystem, focusing on policy, strategy, coordination, and funding oversight.

Another critical aspect of industrial policy is developing the infrastructure necessary for innovation. Investment in digital infrastructure, such as broadband networks, data centers, and AI laboratories, allows businesses to access the technological resources they need to innovate efficiently. By building innovation hubs such as the RIICs, fostering partnerships with research institutions, and supporting technology transfer initiatives, industrial policy can enhance collaboration between the public and private sectors, creating ecosystems that drive technological advancement and productivity improvements. For example, many countries establish technology clusters or science and technology parks to encourage collaboration among tech firms, research institutions, and startups, leading to cross-pollination of ideas and faster commercialization of innovations.

One challenge for Filipino companies that are keen to embrace automation is the lack of experience or relevant skills particularly innovation, data analytics, and leadership skills. Industrial policy can play a significant role in building a skilled workforce, which is fundamental to realizing productivity gains through innovation. By supporting education and training programs, especially in fields like AI, data science, and engineering; industrial policy ensures that the workforce is equipped to work with new technologies and adapt to changing market demands. These policies also help address skill mismatches that can stymie productivity by fostering continuous learning and upskilling.

To strengthen the innovation and entrepreneurship ecosystem and address the gaps therein, the Department of Trade and Industry [2018] and Aldaba [2018a;2018b] proposed the following measures:

1. Fostering government-academe-industry linkages

a. Expanding student internship programs to provide students with industry-relevant knowledge and competencies along with faculty immersion in industry
b. Capacity building of faculty-researchers in solutions-driven and market-driven research as well as business development, customer discovery, and customer development
c. Establishing techno-parks, hubs, or innovation centers focusing on entrepreneurship, innovation, and technology and business incubation
d. Setting up of common innovation and support facilities catering to local industry needs

2. Enhancing education, human capital development, and workforce training

a. Integrate innovation and entrepreneurship in basic education
b. Technical Education And Skills Development Authority (TESDA) to support local MSMEs, startups, and industries of specific regions through dynamic and customized tech-voc innovation and entrepreneurship programs
c. TESDA to accredit private providers that offer re-skilling and upskilling courses like coding, data analytics, leadership, entrepreneurship, business communication, etc. to produce

knowledge workers/professionals in the new digital and knowledge economy

d. Commission on Higher Education to support initiatives by universities, public or private, to promote innovation and entrepreneurship/technopreneurship as part of university coursework

3. Creating an enabling environment to accelerate innovation and entrepreneurship

a. Capacitate state universities/higher education institutions to establish pathways for university publications and patents to be translated into industry solutions or to pass on university researches to industry for adoption
b. Strengthen IP system to facilitate the commercialization process, including the use of services offered by the Intellectual Property Satellite Offices (IPSOs), Innovation and Technology Support Offices (ITSOs), and the IP Depot
c. Simplify and reduce the cost of IP filing; provide support and assistance to facilitate the process of IP filing and management
d. Ease regulatory policies and administrative burden in starting up businesses to facilitate the introduction of ideas into market

4. Developing more innovative MSMEs and startups

a. Strengthen and expand one-stop-shops for MSMEs, which provide services such as certification, licensing, capability training, production, and marketing of products/ services; services can be expanded to provide business mentorship, particularly for startups, as well as creative and design services that aid in transforming ideas/ prototypes into commercially viable products and services
b. Establish regional startup offices or hubs that can serve as a platform for MSMEs to connect and network with industry experts as well as function as business incubators for stakeholders in the regions
c. Foster greater cooperation among actors in the MSME support network (i.e., incubators, accelerators, small business development centers, export assistance centers) by deepening and strengthening their involvement and engagement with stakeholders, including industry experts
d. Build and/or strengthen MSME partnerships with academe and larger players in industry for mentorship programs for innovation and technology-related training programs and activities
e. Strengthen the Startup Ecosystem Development Program to provide more comprehensive assistance to startups and other members of the startup community

5. Financing for innovation and entrepreneurship

a. Increase government expenditure on R&D towards reaching the UNESCO benchmark of one percent of GDP
b. Strengthen the Startup Grant Program to provide financing for commercially viable projects to bridge the gap between commercialization and R&D
c. Create an investment environment that encourages more private sector participation in financing enterprises, including angel investors, venture capital, and crowd fund-sourcing

6. Establishing more RIICs to promote the growth and development of industry clusters

a. Build and expand the operations of RIICs in collaboration with local state universities and colleges and industry groups and use these as platform for
b. Open innovation and technical partnerships between industry and academe (foreign and local) for market-driven research
c. Build rapid prototyping and demonstration, testing equipment, and reliable ICT networks and communication platforms
d. Improving the supply chain, value adding, and agro-processing, as well as systems for food and agricultural research, access to technologies, financing, regulation, and certification particularly for high-value crops
e. Deepening and upgrading the regions' participation in global value chains particularly for agro-processing, electronics, automotive, aerospace, chemicals, IT-BPM, and renewable energy.

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# Comment on "Industrial policy for innovation: why does it matter?"

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This paper postulates that the lack of domestic innovation has "resulted in low productivity levels" and that this is a crucial barrier to industrial transformation and inclusive growth. However, an important distinction should first be made between innovation, on the one hand, and adoption and adaptation, on the other. Innovation in the Schumpeterian sense is the introduction of a product or process that is novel from the viewpoint of what is globally known technologically; it means pushing the product- or process-frontier outwards.

Viewing the Philippines's position on the technological ladder, however, it cannot be said to be at or close the frontier. A good deal (and indeed the bulk) of future productivity gains for the country is likely to be attained by moving the country closer to the frontier rather than by pushing the frontier itself. This can occur through what Mokyr [1990] calls Smithian or Solovian, rather than Schumpeterian growth. We can move people from lower- to higher-productivity sectors, e.g., from the informal to formal sectors, or say, from traditional to modern agriculture. Or we can promote the wider use of existing technology by encouraging investment in existing capital equipment and digital applications (ride-hailing software easily comes to mind). Perhaps "upgrading" rather than innovation may be the more appropriate term in both cases. At any rate, the barriers to productivity growth in these instances do not typically relate to a lack of new knowledge per se but rather to mundane but thorny issues like lack of credit, property-rights questions, sunk or legacy investments, intrafirm governance structures, regulatory rigidities, or cultural or social inertia.

This is not to deny there may be some industries or sectors where true innovation can indeed be achievable domestically. This might be possible, for example, in software development, which avoids many of the hurdles faced by manufacturing production (such as small domestic supplier base, high energy costs, etc.). But exactly how important these are, how much their success might contribute to aggregate productivity, and whether they ought to be the focus of industrial policy—in the sense of laying claim to a major part of public resources—these are completely different issues. The article speaks of an "innovation-based industrial strategy" and mentions a number of "priority

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industry clusters for development"—presumably meant to constitute the focus of industrial policy. Offhand, however, one must remark that the enumeration is too rich and includes almost all economic sectors (e.g., from manufacturing, to telecoms, to creatives, to agriculture). As has been rightly observed, however, if there are too many priorities, then there is really no priority.

The paper's point might be saved if there were some general "innovation" investment, say some generic R&D labs or staff training, that could serve the needs of all the sectors nominated. But that is hardly the case. The skills and equipment needed by an AI app developer, for example, are quite different from those of an engineer trying to improve an auto factory's robots, or a system design engineer trying working on a new graphics processing unit (GPU). For industrial policy, there is no escaping the need for specificity or focus on investment—which is also the reason it carries risk.

If at all, industrial policy should be designed prudently with detailed information on the country's position on the technological ladder, the target industry's current technological trajectory (see, e.g., Dosi [1982]), its main agents globally, and whether and how far the country wants to join the value chain. This is especially true since a good deal of advanced technology today is proprietary and controlled by specific firms. (Think of NVIDIA's hold on the GPU technology used in AI.) This is unlike the 19th or early 20th century when much industrial technology was virtually a public good and innovation could occur autonomously or at least with a choice of different partners.

The upshot is that moving towards the technological frontier and getting a reasonable shot at true innovation entails first attracting the leading firms who possess the desired technology. As with most foreign investment, this is usually done by providing the matching inputs (e.g. specific types of labor, infrastructure, and local partners) or the environment in which these leading firms can thrive. The firm-specificity of many advanced technologies, however, means that the locational inputs to be provided must also be firm-specific and at scale—with the concomitant risk that this will be viewed by the public as biased and discriminatory.

In exchange, the government needs to be clear-headed about the milestones such favored firms are expected to achieve in terms of both technology transfer and market access. (Past programs like the government's various attempts to incentivize car manufacturing have failed both in terms of vision and scale.) Apart from proprietary technology, a further aspect complicating relationships with leading firms is the inherently limited degree of autonomy allowed to local partners in global value chains (GVCs), which can be a barrier to the development of local capacity to innovate or upgrade [Mendoza 2024]. For industrial policy to be effective, even this must be negotiated. The scale of incentives and nature of the terms given to NVIDIA to secure its recent commitment to build an AI chip factory and AI R&D center in Vietnam are probably worth studying, if not emulating.

The need to commit significant resources, the specificity of investment, and the rapid pace of technological change—all of which raise the cost of error—underscores the need for careful prior study of any sector targeted for industrial policy. In this respect, one must question whether government—and a good deal of local academic opinion—is not still working with a too narrow and anachronistic a focus on what “industrial transformation” means. From the handwringing and self-flagellation that accompanies any presentation of statistics of Philippine manufacturing, one gets the impression we are still working on the need to emulate the industrialization path followed by the newly industrialized economies (NIEs) five decades ago.

In considering any industrial policy, however, it is not the history but the trajectory of global production processes that must be considered. Baldwin et al. [2024] and Rodrik and Sandhu [2024], among others, suggest we instead consider what the services sector can contribute to future development—and conversely realize the limits to the old model of traditional labor-intensive manufacturing. Bangladesh, for instance, despite its foothold in the garments and textiles, now struggles to take the next step since it cannot meet the industry’s requirements for a more educated labor force. Here at home, it has been obvious for some time that the IT-BPM sector is the most competitive and innovative sector of the economy. By its nature, this sector has avoided many of the problems plaguing manufacturing, such as the liberal trade and exchange-rate regime, the high costs of unskilled labor, of energy, and of metropolitan real estate. Yet this sector has been taken for granted, regarded as a mere cash cow, and has received less strategic attention and visioning than some industrial sectors. (See the paper of Serafica [2024] in this issue however.) If there is any silver lining in the threat AI poses to IT-BPM, it is that government has been forced to focus on understanding the industry’s technological trajectory and to begin adumbrating a forward-looking strategy. (Even here, however, Vietnam seems to be several steps ahead.) One can only hope this time government “industrial policy” to promote the services industry will be informed by a strategic vision, coherent, implemented at scale, and sustained. Any effort short of this would be merely performative and better set aside.

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# Exploring the prospects of services-led development for the Philippines

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The growing importance of the services sector has prompted an examination of possible pathways to maximize its impact, particularly on the quality of economic growth. Some emphasize promoting job creation and exports in the sector, in addition to ensuring that the services requirements of the rest of the economy are met. Others argue that the potential for services-led development depends on being able to replicate the features of industrialization by leveraging trade, technology, training, and targeting. There are also proponents of more active strategies on the demand side of labor markets. This paper discusses the interrelated issues the country must address in pursuing economic transformation through services. Priority actions include boosting productivity, expanding services outside the National Capital Region, implementing structural reform, strengthening exports of digital services, accelerating digitalization, and increasing innovation. For the Philippines, harnessing services to achieve broad-based and inclusive growth should be the essence of services-led development.

**JEL classification**: L80, L88
**Keywords**: services, development, exports, digital trade, structural reform, Philippines

## 1. Introduction

The services sector comprises a diverse range of activities such as transport and storage, financial services, research and development, health, and entertainment. Specific services are used for production, while others are crucial for human capital development. Services can also be characterized in terms of the nature of demand (intermediate input vs. final consumption), purpose (consumer vs. business services), or the form of provision (market/private vs. public provision) [Schetkatt and Youmani 2003].

Over time, services tend to play an increasingly bigger role in the economy in terms of both value-added and employment. Demand-side and supply-side factors contribute to the growing share of services in the economy (Schetkatt and

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Youmani [2003]; Cuadrado-Roura [2016]). These include shifts in the structure of final demand due to rising incomes, rural to urban migration, higher female labor force participation, and demographic changes which influence the structure of household expenditure. Increasing use of services by the goods sector and other service industries drives the demand for services as well. Growing international trade in services from lower trade barriers and government demand for services also explains the growth of the services sector. On the supply side, possible factors include productivity differentials between manufacturing and services, the provision of non-market services by the government, and advancements in information and communications technology (ICT) which drive the development of new services.

The impact of the expansion of the services sector depends on which services are growing [Maroto Sanchez 2010]. A primary objective for economic transformation is to move to high-productivity services or improve productivity in services that support other industries [te Velde 2017]. Experts suggest boosting the services sector as a complementary, if not alternative, development path as the space for manufacturing-led development is increasingly becoming constrained for developing countries. The next section presents some of the strategies that have been proposed, followed by an overview of the Philippine services sector. The critical issues and priorities for action in pursuing services-led economic development are then discussed. The paper concludes with a summary of the key messages and final remarks.

## 2. Harnessing services for economic transformation

### *2.1. Understand how specific services shape economic transformation*

For Khanna et al. [2016], a key step in the formulation of strategies is understanding the three main effects of services expansion: (i) direct impacts on employment, exports, and GDP; (ii) indirect impacts on jobs and output through backward linkages with upstream sectors; and (iii) second-order effects for example productivity effects on downstream sectors through forward linkages. Table 1 maps out the roles of different services in economic transformation in terms of their possible direct, indirect, and knock-on effects. For example, hotel and accommodation related to tourism could be a source of export revenues and jobs. Professional services need skilled workers and enhance firm-level productivity, while transport and storage may have limited backward linkages yet have significant downstream effects especially in the goods sector.

**TABLE 1. Services and economic transformation: conceptual pathways**

| Subsector | Direct effects: Jobs (skilled, medium, or low-skilled workers) | Direct effects: Exports | Direct effects: GDP | Indirect effects (static and dynamic) | Induced/ Productivity Effects |
|---|---|---|---|---|---|
| Wholesale and retail | Important for less to medium skills | Less important for most developing countries | Important share of GDP | Important effect on agriculture and manufacturing value chains | Less important |
| Transport and storage | Potentially important (e.g., truck drivers) | Important for some countries | Important share of GDP | Less important (apart from energy) | Important for economy-wide productivity |
| Accommodation and restaurants | Medium important for skilled jobs | Important export revenues | High in certain developing countries | Very important, including for less skilled workers | Less important |
| Information and communication | Important for a few countries especially for skilled workers | Potentially a major source of exports and capital inflows | Medium (mostly less than 10 percent of GDP) | Mostly forward linkages | Important productivity effects |
| Finance and insurance | Important, especially for skilled workers | Potentially a major source of exports and capital inflows | High (around 10 percent of GDP) | Less important for offshore centers but has the potential for forward linkages | Less important for offshore centers but important for finance directed at the real economy |
| Real estate | Very few jobs | Not important | Important share of GDP | Important effect on construction | Less important |
| Professional and support services | Important, especially for skilled jobs | Potentially a major source of exports and capital inflows | Low in developing countries | Forward linkages | Important for firm-level productivity |
| Public administration | Important for low- to medium-skilled workers | Insignificant | Medium to high in developing countries | Medium important | Not very important, except e.g. public infrastructure works |
| Education | Important for medium-skilled employment (e.g. teachers) | Less important, apart from a few countries | Relatively high share | Mostly temporary | Important for human capital in the long run |
| Health | Important for medium-skilled employment (e.g., nurses) | Less important, apart from a few countries | Relatively low share | Mostly temporary | Important for human capital in the long run |

Source: Lifted in full from Khanna et al. [2016:10] and Balchin et al. [2016:7]

Rather than simply absorbing low-skilled workers with limited opportunities, it would be more strategic to promote exports and job creation in sectors with high potential (services as a growth escalator sector) while also supporting other services that have significant linkages and knock-on productivity effects (services at the service of the whole economy) (te Velde [2017]; Khanna et al. [2016]).

### *2.2. Leverage the 4Ts: trade, technology, training, and targeting*

Nayyar et al. [2021] explain that the success of services-led development depends on whether the scale, innovation, and spillovers along with job creation for unskilled labor that propelled industrialization can be replicated in the services sector. Furthermore, a one-size-fits-all approach will not be effective given the range of services which differ in terms of skill intensity, offshorability, capital intensity, R&D intensity, and intersectoral linkages.

To increase the contribution of services to development, four policy areas are suggested that will help address the potential to attain larger scale economies, enhance labor productivity through innovation, and capitalize on spillover effects through linkages:

- Trade – Achieving greater scale depends on being able to access larger markets through trade. Lower barriers at the border and reduced regulatory constraints behind the border increases market contestability, which can also help expand domestic trade.
- Technology – Digital technologies enable workers to perform tasks more efficiently and encourage investments in innovation. Support for technology adoption and use will be needed in addition to providing the necessary ICT infrastructure. Moreover, an enabling regulatory framework is essential to encourage the growth of digital tools and business models.
- Training – Improving training and skill development is crucial for increasing productivity while also assisting more workers to shift to skill-intensive subsectors or perform more complex tasks. Meeting the rising demand for digital competencies and other skills is an important aspect of the training needed by workers and firms to be competitive.
- Targeting – Given the potential for stronger linkages between services and other sectors, targeting the growth of services with higher multiplier and knock-on effects can expand the impact on job creation and productivity.

The importance of these core strategies varies across the different subsectors. For example, for information and communication as well as finance and insurance, the use of all four levers will be needed, while skill-intensive social services such as education and health will benefit from improving the trade, technology, and training dimensions.

### *2.3. Focus on expanding productive employment*

According to Rodrik and Sandhu [2024], jobs initiatives have traditionally focused on workforce development. Given the scale of the employment needed however, productivity-enhancing labor market strategies on the demand side are crucial as well. They identify four broad strategies based on a review of various programs that aim to increase productivity and/or employment possibilities in the services sector. These initiatives target (a) job creation, (b) productivity improvement or (c) both, and address both the demand and supply side of the labor markets. See Table 2.

**TABLE 2. Broad strategies for expanding productive employment in services**

| Target | Objective | Examples of mechanisms |
|---|---|---|
| Large and relatively productive firms | To expand employment, either directly or through their supply chains | Collaboration between large firms and suppliers, market linkages, sharing of unemployment data to aid in recruitment, or removal of regulatory burden |
| Smaller firms | To improve productivity and enhance entrepreneurial capabilities | Management training, loans or grants, business competition, internship, specific infrastructure, or technology assistance |
| Directly to workers or firms | To expand the skill set of less educated workers and enable them to perform tasks typically assigned to more skilled workers | Training, provision of digital tools or other new technologies to complement low-skilled labor |
| Less-educated workers | To enhance employability, job retention, and eventual promotion | Combination of vocational training with “wrap-around” services such as counselling, internships, and transportation stipends |

Source: Rodrik and Sandhu [2024].

## 3. Overview of the services sector

Balaoing-Pelkmans and Mendoza [in this volume] have highlighted the increasing share of the services sector in the economy. From 52.8 percent of GDP in 2000, the sector has grown to 62.3 percent in 2023. The structure of the sector has also changed during this period. As Table 3 shows, the contribution of financial and insurance activities and professional and business services increased significantly. Except for the years from 2000 to 2005, when the share of information and communication almost doubled, its contribution has only grown slightly while the share of the other subsectors declined. Wholesale and retail trade remains the largest services subsector.

**TABLE 3. Share of subsectors in total Gross Value Added (GVA) of the Services sector**

| Subsector | 2000 | 2005 | 2010 | 2015 | 2020 | 2023 |
|---|---|---|---|---|---|---|
| Wholesale and retail trade; repair of motor vehicles and motorcycles | 34.2 | 33.6 | 32.1 | 30.3 | 30.8 | 29.8 |
| Transportation and storage | 7.2 | 6.4 | 5.5 | 6.2 | 4.8 | 5.9 |
| Accommodation and food service activities | 3.8 | 3.6 | 3.4 | 3.4 | 2.2 | 3.1 |
| Information and communication | 2.7 | 5.1 | 5.2 | 5.0 | 5.5 | 5.5 |
| Financial and insurance activities | 9.2 | 10.3 | 12.0 | 13.3 | 16.6 | 16.5 |
| Real estate and ownership of dwellings | 13.2 | 11.7 | 11.1 | 11.6 | 9.7 | 8.8 |
| Professional and business services | 3.9 | 5.6 | 8.2 | 9.9 | 10.0 | 10.1 |
| Public administration and defense; compulsory social activities | 9.0 | 8.1 | 7.5 | 6.4 | 8.6 | 7.8 |
| Education | 9.6 | 8.7 | 8.0 | 6.7 | 6.5 | 6.5 |
| Human health and social work activities | 3.2 | 3.5 | 3.0 | 3.1 | 2.9 | 3.0 |
| Other services | 3.8 | 3.5 | 4.0 | 4.1 | 2.4 | 3.1 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| *Share of the Services Sector in* GDP | 52.8 | 54.4 | 56.6 | 58.8 | 60.7 | 62.3 |

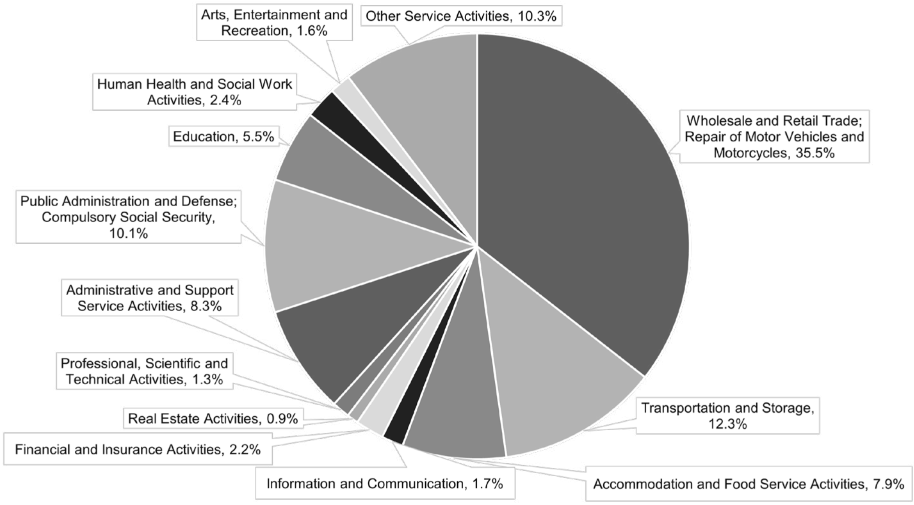
Note: Professional and business services cover professional, scientific and technical activities and administrative and support service activities. Other services cover arts, entertainment, and recreation and other service activities.
Source: PSA [2024a].

In terms of total employment, the share of the services sector was 59.3 percent in 2023. Wholesale and retail trade was the biggest subsector, and together with transportation and storage and other service activities, account for 58.2 percent of employment in the services sector (Figure 1).

Figure 2 reveals the extent to which manufacturing relies on services as intermediate inputs. In 2022, the services value-added content of manufacturing exports was 27.3 percent. The highest shares were in motor vehicles (32.9 percent), followed by fabricated metal products (31.9 percent) and coke and refined petroleum products (31.8 percent).

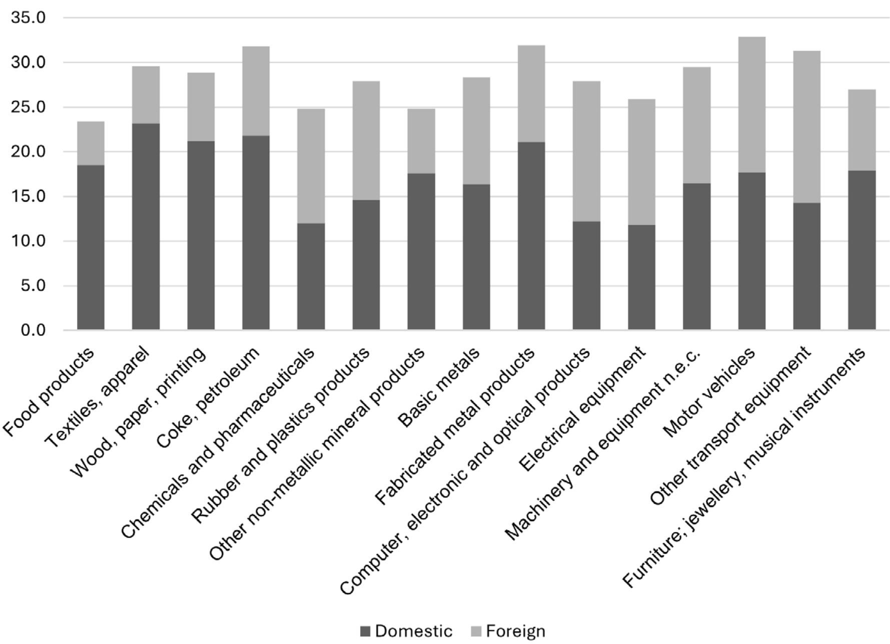
The exports of services generated about 3.7 million domestic employment in 2020. Table 4 provides a breakdown of the domestic employment in gross exports. It includes direct employment from the exporting industry as well as the employment indirectly generated in domestic industries embodied in intermediate inputs [Horvát et al. 2020]. Thus, it shows the backward linkage of services exports to other sectors (which could also involve other services) in terms of employment.

**FIGURE 1. Share of subsectors in total employment of the services sector (2023)**




Note: Final - January to August; Preliminary - September to December.
Source: PSA [2024b].

**FIGURE 2. Services content of manufacturing exports (2020), as a percentage of gross exports**




Source: OECD [2023a].

Almost 64 percent of the employment embodied in services exports are medium-skilled (Table 5). In public administration, defense, education, human health and social work activities, high-skilled occupations account for 46.6 percent, while in arts, entertainment and recreation; other service activities; and activities of households as employers, the occupations are predominantly low-skilled, accounting for 63.2 percent.

**TABLE 4. Domestic employment embodied in gross exports of services (2020), in thousands**

| Activity | Total | Direct | Indirect |
|---|---|---|---|
| Services of the business economy | 3,681 | 2,842 | 839 |
| Wholesale and retail trade; repair of motor vehicles and motorcycles; transportation and storage; accommodation and food service activities | 2,246.2 | 1,828.7 | 417.5 |
| Information and communication | 382.4 | 186.3 | 196.1 |
| Financial and insurance activities | 62.7 | 28.8 | 33.9 |
| Real estate; Professional and business support services | 989.8 | 798.2 | 191.6 |
| Public administration, defense, education, human health and social work activities | 38.6 | 34.6 | 4 |
| Arts, entertainment and recreation; Other service activities; Activities of households as employers | 24.1 | 20.2 | 3.9 |

Source: OECD [2023b].

**TABLE 5. Domestic employment embodied in gross exports by type of occupation (2020), in thousands**

| Activity | High-skilled occupation | Medium-skilled occupation | Low-skilled occupation |
|---|---|---|---|
| Services of the business economy | 870.8 | 2,340.3 | 469.9 |
| Wholesale and retail trade; repair of motor vehicles and motorcycles; transportation and storage; accommodation and food service activities | 483.3 | 1,419.4 | 343.5 |
| Information and communication | 163.9 | 188.4 | 30.1 |
| Financial and insurance activities | 17.6 | 39.6 | 5.5 |
| Real estate; Professional and business support services | 206.1 | 692.9 | 90.8 |
| Public administration, defense, education, human health and social work activities | 18 | 15.0 | 5.6 |
| Arts, entertainment and recreation; Other service activities; Activities of households as employers | 1.7 | 7.2 | 15.3 |

Note: High-skilled occupations (managers, professionals, technicians, and associate professionals); medium-skilled occupations (clerical support workers; service and sales workers; skilled agricultural, forestry and fishery workers; craft related trades workers; and plant and machine operators, and assemblers); and low-skilled occupations (elementary occupations) [Chiapin Pechansky and Lioussis 2024].
Source: OECD [2023b].

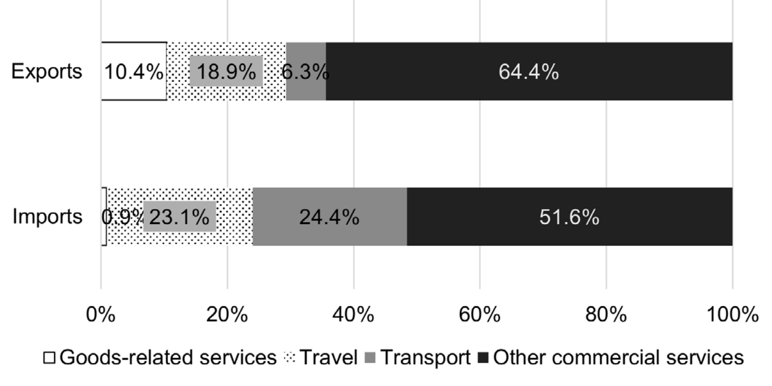
The Philippines is a net exporter of commercial services, which was dominated by 'Other commercial services' in 2023 (Table 6 and Figure 3).

**TABLE 6. Trade in commercial services, Philippines**

| | Value (US$ million) | | Share in world (percent) | | Y-O-Y growth (percent) | |
|---|---|---|---|---|---|---|
| | Exports | Imports | Exports | Imports | Exports | Imports |
| 2014 | 25,483 | 20,607 | 0.49 | 0.41 | 9 | 28 |
| 2015 | 29,047 | 23,355 | 0.58 | 0.48 | 14 | 13 |
| 2016 | 31,186 | 23,804 | 0.62 | 0.49 | 7 | 2 |
| 2017 | 34,813 | 25,845 | 0.63 | 0.49 | 12 | 9 |
| 2018 | 38,378 | 26,271 | 0.63 | 0.46 | 10 | 2 |
| 2019 | 41,245 | 27,686 | 0.66 | 0.46 | 7 | 5 |
| 2020 | 31,800 | 17,553 | 0.61 | 0.36 | -23 | -37 |
| 2021 | 33,548 | 19,124 | 0.54 | 0.33 | 5 | 9 |
| 2022 | 41,101 | 24,855 | 0.57 | 0.38 | 23 | 30 |
| 2023 | 48,259 | 28,806 | 0.62 | 0.40 | 17 | 16 |

Source: WTO and UNCTAD [2024]

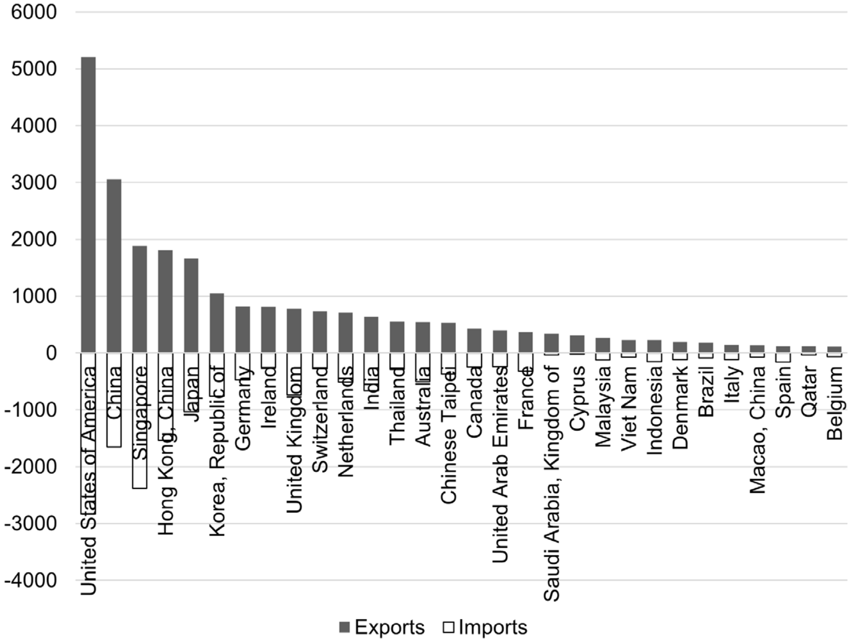
**FIGURE 3. Services trade by main sectors, Philippines (2023)**




Source: WTO and UNCTAD [2024]

In 2021, the country's top trade partner in services was the United States, followed by China and Singapore. The Philippines enjoyed a trade surplus with most countries except with Singapore, India, and Spain (Figure 4).

**FIGURE 4. Commercial services, top 30 trade partners of the Philippines, 2021 (USD million)**

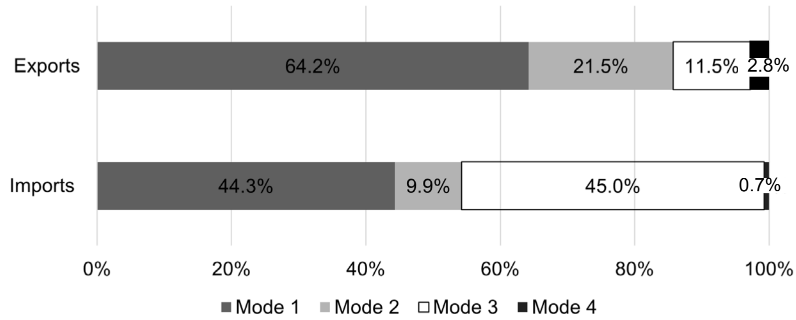



Source: OECD [2023a].

Figure 5 provides a breakdown of the Philippines' trade in services by mode of supply.[1] In 2022, the value of Philippine services exports (for all modes) was estimated at USD 48.6 billion, representing 0.28 percent of the world total. Mode 1 (Cross-border supply) was the dominant mode of supply, accounting for 64.2 percent of the total. Other business services delivered through cross-border supply was the top export of the Philippines. The value of Philippine services imports (for all modes) was estimated at USD 54 billion, representing 0.32 percent of the world total. Both Mode 3 (Commercial presence) and Mode 1 were the dominant modes of supply. Insurance and financial services through commercial presence was the top import.

[1] According to the General Agreement on Trade in Services (GATS) [WTO 1994], trade in services occurs via the following modes of supply: Mode 1 (Cross-border supply) – from the territory of one member into the territory of any other member; Mode 2 (Consumption Abroad) – in the territory of one member to the service consumer of any other member; Mode 3 (Commercial Presence) – by a service supplier of one member, through commercial presence in the territory of any other member; and Mode 4 (Presence of Natural Persons) – by a service supplier of one member, through presence of natural persons of a member in the territory of any other member.

**FIGURE 5. Structure of services trade by mode of supply (2022)**




Source: WTO and UNCTAD [2024]

## 4. Critical issues and priorities for action

### *4.1. Boosting productivity*

The services sector has consistently exhibited a higher labor productivity than the agriculture, forestry, and fishing sector but lower than the industry sector [PSA 2019]. There is significant variation across services, however, with certain subsectors producing higher value of output per worker compared to industry, including manufacturing.

According to Debuque-Gonzales et al. [2021], when the COVID-19 pandemic hit in 2020, the services sector contracted by 9.2 percent. Significantly impacted were service activities that relied on personal contact and mobility such as wholesale and retail trade (-6.0 percent), education(-10.8 percent), transport and storage (-30.9 percent), accommodation and food services (-45.4 percent), and entertainment and recreation (-49.4 percent). In contrast, information and communication grew by five percent and financial and insurance services by 5.5 percent due to the shift to online platforms and expansionary measures adopted by the Bangko Sentral ng Pilipinas (BSP), respectively. As shown in Table 7, these two subsectors continue to thrive, while services that were badly affected have net yet recovered. For other subsectors such as real estate activities, professional and business services, and human health and social work activities, labor productivity was already on the decline even prior to the pandemic.

Considering that information and communication and financial and insurance services account for only 4.3 percent of total employment in the services sector (excluding public administration; see Figure 1), the magnitude of the challenge is quite significant. The broad strategies proposed by Rodrik and Sandhu [2024] could be useful in developing solutions for specific industries. They emphasize the value of enhancing the skills and capacities of both workers and firms, the need for intermediation services to link the demand and supply sides of labor markets, and the importance of understanding the local context. Policy experimentation will help fill the knowledge gaps and design of effective interventions that could be expanded on a national scale.

**TABLE 7. Labor productivity (GVA to employment) (at constant 2018 prices, in thousand pesos)**

| Sector/Subsector | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|
| Services | 451 | 469 | 478 | 475 | 444 | 445 | 459 |
| Wholesale and retail, repair of motor vehicles and motorcycles | 387 | 405 | 417 | 405 | 351 | 357 | 385 |
| Transportation and storage | 207 | 217 | 217 | 176 | 186 | 209 | 219 |
| Accommodation and food service activities | 213 | 233 | 220 | 158 | 175 | 182 | 180 |
| Information and communication | 1,219 | 1,279 | 1,286 | 1,674 | 1,437 | 1,426 | 1,517 |
| Financial and insurance activities | 2,731 | 2,772 | 2,863 | 3,185 | 2,992 | 3,079 | 3,494 |
| Real estate activities | 6,070 | 5,840 | 5,232 | 5,372 | 5,168 | 4,653 | 4,633 |
| Professional and business services | 649 | 624 | 590 | 572 | 534 | 490 | 483 |
| Education | 558 | 611 | 605 | 535 | 522 | 544 | 539 |
| Human health and social work activities | 639 | 596 | 596 | 566 | 534 | 542 | 562 |
| Other service activities | 130 | 133 | 147 | 100 | 89 | 106 | 120 |

Note: Professional and business services cover professional, scientific and technical activities and administrative and support service activities. Other services cover arts, entertainment, and recreation and other service activities
Source: PSA [2022;2023a;2024a]

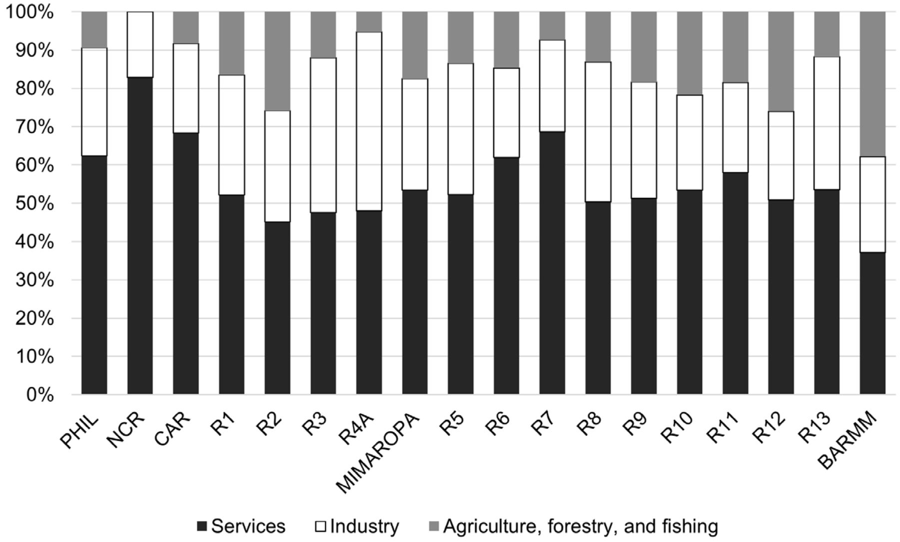
### *4.2. Expanding service industries outside the National Capital Region*

At the regional level, the contribution of services varies. In the National Capital Region (NCR), its share is almost 83 percent, while in the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM), the service sector accounts for 37 percent of gross regional domestic product (GRDP). See Figure 6.

Most of the gross value added in services is produced in NCR (Table 8). Across the different types of services, the share of NCR is highest compared to other regions, especially with respect to producer services. In terms of employment, NCR dominates in producer services as well. In the other clusters, the shares of employment in Regions III and IV-A are also significant [PSA 2024].[2]

[2] The clusters are based on Browning and Singelmann [1975]. See also Serafica et al. [2021].

**FIGURE 6. GDP/GRDP by main sector, percent share at current prices (2023)**




Source: PSA [2024c].

**TABLE 8. GVA in Services, by region (2023)**

| | Total Services | Producer Services | Distributive Services | Personal Services | Social Services |
|---|---|---|---|---|---|
| Philippines (million pesos) | 13991.8 | 5423 | 6155 | 977 | 1437 |
| *Share of region (percent)* | | | | | |
| NCR | 40.19 | 55.00 | 33.68 | 26.74 | 21.30 |
| CAR | 1.90 | 1.84 | 1.65 | 3.25 | 2.33 |
| I | 2.84 | 1.74 | 3.16 | 4.27 | 4.62 |
| II | 1.53 | 0.79 | 1.85 | 1.16 | 3.27 |
| III | 8.64 | 7.09 | 8.84 | 14.78 | 9.44 |
| IVA | 11.19 | 9.26 | 12.06 | 14.68 | 12.41 |
| MIMAROPA | 1.68 | 0.82 | 1.93 | 3.63 | 2.50 |
| V | 2.37 | 1.72 | 2.45 | 2.54 | 4.37 |
| VI | 5.17 | 3.31 | 6.25 | 6.62 | 6.61 |
| VII | 7.45 | 7.25 | 7.54 | 7.66 | 7.66 |
| VIII | 1.91 | 1.41 | 1.96 | 1.35 | 3.93 |
| IX | 1.80 | 0.84 | 2.39 | 1.07 | 3.34 |
| X | 4.21 | 2.25 | 5.96 | 4.00 | 4.31 |
| XI | 4.92 | 3.52 | 6.02 | 4.24 | 5.93 |
| XII | 2.06 | 1.60 | 2.12 | 2.26 | 3.37 |

**TABLE 8. GVA in Services, by region (2023) (continued)**

| | Total Services | Producer Services | Distributive Services | Personal Services | Social Services |
|---|---|---|---|---|---|
| XIII | 1.41 | 1.32 | 1.22 | 1.44 | 2.49 |
| BARMM | 0.74 | 0.24 | 0.92 | 0.31 | 2.14 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Note: Total Services exclude public administration and defense; compulsory social security; Producer Services include financial and insurance activities; real estate; and professional and business services; Distributive Services include wholesale and retail trade, transport and storage, and information and communication; Personal Services include accommodation and food service activities, arts, entertainment, and recreation, and other service activities; and Social Services include education services and human health and social work activities.
Source: PSA [2024d].

Given the differences in economic attributes, demographic profiles, social conditions, and other factors, the size of the service industries will not be the same across the country. The lack of services outside the NCR, however, stifles the development of the regions and thus provides an opportunity to strategically target specific services to promote economic transformation at the sub-national level. Both producer and distributive services are critical intermediate inputs and have significant knock-on productivity effects, as described in Khanna et al. [2016]. Nayyar et al. [2021] suggest taking a value chain approach to target the relevant services that complement specific industries. Such an approach can be applied to various types of value chains, whether in agriculture, mining, manufacturing, or even other service industries (e.g. tourism) that are important to a region and vital for economic diversification and industrial upgrading identified in Balaoing-Pelkmans and Mendoza [in this volume] and Aldaba and Aldaba [in this volume].

### *4.3. Implementing structural reform*

The availability of services may be limited in the short run, but unlike natural resources, services are not finite and can expand with the help of technology (e.g., using mobile services, the internet, cloud computing) and an enabling policy and regulatory environment (e.g., liberalization, competition, and ease of doing business reforms). The right policies not only remove impediments to market entry and growth but can facilitate the introduction and adoption of new technologies as well.

Most service industries are regulated in response to market failures (e.g., asymmetric information, public goods, negative externalities, and monopoly power) or various objectives (e.g. social equity, cultural preservation, and national security). The purpose of structural reform is to enhance the efficiency of markets and reduce barriers to entry and expansion through improvements in institutional frameworks, regulations, and government policies [APEC 2016]. Effective structural reform requires coherence and coordination between services policies and other policy areas, such as trade, investment, competition, industrial policies, and social policies [UNCTAD 2017].

While some regulations are determined by the local government (e.g., business permits and zoning), trade and investment policies are set at the national level. In the Philippines, moreover, trade and investment restrictions in key services industries have been embedded in the fundamental law of the land [Serafica 2024]. Although market access barriers in the services sector exist around the world (See OECD [2024a]), the Philippines is quite unusual in that such limitations are locked in the Constitution. The 1987 Constitution sets foreign ownership restrictions in public utilities (up to 40 percent), educational institutions (up to 40 percent), mass media (zero), and advertising (up to 30 percent). The practice of all professions is also limited to Filipino nationals unless permitted by law.[3]

In 2022, the Public Service Act was amended (RA No. 11659), resulting in the liberalization of services that are not natural monopolies. In the case of mass media, legal opinions of the Securities and Exchange Commission (SEC) effectively extend the restriction to most types of websites and informational online platforms, including those that feature products and services provided by users and third parties (e.g., online marketplaces, learning platforms, and other publishers of third-party content) or publish advertisements [Serzo 2021]. Mass media is part of the digital network service value chain, and it is not uncommon for countries to maintain some foreign equity limits, particularly in legacy media such as terrestrial broadcasting [OECD 2024a;2024b]. Full nationalization of the entire sector constrains the growth potential of the Philippine digital economy. According to Serzo [2021], for example, limiting funding opportunities to domestic sources stifles innovation among local start-ups that require capital funds for product development and scaling up. In addition, foreign companies are discouraged from introducing novel products into the Philippine market. The prohibition leads to cross-border regulatory arbitrage, forcing firms to move their operations in full or in part to jurisdictions with lower risks.

Maximizing the benefits of greater market openness requires a robust competition policy framework to deal with anti-competitive practices and prevent dominant firms from abusing their market power. A supportive regulatory environment in which barriers to entry, exit, and expansion are removed will help eliminate inefficient service suppliers, especially in the non-tradable subsectors that lack exposure to global competition. The quality of regulatory and institutional framework is especially important in the provision of infrastructure services such as telecommunications and ICT services and transport and financial services [UNCTAD 2020]. To promote interport competition and improve the efficiency of key logistics nodes in the supply chain, Tongzon [2018] proposed separating the regulatory and management functions of the Philippine Ports Authority. In financial services, Sandoval and Milo [2018] emphasized the importance of aligning domestic regulations with the objectives of financial liberalization and

[3] The 12th Regular Foreign Investment Negative List (EO No. 175, s. 2022) contains the list of professions where foreigners are not allowed to practice and the list of investment areas that are subject to foreign equity restrictions.

the country's commitments in various regional and trade agreements. The use of the regulatory sandbox approach was also recognized to balance the need for prudential regulation with the promotion of competition and efficiency through innovation. Barcenas [2019] recommended removing unnecessary requirements in the establishment and operation of telecommunications and broadcasting service providers, particularly the need for a franchise from Congress. In addition to reforming the licensing regime to facilitate the development of ICT in the country, Serafica and Oren [2024a] stressed the importance of ensuring the regulatory independence of the National Telecommunications Commission.

### *4.4. Strengthening exports of digital services*

Digitally delivered services accounted for 61 percent of the country's exports of commercial services in 2023.[4] The estimated value of the country's digitally delivered services exports was $29.4 billion, representing 0.69 percent of the world total. The estimated value of the country's digitally delivered services imports was $14.2 billion, representing 0.40 percent of the world total. See Table 9.

**TABLE 9. Digitally delivered services exports by year**

| | Value (US$ million) | | Share in world (percent) | | Y-O-Y growth (percent) | |
|---|---|---|---|---|---|---|
| | Exports | Imports | Exports | Imports | Exports | Imports |
| 2014 | 14,290 | 5,154 | 0.64 | 0.25 | 9 | 32 |
| 2015 | 16,858 | 6,824 | 0.78 | 0.35 | 18 | 32 |
| 2016 | 16,461 | 6,996 | 0.74 | 0.34 | -2 | 3 |
| 2017 | 16,827 | 7,581 | 0.69 | 0.34 | 2 | 8 |
| 2018 | 17,976 | 7,652 | 0.67 | 0.32 | 7 | 1 |
| 2019 | 18,635 | 8,857 | 0.66 | 0.34 | 4 | 16 |
| 2020 | 22,938 | 8,809 | 0.72 | 0.30 | 23 | -1 |
| 2021 | 25,017 | 10,370 | 0.66 | 0.32 | 9 | 18 |
| 2022 | 27,307 | 12,643 | 0.70 | 0.38 | 9 | 22 |
| 2023 | 29,414 | 14,202 | 0.69 | 0.40 | 8 | 12 |

Source: WTO [2023].

Other business services accounted for 75 percent (USD 22.2 billion) of total Philippine exports of digitally delivered services. In terms of imports, 58 percent (USD 8.3 billion) was also due to other business services. See Table 10.

[4] Digitally delivered services refer to services traded through computer networks . Note that "voice networks" are no longer distinct from the "computer networks" [IMF et al. 2023:90].

**TABLE 10. Structure of digitally delivered services 2023**

| Category | Value (USD million) | Share in total digitally delivered services (percent) | Share in world (percent) |
|---|---|---|---|
| **EXPORTS** | | | |
| Other business services | 22,136 | 75.3 | 1.26 |
| Computer services | 6,285 | 21.4 | 0.72 |
| Telecommunications services | 415 | 1.4 | 0.38 |
| Financial services | 304 | 1.0 | 0.04 |
| Personal, cultural, and recreational services | 150 | 0.5 | 0.16 |
| Insurance and pension services | 81 | 0.3 | 0.04 |
| Charges for the use of intellectual property n.i.e. | 38 | 0.1 | 0.01 |
| Information services | 6 | 0.02 | 0.01 |
| **IMPORTS** | | | |
| Category | Value (USD million) | Share in total digitally delivered services (percent) | Share in world (percent) |
| Other business services | 8,271 | 58.2 | 0.49 |
| Insurance and pension services | 1,999 | 14.1 | 0.66 |
| Financial services | 1,464 | 10.3 | 0.41 |
| Computer services | 998 | 7.0 | 0.23 |
| Telecommunications services | 769 | 5.4 | 0.83 |
| Charges for the use of intellectual property n.i.e. | 452 | 3.2 | 0.08 |
| Information services | 138 | 1.0 | 0.35 |
| Personal, cultural, and recreational services | 111 | 0.8 | 0.11 |

Source: WTO [2023].

The strong performance of the Philippine services trade, specifically in digital trade, can be attributed primarily to the information Technology-Business Process Management (IT-BPM) sector. The sector comprises (a) contact center and business process services, (b) information technology services, (c) game development, (d) animation, (e) healthcare or health information management, and (f) global in-house centers. In 2022, around 12 percent of the total global revenues were generated from the Philippines, and the country accounted for about 16 percent of the global full-time employees [IBPAP and Everest Group 2022]. Based on the annual IT-BPM report released by the PSA [2023e], which covers selected industries in the information and communication (Sector J) and administrative and support service activities (Sector N) sectors, customer relationship management activities (N82211) was the biggest industry, followed by sales and marketing (including telemarketing) activities (N82212) and other computer programming activities (J62019). In 2021, these three activities accounted for 76.58 percent of employment and 77.44 percent of the revenues generated from outside the country.

The Philippine IT-BPM sector not only aims to sustain its market position but also aspires to move up the global value chain by shifting to high-value services. A key strategy is to leverage talent and technology to achieve its vision as "the world's number one experience hub for digitally-enabled and customer-centric services" [IBPAP and Everest Group 2022]. On the external front, an emerging issue in digital trade is the rise in the number of restrictions on cross-border data flows as more countries are introducing data localization measures that are becoming more restrictive. To stem the tide of rising trade barriers and fragmentation, increased collaboration on improving international rules on digital trade is needed [OECD 2024a]. The Philippines must take an active role in shaping such rules.

### *4.5. Accelerating digitalization throughout the country*

According to the ITU [2024a], in 2022, 75.2 percent of individuals were using the internet. In 2023, while 73.7 out of 100 people had active mobile broadband subscriptions, for fixed broadband, the subscription rate was much lower at only 6.54 per 100 people. In terms of prices, mobile broadband achieved the affordability target in 2023 with a 1.78 percent share of the country's monthly GNI per capita, but fixed broadband is still expensive at 10.1 percent, far exceeding the international target of a two percent share of the monthly Gross National Income per capita [ITU 2024b]. Furthermore, uneven internet access persists across the country. Whereas over 30 percent of households in NCR have access to fixed wired broadband, in the other provinces, less than ten percent are connected. The disparity is widespread both between and within provinces [Kanehira et al. 2024]. At the firm level, digital intensity was found to be higher in services than in manufacturing, although there was significant variation in digitalization across the services subsectors. Moreover, firms that were connected using fiber broadband were more data-intensive [WB 2024a].

The lack of digital connectivity hinders productive participation in the digital economy. Prospects for online jobs and digital trade are constrained, especially for those in the countryside, and the impacts of digital services such as e-commerce, fintech, and smart city initiatives are limited. In addition to inadequate internet access, the disparity in skills, capabilities, and resources in households and firms exacerbates the digital-spatial divides, contributing further to socioeconomic divides [Bayudan-Dacuycuy and Serafica 2023]. The diffusion of digital technologies together with services policy reforms creates a virtuous cycle of enhanced opportunities and capacities, which not only increase productivity in services and downstream sectors but also strengthen human capital through improvements in education and health [WB 2024a].

Of the various digital technologies, artificial intelligence (AI) is the most transformative for the service sector which can have wide ranging effects on industries, firms, and workers. The spectrum of AI capabilities is expanding and includes (i) **automated intelligence systems** that automate repetitive and labor-intensive tasks; (ii) **assisted intelligence systems** that examine and identify trends in data to gain insights making it easier and faster for users to complete tasks; (iii) **augmented intelligence systems** that help better understand and predict future scenarios; and (iv) **autonomous intelligence systems** that eliminate the need for human intervention in making decisions. The holy grail of AI is **artificial general intelligence (AGI)**, when AI attains proficiency in knowledge formation, comprehension, reasoning, abstraction, and communication [PWC 2018]. OpenAI's ChatGPT, which attracted global attention last year, is an example of **generative AI**, which can create content such as text and images based on the data on which it was trained [Martineau 2023]. Compared to other countries in the region, the Philippines is relatively more exposed to the displacement effect of AI because of its higher engagement in cognitive tasks in services. The emergence of new tasks and the increase in labor demand from the positive productivity effect can help offset the negative effects [WB 2024b].

### *4.6. Increasing innovation*

The 2021 Survey of Innovation Activities of Establishments provided the first comprehensive picture of the innovation behavior of the services sector [Serafica and Oren 2024b]. It revealed that information and communication and financial and insurance activities had the highest proportion of innovation-active and innovative establishments.[5] Real estate activities and arts, entertainment, and recreation were consistently in the bottom two. A subsector that provides IT-BPM services, administrative and support services, also performed poorly, ranking third to last in terms of being innovation-active and process innovation. Moreover, it was second to last with respect to product innovation. In general, the most common type of innovation was organizational innovation, followed by marketing, process, and product innovation the least. Training was the most employed innovation activity, and there was greater reliance on internal and market sources of information rather than technical publications or regulatory bodies. Higher education institutions were not popular cooperation partners, and engaging external experts was the least common knowledge management practice.

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[5] An establishment is considered **innovation-active** if it is: (a) a product innovator (b) a process innovator (c) engaged in innovation projects either not yet complete or abandoned; and/or (d) engaged in expenditure of innovation activities. It is considered **innovative** if it has implemented a product, process, organizational, or marketing innovation.

The Philippine Innovation Act [RA No. 11293] identifies numerous actions to address cost, knowledge, market, and legal or regulatory barriers to innovation. Because the services sector includes a wide range of activities, even within a subsector, strategies to increase innovation must be tailored to the specific needs of the industry and firms.

## 5. Conclusion

It helps to be reminded of services' basic nature. Services are "the result of a production activity that changes the conditions of the consuming units or facilitates the exchange of products or financial assets" [UN 2008:96]. Thus, there can be no agricultural modernization, industrial upgrading, or human capital development without services. Even though there is a natural tendency for the sector to grow over time, deliberate actions are needed to ensure that services contribute positively to the quality of economic transformation.

Experts have emphasized the importance of promoting exports and job creation in the sector while also recognizing the critical role of services in supporting the rest of the economy. There has also been a focus on leveraging trade, technology, training, and targeting, along with initiatives aimed at directly increasing productive employment. A variety of approaches should be pursued given the size and diversity of service industries.

In the case of the Philippines, six issues and priorities for action were identified, namely: boosting productivity, expanding services outside NCR, implementing structural reform, strengthening exports of digital services, accelerating digitalization, and increasing innovation. These recommendations are interrelated. Structural reform in the ICT sector will not only address the lack of internet connectivity but also strengthen the innovation ecosystem and improve the productivity of firms and downstream users. Accelerating digitalization will also raise the productivity of organizations and enable more Filipinos to participate in digital trade, not just as consumers but as service exporters themselves. Innovative products and business models help increase access to finance, healthcare, and education in areas that are underserved or unserved.

We are fortunate to live in a time when various digital technologies have allowed us to transcend barriers to delivering services within and across borders. Although there are still physical constraints, the lack of services, particularly outside the main urban centers, is made worse by policy and regulatory impediments. These artificially limit the availability and quality of specific services that are essential to various industries, communities, and households.

Some key reforms are straightforward but may be politically infeasible in the near term. Other proposed actions are quite general and only provide overall directions. Specific interventions to boost productivity or innovation at the firm- or household-level, for example, will benefit from experimentation to inform the design of initiatives before these are implemented on a large scale. Regulatory sandboxes are also useful, especially in testing the impacts of new technologies, products, or business models.

For the Philippines, harnessing services to achieve broad-based and inclusive growth should be the essence of services-led development. Given the range of services and unique local requirements, various strategies are needed in addition to fixing long-standing structural issues. The pace and depth of the actions taken will depend on our level of ambition as a nation, articulated in the AmBisyon Natin 2040 vision of a "prosperous, predominantly middle-class society where no one is poor" [NEDA 2017:50].

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# Comment on "Exploring the prospects of services-led development in the Philippines"

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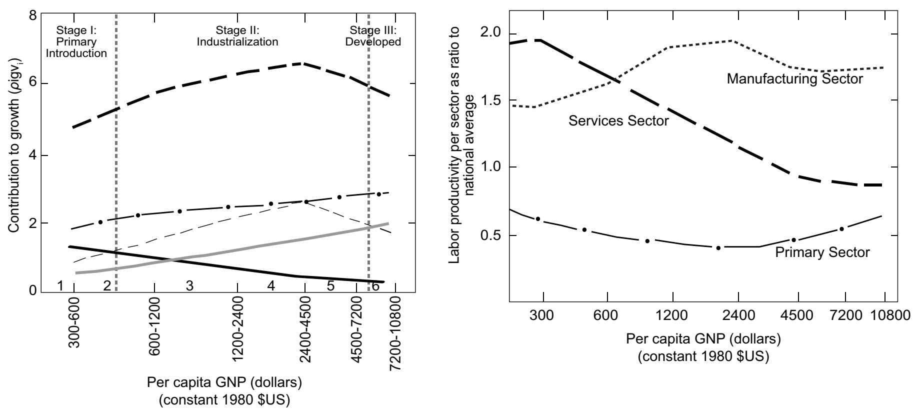
Dr. Serafica's comprehensive and insightful paper offers hope that, by designing and implementing policies that raise not only employment, but also productivity and wages in the service sector, the Philippines government can increase average per capita income even in the absence of consumer-punishing, rent enabling, import substitution. Such policies, if they are effective, would generate "services-led development."

The idea that services could lead development is rather new. The received wisdom from the earliest students of economics was that only growth of the manufacturing sector would generate the "externalities" that could jump-start economic growth. Perhaps it is useful to review the reasoning that led early students of growth to that conclusion.

Among the classic growth models developed a decade after the second world war, the stages of growth theory advanced by Chenery [1960] stands out for its relative success at predicting patterns of economic development over the subsequent 60 years. Chenery's model posits three successive "stages" of economic growth: (1) primary production, (2) industrialization, and (3) developed (see Figure 1, Panel a).

**FIGURE 1. Syrquin's model of service sector growth contribution and value-added per worker in a country's income evolution**




Source: Syrquin [1988].
Note: Multiplying the per capita GNP labels on the horizontal axes by 2.88 converts from 1980 USD to 2015 USD used in the rest of these comments.

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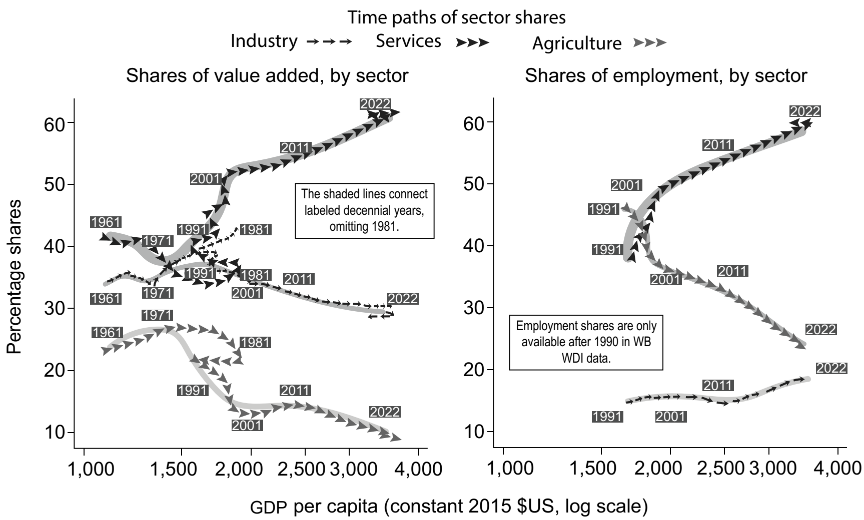
According to this theory, a precondition for an economy to transition from dependency on primary production to development, is for its manufacturing sector to serve as the engine of growth throughout the intermediate “industrialization” stage.[1] After growing to dominate the other two sectors in both value added and employment, the manufacturing sector, according to the theory, generates both intermediate and final demand for services. Transition to the “developed” third stage occurs after the service sector’s contributions to GDP growth exceeds those of the other two sectors. This dynamic causes the service sector to expand until it contributes more to growth and employs more workers than either of the other sectors. This pattern has been evident in the Philippines since 1991, as seen in Figure 2.

**FIGURE 2. Sector shares vs. GDP per capita over time**



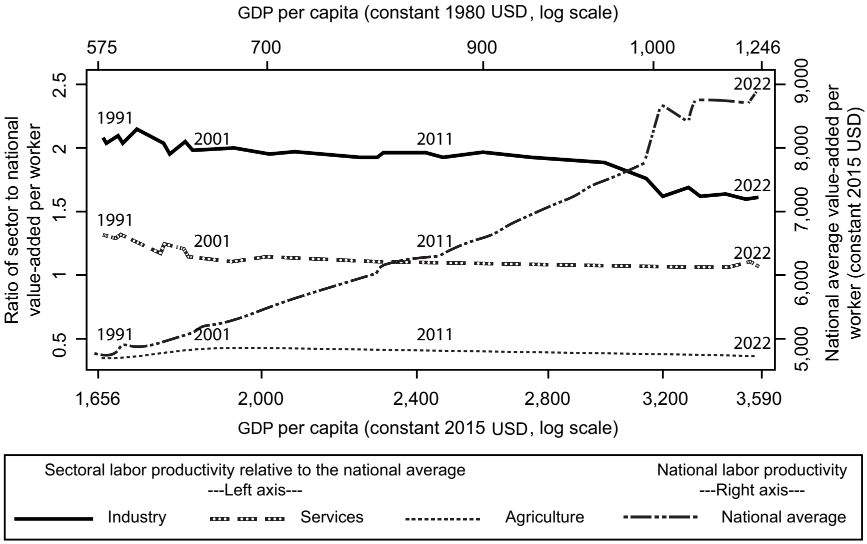

Source: World Bank’s WDI databank, accessed November 5, 2024; Years 1960 to 2022.
Note: The service sector shares of value-added and employment have grown remarkably in the Philippines since 1991, both now exceeding 60 percent, without an intermediate industrialization stage as postulated by Chenery/Syrquin models.

However, despite the service sector’s growing dominance as a contributor to growth and as a source of employment, Chenery [1960] saw the value-added per service sector worker declining, falling farther and farther behind the manufacturing sector (Figure 1, Panel b). Notwithstanding Baumol’s subsequent

[1] Manufacturing has been the engine of growth” largely because manufactured goods are tradeable, providing domestic manufacturing firms with unlimited markets and thus enabling economies to scale. By contrast, traditional services were predominantly limited to domestic markets, creating less opportunity for expansive growth. Manufacturing sector workers have also benefited from standardized technology, allowing less-skilled labor to work with capital equipment which increases their productivity and wages. In addition to these beneficial externalities from sales to foreign customers, manufacturing firms can create local demand for intermediate goods and local supply to domestic firms, stimulating growth through these “forward linkages.”

comment that the lower bound on service sector productivity would be determined by the wages service sector workers might earn if they switched to the higher paid manufacturing sector, World Bank data on value added per worker in the Philippines displays a pattern like that predicted by Chenery and Syrquin. As shown in Figure 3, while Filipino GDP per capita has increased from USD 1,600 to USD 3,600 in 2015 USD (equivalent to an increase from USD 575 to USD 1,246 in 1980 USD) and national labor productivity has increased from USD 4,770 to USD 8,730 in 2015 USD, labor productivity in the Philippines service sector has continued to decline relative to nationwide labor productivity.

**FIGURE 3. Labor productivity of Filipino workers, 1991 to 2020**




Note: For compatibility with Figure 1, the top axis converts the 2015 USD to 1980 USD at a ratio of 2.88:1.

As Serafica [2024] notes, the Filipino service sector is absorbing an increasing share of the nation's labor force, but service worker productivity remains well below the similarly declining productivity of workers in the manufacturing sector. If this pattern persists, the Filipino service sector may continue to grow without enriching the economy.

In almost all countries over the last 50 or more years, agriculture's shares of GDP and employment have steadily declined, manufacturing's share has peaked at mid-income levels and then given way to service. Yet, as Serafica's [2024] paper highlights, the Philippines deviates from this path, passing directly from dominance of the primary sectors to dominance of the service sector, without the benefit of the manufacturing sector's impact on growth and the consequent increase in per capita incomes it has typically entailed.

Dani Rodrik, writing with Rohan Sandhu [2024] and Joseph Stiglitz [2024], argues that the global economy has outgrown the manufacturing-led development model. According to these and other authors cited by Serafica, the "window" for manufacturing-led growth may have closed. This conjecture might be tested using aggregate data or, instead, by applying quasi-experimental impact evaluation methods to purposefully collected experimental evidence.

With aggregate data one could attempt to apply vector auto-regression methods to separately identify the causal impacts of the service sector and the manufacturing sector on national growth. A brief review of any existing literature on this topic could support Serafica's recommendations for future research. Furthermore, Yap and Turla's [2024] paper exploring the application of complexity methods to the analysis of industrial policy, which uses VAR methods to estimate the impact of lagged sectoral performance on subsequent growth, could include the service as well as the manufacturing sectors among the determinants of growth. Since the critical issue for services-led development is whether the growth of particular components of the service sector could generate high paying jobs, with high value added, the research could use indices of these service jobs as dependent variables. Furthermore, in her paper, Serafica presents data on several different decompositions of the Filipino service sector which could be used to find the sector jobs with the highest value added. By constructing a table with entries defined as the quotient of Table 9 (gross value added) and Table 10 (number of employees), one could also learn the parts of the service sector where workers are the most productive.[2]

Acknowledging that the mechanisms for achieving sector-led growth are not fully understood, Rodrik and Sandhu [2024] suggest a second more granular empirical approach. The Philippine government, perhaps with assistance from a partner institution[3] could conduct policy research, using either experimental or quasi-experimental methods, on a sample of service sector firms and test whether or under what conditions specific interventions generate high productivity jobs. This kind of study could apply the same intervention to small service sector firms in different sub-sectors in order to distinguish the impact on key outcome variables, by sub-sector. Or, the study could apply the same intervention to a sample of small manufacturing sector firms as well as to service sector firms, to test whether the intervention elicits high value job creation in one sector more than the other. Among the impacts hopefully caused by the experimental policy could be: (a) the increase in labor productivity and value-added per worker, (b) the increase in exports of tradeable services; and (c) an increase in forward linkages in either sector.

[2] Also see Autor and Price [2013] which breaks down service sector jobs into those with more or less potential for automation. Workers who can partner with AI systems may be more productive and, therefore, more highly paid.

[3] Candidate partners include, for example, the Philippines Institute for Development Studies (PIDS), a multilateral development bank, the International Initiative for Impact Evaluation or the Abdul Latif Jameel Poverty Action Lab (J-PAL).

The experimental approach to policy design has its supporters and detractors. Rodrik and Sandu [2024] support policy experiments and provides a useful list of 20 published experiments, which, they suggest, might improve firm performance in the service as well as the manufacturing sectors. However, a paper dated a few months earlier by Rodrik and Stiglitz [2024] cautions that policies should not be guided solely by experiments. "China explicitly experimented by trying new policy arrangements in some provinces before launching them elsewhere. As these experiences show, learning from policy successes and failures is possible even when policy makers' causal inference standards fall short of RCTs or other econometric techniques of "evidence-based policy making" [Rodrik and Stiglitz 2004]. As an archipelagic nation, the Philippines could leverage its diverse regions to conduct localized policy trials, which could yield valuable insights without requiring the constitutional changes highlighted by Serafica as impediments to some otherwise promising policy reforms or the monetary budget and political capital often required to conduct a well-powered randomized controlled trial.

While both the aggregate statistical analysis and the granular impact evaluation method are beyond the scope of Serafica's paper, she could include comments on these and other relevant empirical approaches which Filipino policy makers could use to guide their choice of policies to implement on a larger scale. The challenge to industrial policy in the Philippines is to continue increasing the size of the service sector while exploring policies which offer higher value-added and thus higher wages to service sector employees. Policy experiments like those proposed by Rodrik and Sandhu (op. cit.) could generate excitement and political momentum for services-led growth and inform strategies that address low-productivity domestic services, which is essential to maintaining social cohesion. While experiments may be micro in scale, they offer an invaluable foundation for data-driven development, particularly in navigating the unique constraints of the Philippine economy.

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# Natural gas and transitioning to renewable fuels: considerations from industrial policy

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The Philippines is committed under the Paris Agreement to reduce greenhouse gas emission (GHG). In formulating its intended national contribution program, the government is starting with the energy sector by reducing reliance on coal as the primary fuel in electricity production as it transitions to the use of renewable fuels, such as wind and solar. Given the relatively high cost of renewables at this point, the Philippines is envisioning natural gas (NG), whether imported or indigenous, as a substitute fuel for coal in the interim. Some aspects of recent industrial-policy approaches are considered to make this fuel substitution feasible.

**JEL classification**: Q4, O25
**Keywords**: natural gas, optimal investments, industrial policy, carbon tax

## 1. Introduction

What does a country like the Philippines need to do to transform its economy into a newly industrializing economy (NIE) like Taiwan and South Korea, which both started as largely agricultural? In the 1970s, both Taiwan and South Korea emerged as exporters of manufactured products on a global scale, and today are considered models of successful industrialization. The Philippines, like many developing economies, faces the development problem of transforming its economy into one whose GDP emanates largely from industry and services, while further reducing the share of agriculture therein. What does the Philippines need to do to achieve the status of Taiwan and South Korea? Is there any government intervention that can accelerate the country's transformation into an industrializing economy? In this context, we look at the applicability of some industrial-policy approaches that have been proposed by a long line of economic thinkers.

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In this paper, these issues are examined in the context of the country's decision to accede to the Paris Agreement (PA).[1] As a starting point to reduce greenhouse gas (GHG) emission in the energy sector, the Philippine Development Plan (PDP), seeks to reduce reliance on coal as the main fuel source in electricity power generation and to shift to renewable fuels, including wind and solar. Given the relatively high cost of renewables at this juncture, the PDP envisions substituting natural gas (NG) for coal as an interim measure. Although NG is also a fossil fuel, it has a lower GHG index than coal.

Moreover, NG is a sufficiently large sector wherein one or a few firms can meet total demand. Rules of competition do not apply. And so, the NG industry is viewed from the lens of imperfect competition that is subject to government regulation. The regulatory framework must be carefully designed to raise the likelihood of realizing non-trivial economies, such as, realization of scale economies in the NG industry and in other sectors that have strong complementarities with it.

In the transition to renewables and in line with the long-run targets of the PA, the Philippines and other developing countries that are currently heavily reliant on coal and imported oil for generating electricity are looking at NG as a substitute energy source in the interim period. NG is also a nonrenewable fossil fuel, but it is less polluting than coal and oil. A large number of existing power plants at this point are coal-fired. The fuel mix can change if NG can be made cost-competitive against coal with appropriate fiscal policies, such as, relying on a carbon tax or a cap-and-trade regulation. In addition, investment incentives typically extended under an industrial-policy program of the government may also help. The use of NG as a substitute over a reasonably long period of time opens a window of opportunity for renewables to achieve technological innovations that result in competitive prices.

We support the smooth transition to renewables using NG as a substitute fossil fuel for electricity in the interim for several reasons. First, it is in the service of promoting an international public good, being climate-change mitigating in generating electricity. Second, it is an opportunity to put in place an industrial policy that promotes broad-based economic growth in the long run, namely, the development of a Philippine Upstream Indigenous Natural Gas Industry (PUINGI). Third, the development of PUINGI will enhance energy security in the face of volatile international markets.

The study is organized as follows. Section 2 revisits aspects of industrial policy that justify possible government interventions geared to accelerating the desired growth and industrial transformation. Selected formal models of growth and industrialization are presented. Section 3 presents a screening curve-load duration curve analysis and presents some scenarios that render NG power plants cost competitive relative to coal-fired plants. It looks at the experience of the

[1] The PA is a binding international treaty on climate-change mitigation. It was signed by 196 countries (COP 21) in 2015 and entered into force in 2016. The Philippines acceded to the agreement in 2017.

Philippines with the Malampaya gas-to-power project (MGPP) and uses it as an industrial-policy platform for an indigenous NG industry as the energy sector transitions to renewable fuels in an emission-constrained environment. Section 4 elaborates on an industrial policy for developing an indigenous natural gas. Section 5 summarizes and concludes.

## 2. Considerations from industrial policy

Pathways to industrialization have been proposed by a long line of economic thinkers using tractable models of growth. One prominent model is that of a dual economy wherein a modern sector, manufacturing, coexists with a traditional sector, agriculture. The development task is to reduce reliance on agriculture for output and employment, and increase, instead, the GDP shares of manufacturing, accompanied by rising productivity and improvements in living standards of households.

### *2.1. Development of a dual economy*

The development problem that many countries in East and Southeast Asia faced after World War II was to transform their economies from one largely agricultural into one that could be considered industrializing. The task has been referred to as developing a dual economy (see, e.g., Jorgenson [1961]). The task entails raising agricultural productivity and ensuring that the non-agricultural sector, namely industry and services, grows at a sufficiently rapid pace to be able to absorb labor rendered in excess in agriculture. The most dynamic subsector in industry is manufacturing but labor absorption therein of surplus agricultural labor is not automatic. It calls for skill acquisition suitable for manufacturing and job creation in manufacturing. The government has a role in both the labor supply and demand sides, generally regarded as part of industrial policy. Neoclassical models of the labor market identify limitations of the labor market that call for collective actions that the government is in a better position to deliver. If, for instance, information is asymmetric, that is, both limited and unequally distributed, rendering job search and job matching lengthy and costly, the government may intervene by improving information dissemination conducive to expediting job mobility and matching. In this regard, we often see the public sector, whether at the national or local level, intervening by setting up a labor-market information system, Moreover, in most monsoon economies like the Philippines, the skills used in agriculture are rarely usable in manufacturing without some retraining (see, e.g., Oshima [1987]). Such retraining may be sponsored by the government.

### *2.2. Big-push industrialization*

To speed up growth of the non-agricultural sector and to accelerate labor absorption, the government is often called upon to identify and promote sectors with production technologies that feature learning-by-doing and increasing returns. The latter occurs when investment by one firm creates knowledge that other firms then imbibe. As other firms invest, they create output at no extra cost in knowledge acquisition, resulting in increasing returns. Promotion of sectors may be limited to one sector but known to have strong complementarities with other sectors. We use this approach in this paper in focusing on the development of the NG industry. The latter is a vital part of the country's infrastructure system and can be counted on to affect the growth of complementary sectors.

Big-push industrialization is closely related to endogenous-growth theory.[2] The latter set of formal models advance the neoclassical Solow-Swan growth model by focusing on the role of increasing returns, human capital investments, and technological progress that overcome diminishing marginal productivity of capital per labor. All this can be integrated into a comprehensive set of industrial policies that are geared to achieving restructuring, coordination, innovation, and a diverse product space.[3]

## 3. Indigenous NG in the fuel mix

In terms of carbon dioxide ($CO_2$) emission, NG is lower compared to other fossil fuels. And yet, many countries are still wedded to the latter, particularly in electricity generation. The main reason is that coal-fired power plants, for instance, are said to be least cost if run as a baseload. In reaching this conclusion, the cost of GHG emission is not taken into consideration.

Employing a down-to-earth cost-benefit analysis on NG power plants, whereby we net away from the direct cost of climate-change mitigation the benefits in the form of avoided-cost damages of climate-change policies, we find that NG power plants are cost competitive versus coal-fired power plants.

Recent estimates show that power plants using sub-bituminous coal emit 0.98 metric tons (MT) of $CO_2$ per Megawatt-hour (MWH) while combined-cycle NG power plants emit only 0.44 metric tons of $CO_2$ per MWH (MTCO2/MWH) (see, e.g., EIA [2017a]; Cushman-Roisin and Cremonini [2018]). Moreover, coal-fired power plants emit more than 500 times more sulfur dioxide ($SO_2$) and more than ten times of nitrogen oxide (NOx) than combined-cycle NG power plants (see, e.g., De Gouw [2014]). These pollutants not only harm the environment, but also cause serious respiratory health problems. Table 1 presents the estimated monetary cost of all damages emanating from local pollutants emitted by different types of power plants. The $SO_2$ damage from coal-fired power plants is the highest, insofar as this induces respiratory problems, including, coughing, wheezing, shortness of breath, or a tightness around the chest. Damages from Combined Cycle Gas Turbine (CCGT) NG plant emissions are lower than either coal or diesel plants in order of magnitude.

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[2] See, for example, Murphy et al. [1989]; Romer [1986]; Lucas [1988].

[3] For an expository approach, see, for example, Rodrik [2004] and Juhász et al. [2023].

**TABLE 1. Marginal damage costs of local pollutants per generation technology (in USD per MWH)**

| Generation technology | $SO_2$ | NOx | PM2.5 |
|---|---|---|---|
| Coal | 14.76 | 1.05 | 1.79 |
| CCGT | 0.02 | 0.082 | 0.008 |
| Diesel | 1.16 | 4.06 | 0.12 |

Source: Jandoc et al. [2018].

Moreover, compared to coal-fired power plants, NG power plants are more flexible. Depending on the technology used, gas turbine plants can reach full load from 30 minutes to four hours after start-up, whereas coal-fired power plants take days to reach full load after a cold start (Table 2). In the current Philippine setting, NG power plants are suitable for baseload as well as mid-merit and peaking operations.

**TABLE 2. Time it takes for a power plant by type to reach full load**

| Type | Start- up time | Start-up cost (USD/MW) | Efficiency (at 100 percent load) | Minimum uptime | Minimum downtime |
|---|---|---|---|---|---|
| Open Gas Cycle Turbine (OCGT) | 5-11 hours | <1-70 | 35-39 percent | 10-30 min | 30-60 mins |
| Combined Cycle Gas Turbine (CCGT) | 1-4 hours | 55 | 52-57 percent | 4 hours | 2 hours |
| Coal | 2-10 hours | >100 | 43 percent | 48 hours | 48 hours |

Source: IRENA [2019]

In this section, we outline various scenarios to determine the level of new investment needed in natural gas (NG) power plants to reach an optimal energy mix by 2040. This assessment considers existing capacities and includes committed projects scheduled for completion. To establish the ideal generation mix for 2040, we apply the model by Jandoc et al. [2018], analyzing "screening curves" along with a linear "load duration curve." This example focuses on the Luzon grid.

The "load duration curve" offers a simplified representation of electricity demand over a specific year. For this analysis, we used hourly load data from the National Grid Corporation of the Philippines (NGCP) for Luzon, spanning October 1, 2016 to September 30, 2017. Peak demand occurred on May 19, 2017 at 2:00 PM, reaching 10,033 megawatts (MW), while the lowest demand was recorded on January 2, 2017 at 4:00 AM with 4,077 MW. Using these hourly patterns, we then projected demand to meet the Department of Energy's (DOE) forecast for Luzon in 2040.

Luzon's projected electricity demand in 2040 amounts to 30,000 MW. We then net out the projected generation from renewable sources (geothermal, hydro, biomass, wind, and solar).[4] To account for total supply needed in 2040, we assumed a 15 percent adjustment for reserves,[5] and nine percent adjustment for line losses.[6] The total amount that needs to be supplied in 2040 after making these adjustments is 34,617.41 MW. To take account of current infrastructure in place, we further net out the dependable and committed capacities of existing power plants. According to the DOE, dependable (including committed) capacity of diesel is 608.6 MW; CCGT power plants can satisfy 3,914.64 MW; and coal-fired power plants can satisfy 8,342.47 MW.[7] Since existing capacity coming from these three plant-types can only satisfy 12,865.71 MW, the remaining 21,751.7 MW need to be satisfied by dependable capacities coming from new power plants.[8]

The "screening curves", on the other hand, are simplified representations of the cost to generate electricity from the different sources; in our case, coal-fired power plants and CCGT power plants. The screening curves have a fixed-cost component and a variable-cost component. The fixed-cost component consists of the annualized overnight construction cost plus the annual fixed operating and maintenance (O&M) costs. The overnight construction cost refers to the cost of all material, labor, and fuel, among other inputs, needed to construct the facility if that cost were incurred at a single point in time; it ignores financing costs (i.e., interest rates) as though the generating facility is built overnight. The levelized costs include the capital costs, O&M costs (including replacement of capital items as a result of wear and tear), and fuel costs. While capital and fixed O&M costs are proportional to the installed capacity, variable O&M and fuel costs are functions of electricity output. Table 3 presents the different fixed-cost and variable-cost components of the screening curve.[9] Table 3 shows the tradeoff inherent in the different technologies. For instance, the fixed-cost component in the second column shows that it would be more expensive to build new coal-fired power plants compared to CCGT or diesel power plants. However, the variable cost in the third column indicates that although it is more expensive to build coal-fired power plants, the cost per unit of producing electricity is lowest for them once the plant has been constructed.

[4] Although the recent Philippine Energy Plan 2023-2025 projects 1,200 MW of new nuclear capacity for 2032, we ignore this generation source for several reasons. First, there are still political economy considerations that work against nuclear generation. Second, Van Kooten et al. [2013] find that in the absence of a sufficiently high carbon tax (around USD 150/MT$CO_2$), fossil fuels dominate nuclear generation.

[5] A reserve margin of 15 percent implies that the system has 15 percent excess capacity over expected peak demand.

[6] Electric power transmission and distribution losses (percent output) for the Philippines is nine percent as of 2014 [World Bank 2014].

[7] We assume that diesel plants have a comparative advantage to satisfy peak loads over CCGT fired power plants. (see, e.g., Papaefthymiou et al. [2014]).

[8] Further details regarding the construction of the load duration curve can be found in Jandoc et al. [2018].

[9] For more information on the assumptions on the screening curve, refer to Jandoc et al. [2018].

**TABLE 3. Fixed-cost and variable-cost of the screening curve equations**

| Generation technology | $SO_2$ | Fixed Costs (USD/MW per year) Variable Unit Cost (USD/MWH) |
|---|---|---|
| Coal | 185,000 | 34.86 |
| CCGT | 5,900 | 84.42 |
| Diesel | 1,028 | 96.17 |

Note: Fixed cost for new investments includes both fixed O&M and overnight construction costs. Variable unit cost is fuel cost plus variable O&M costs.
Source: Jandoc et al. [2018].

In this section, we compare three scenarios: First, we look at a business-as-usual scenario where a PUINGI is not developed but the Philippines invests in Liquified Natural Gas (LNG) import hubs and regasification facilities aimed at avoiding the NG power plants from becoming stranded assets. Second, we present a scenario where the NG plant operators enjoy a price discount from the operation of a newly operational PUINGI source, to reflect a scenario similar to the operation of Malampaya. The difference in Malampaya price and the world price for NG is substantial; for instance, the estimated Ilijan gas price is USD 6.616 per gigajoule, compared to the prevailing LNG price of USD 9.47 per gigajoule in the Asian market.[10] The final scenario examines the effect of complementary policies, such as a carbon tax, that will make energy obtained from a less polluting source like NG more attractive.

### *3.1. Scenario 1: NG with no price advantage*

In this scenario we examine the case wherein there are no further developments in PUINGI. However, we consider the more likely alternative of investing in LNG terminals with regasification facilities that will allow imports of LNG. This is to avoid the NG assets from being stranded. However, relying on imports precludes the price advantage offered by using indigenous NG. This will serve as the base scenario against those in the next subsection where PUINGI is developed and where complementary policies are enacted.

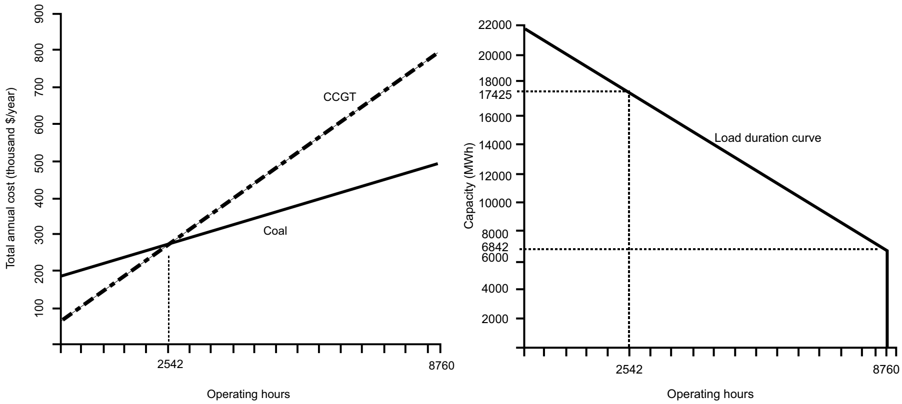
Panel (b) in Figure 1 shows the duration curve for the excess load that cannot be satisfied by existing generation capacities of coal, CCGT, and diesel power plants.[11] The load duration curve starts from the hour of the highest demand, with load at 21,751 MW, and slopes downward to the hour of the lowest demand, with load at 6,842 MW.[12] The issue on optimal investment in new power plants is basically what type of plants will satisfy these loads at least cost. The answer may be seen in Panel (a) of Figure 1, which presents the screening curves of the

[10] If we factor in the cost of regasification, the Malampaya gas price becomes even more cost competitive.
[11] According to DOE, there is currently no open-cycle gas turbine (OCGT) dependable capacity, even though OCGT plants exist in the country.
[12] Note that there are 8,760 hours in a non-leap year.

different power plant technologies. The line for coal is flatter than the line for CCGT power plants because the fixed cost is higher (as given by the y-intercept) but the variable cost or cost per unit of electricity produced is lower (as given by the flatter slope). The intersection between these two curves determines where the technologies "switch." In the figure, the first 2,542 hours with the highest demand will be supplied by CCGT power plants. In this segment, the line for CCGT power plants in the screening curve is below coal-fired power plants, which indicates that new CCGT power plants have a comparative advantage in satisfying the higher load hours. The rest of the hours are supplied by electricity generated new coal-fired power plants.

**FIGURE 1. Least cost generating mix for residual capacity of Luzon grid for Scenario 1**

(a) Screening curves (b) Load duration curve

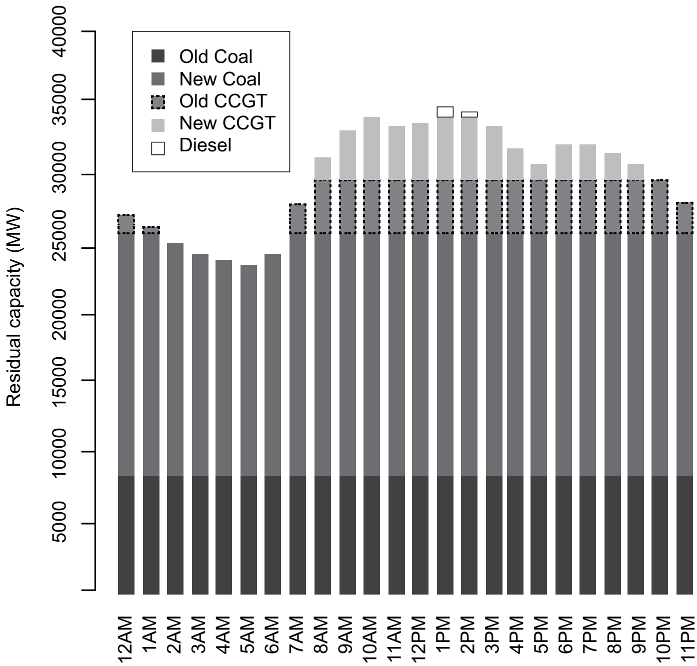



Note: Left panel shows the screening curves while the right panel the load duration curve net of current capacities.
Source: Authors' calculation based on DOE data.

Figure 2 shows the generation profile of the Luzon grid for a typical day, given existing capacities with the additional investments in coal-fired and CCGT power plants. Here, new coal-fired and CCGT power plants satisfy the load indicated by the dark gray and light gray bars. Diesel power plants satisfy the peaking loads given by the white bars. In this figure, new CCGT power plants are only used for the high demand hours from 8:00 AM to 9:00 PM. The other hours can be satisfied either with existing coal and NG power plants or with new coal-fired power plants.

Table 4 summarizes the dependable capacity of the different technologies. In this baseline scenario, the capacity from both new coal and NG power plants is more than double its existing capacity. In the next subsections, we shall compare this scenario to those where NG power plants become more attractive due to the price advantage afforded by the development of the PUINGI, and complementary policies, such as, a carbon tax designed to penalize pollution-intensive sources arising from the dictates of a low-carbon environment.

**FIGURE 2. Generation profile for Luzon by 2040 (Scenario 1)**




Source: Authors' calculation based on DOE data.

**TABLE 4. Dependable capacity for existing and new plants, Scenario 1**

| Technology | Capacity (MW) |
|---|---|
| **Coal** | **25,767.5** |
| Existing | 8,342.5 |
| New | 17,425.0 |
| **CCGT** | **8,241.3** |
| Existing | 3,914.6 |
| New | 4,326.7 |
| **Diesel** | **608.6** |
| **Total** | **34,617.4** |

Source: Authors' calculation.

Table 5 calculates the costs associated with the least-cost generating mix in Scenario 1. The cost of operating the grid will be USD 14.67 billion, of which 75 percent is accrued by coal-fired power plants.

**TABLE 5. Cost of satisfying demand for Luzon grid in 2040 (Scenario 1) Total Cost (Billion USD)**

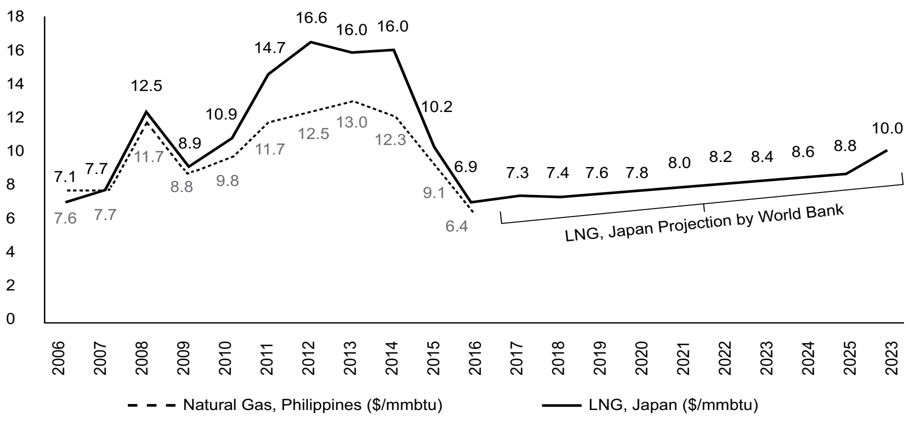
| Generation Technology | Fixed | Variable | Total | Percent of Total Cost |
|---|---|---|---|---|
| Coal | 3.24 | 7.77 | 11.01 | 75 percent |
| CCGT | 0.49 | 3.14 | 3.63 | 25 percent |
| Diesel | 0.0006 | 0.03 | 0.03 | 0 percent |
| TOTAL | | | 14.67 | 100 percent |

Source: Authors' calculation.

### *3.2. Scenario 2: NG with cost advantage due to PUINGI*

We repeat the same exercise of constructing the load duration and screening curves as that in the previous section, but add the scenario where NG enjoys a price discount due to the operationalization of a PUINGI facility. In this subsection, we assume that NG from indigenous sources will cost 20 percent less than the (import) market. Our guide for this price differential is the reported difference between the Malampaya price and the world price of NG. As Figure 3 shows, the difference between NG prices is substantial, especially during episodes of rapidly increasing gas prices.[13]

**FIGURE 3. Natural gas prices (USD per million BTU)**




Source of basic data: DOE and World Bank.

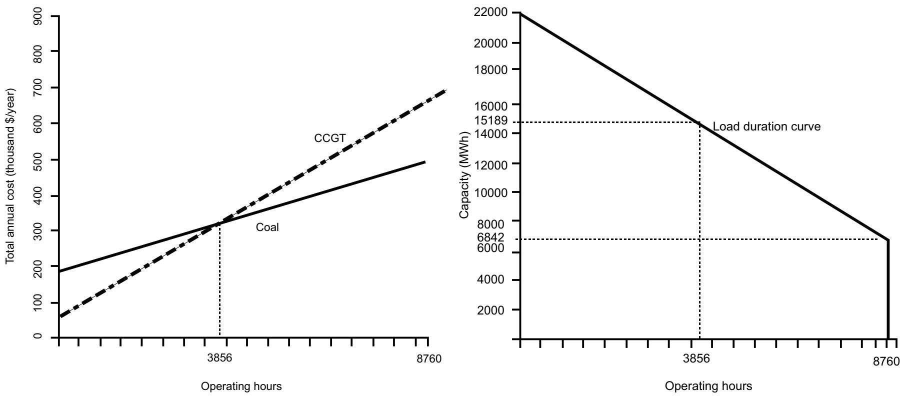
The main effect of this premium is to flatten the slope of the screening curve. In Panel (a) of Figure 4, the result of this flattening is to increase the number of hours per year in which NG gas plants are used from 2,542 to 3,856 hours. Thus, investments in new NG power plants will displace investments in new coal-fired power plants. This is shown in Figure 5, where the bars associated with new coal-fired power plants shorten, and in their place, the bars from new NG power plants lengthen.

[13] According to EIA [2017b], LNG regasification costs add approximately USD 1.00/MMBTU to landed LNG.

The upshot: power generated from NG power plants will now be used throughout the day, displacing some of the power generated from coal-fired power plants for mid-merit generation.

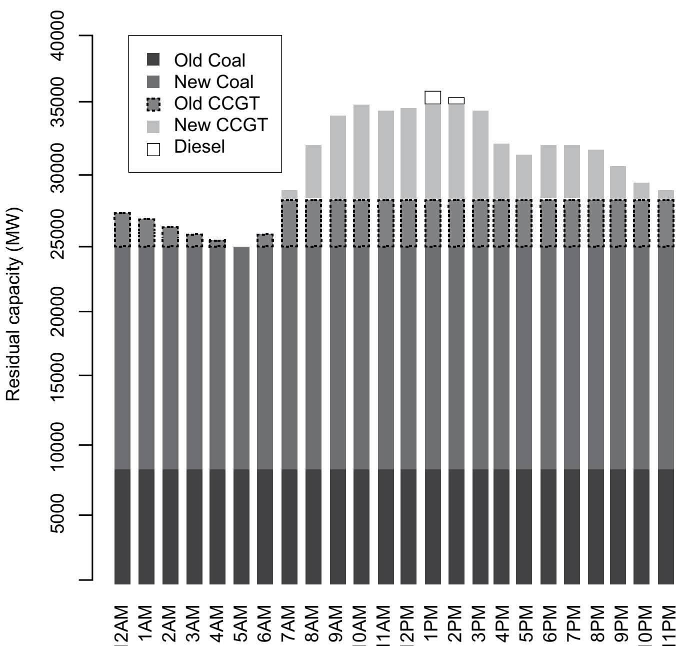
**FIGURE 4. Least cost generating mix for residual capacity of Luzon grid for Scenario 2**

(a) Screening curves (b) Load duration curve




Note: Left panel shows the screening curves while the right panel is the load duration curve net of current capacities.
Source: Authors' calculation based on DOE data.

**FIGURE 5. Generation profile for Luzon by 2040 (Scenario 2)**




Source: Authors' calculation based on DOE data.

Table 6 shows the dependable capacity of the different technologies in this scenario. With the price advantage afforded by PUINGI, there will be more than a 50 percent increase in dependable capacity from new NG power plants compared to the baseline scenario. On the other hand, there will be a nearly 13 percent decrease in dependable capacity from new coal-fired power plants.

**TABLE 6. Dependable capacity for existing and new plants (Scenario 2)**

| Technology | Capacity (MW) |
|---|---|
| **Coal** | **23,531.5** |
| Existing | 8,342.5 |
| New | 15,189.0 |
| **CCGT** | **10,477.3** |
| Existing | 3,914.6 |
| New | 6,562.7 |
| **Diesel** | **608.6** |
| **Total** | **34,617.4** |

Source: Authors' calculation.

**TABLE 7. Cost of satisfying demand for Luzon grid in 2040 (Scenario 2) Total Cost (Billion USD)**

| Generation Technology | Fixed | Variable | Total | Percent of Total Cost |
|---|---|---|---|---|
| Coal | 2.82 | 7.19 | 10.01 | 70 percent |
| CCGT | 0.62 | 3.66 | 4.28 | 30 percent |
| Diesel | 0.0006 | 0.03 | 0.03 | 0 percent |
| TOTAL | | | 14.32 | 100 percent |

Source: Authors' calculation.

Table 7 calculates the costs associated with the least-cost generating mix in Scenario 2. Compared to the baseline scenario, the cost of operating the grid is now cheaper in Scenario 2 with the price advantage afforded by PUINGI. This is due to less reliance on coal, and the associated drop in power generation cost by relying more on natural gas.

The final scenario considers a policy that will give further advantage to NG power plants. We focus on imposing a tax on the carbon content of polluting sources. This further gives advantage to NG power plants since, as mentioned earlier, the carbon emission of NG power plants is lower compared to coal-fired power plants.

There are several initiatives in Congress towards the imposition of a carbon tax. For instance, there is House Bill (HB) No. 4739 or the *Piso Para sa Kalikasan*

Act that would introduce a "climate tax" amounting to ₱1.00 per kilogram of $CO_2$ (or ₱1,000 per metric ton of $CO_2$) to discourage carbon emissions from electricity consumption. This proposed amount is roughly equivalent to USD 20 per metric ton (MT) of $CO_2$, which is substantially below recent calculations of the global social cost of carbon (SCC) estimated to be around USD 40 per $MTCO_2$ (see Feldstein et al. [2017]). In this scenario, we illustrate the effect on the optimal generation mix when damages from carbon emissions are corrected by imposing a carbon tax.

The main effect of a carbon tax works through the slope of the screening curves. The variable-cost component is affected by including the damage caused by carbon. In Table 8, we present what a USD 20 per $MTCO_2$ worth of damage translates to in terms of the tax imposed per technology.[14] The fourth column in this table shows that the damage from CCGT plants is substantially less than coal. When the tax is imposed, the unit cost differential between CCGT and NG power plants narrows from 93 percent to around 40 percent. This means that electricity generated by CCGT plants is cost competitive compared to coal with the imposition of a carbon tax.

**TABLE 8. Fixed cost and variable cost of the screening curve equations**

| Generation Technology | Fixed Costs ($/MW per year) | Variable Unit Cost ($/MWH) | Carbon Cost ($/MWH) | Marginal Social Cost ($/MWH) |
|---|---|---|---|---|
| Coal | 185,000 | 34.86 | 19.41 | 54.27 |
| CCGT | 5,900 | 67.54 | 8.71 | 76.25 |
| Diesel | 1,028 | 96.17 | 17.92 | 114.09 |

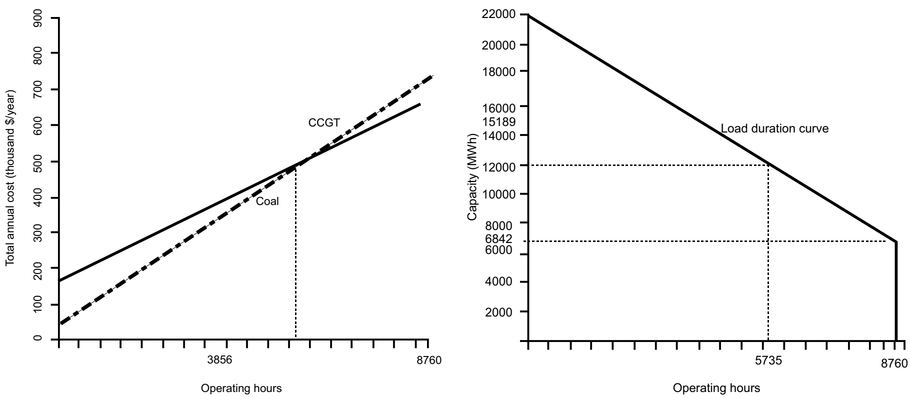
Note: Fixed cost for new investments includes both fixed O&M and overnight construction costs. Variable unit cost is fuel cost plus variable O&M costs. Carbon cost considers damages amounting to USD 20 per $MTCO_2$. Marginal social cost is the sum of the variable unit cost and the carbon cost.
Source: Authors' calculation.

In Figure 6, the effect of the carbon tax is to increase further the number of hours per year in which NG power plants are used. Compared to the baseline scenario, the number of hours of operationalizing the NG power plants more than doubles from 2,542 to 5,735 hours. As with Scenario 2, investments in new NG power plants will further displace investments in new coal-fired power plants, which is shown in Figure 7. In Figure 7, the bars associated with the new coal-fired power plants substantially shorten compared to the baseline scenario, with new NG power plants taking up the slack. The power generated from NG power plants will now be used even for off-peak hours, for instance from 12:00 midnight to 2:00 AM.

[14] For details, refer to Jandoc et al. [2018].

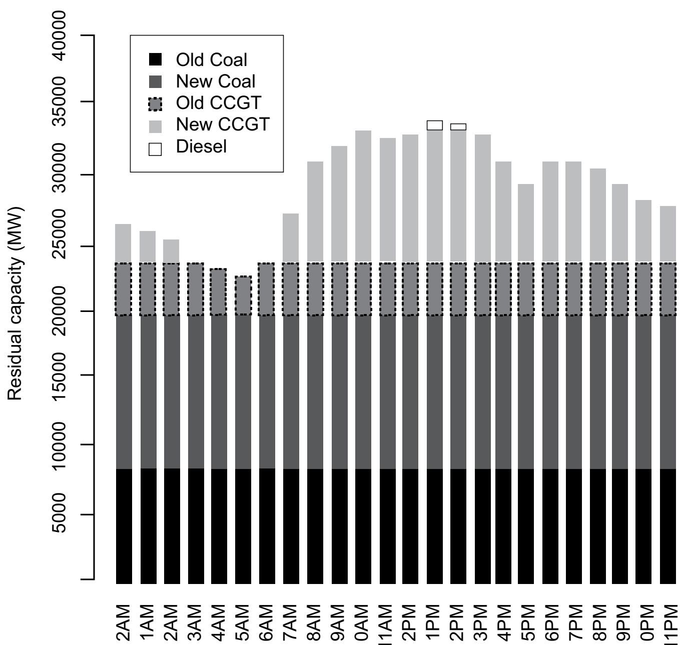
**FIGURE 6. Least cost mix for residual capacity of Luzon grid (Scenario 3)**

(a) Screening curves (b) Load duration curve




Note: Left panels are the screening curves while the right panel is the load duration curve net of current capacities.
Source: Authors' calculation based on DOE data.

**FIGURE 7. Generation profile for Luzon by 2040 (Scenario 3)**




Source: Authors' calculation.

Table 9 summarizes the dependable capacities generated from the three scenarios presented, as well as the total estimated carbon emissions. In Scenario 3, dependable capacity from coal-fired power plants shrinks by more than 20 percent compared to the baseline scenario, while dependable capacity for CCGT plants increases by 66 percent. Since power generated from NG power plants is "cleaner" than that from coal-fired power plants, total $CO_2$ emissions decrease, and the more price-attractive electricity generated from NG power plants is relative to coal-fired power plants. In Scenario 3, for instance, total $CO_2$ emissions decrease by almost 29 million MT, approximately a 13 percent drop compared to the baseline scenario.

**TABLE 9. Dependable capacity and carbon emissions for existing and new plants**

| Technology | Capacity (MW) | | | Emitted $CO_2$ (in million MT) | | |
|---|---|---|---|---|---|---|
| | Scenario 1 | Scenario 2 | Scenario 3 | Scenario 1 | Scenario 2 | Scenario 3 |
| **Coal** | **25,767.5** | **23,531.5** | **20,333.5** | **218.5** | **202.0** | **174.6** |
| Existing | 8,342.5 | 8,342.5 | 8,342.5 | 71.6 | 71.6 | 71.6 |
| New | 17,425.0 | 15,189.0 | 11,991.0 | 146.9 | 130.4 | 102.9 |
| CCGT | **8,241.3** | **10,477.3** | **13,675.3** | **16.4** | **21.9** | **31.5** |
| Existing | 3,914.6 | 3,914.6 | 3,914.6 | 10.3 | 10.3 | 10.3 |
| New | 4,326.7 | 6,562.7 | 9,760.7 | 6.1 | 11.6 | 21.2 |
| **Diesel** | **608.6** | **608.6** | **608.6** | **0.3** | **0.3** | **0.3** |
| **Total** | **34,617.4** | **34,617.4** | **34,617.4** | **235.2** | **224.2** | **206.4** |

Source: Authors' calculation.

However, the reduction of carbon emissions in Scenario 3 will come at a higher cost of operations. As Table 10 shows, the cost of operating the grid increases to USD 20.06 billion, around 40 percent higher compared to the cost in Table 8. While this increased cost may translate to higher electricity prices for households or firms, this increased cost should be compared with the cost of alternative policies such as a feed-in tariff for renewables, which, as Ravago and Roumasset [2018] discussed, can also be quite substantial.

**TABLE 10. Cost of satisfying demand for Luzon grid in 2040 (Scenario 3) Total Cost (Billion USD)**

| Generation Technology | Fixed | Variable | Carbon Tax | Total | Percent of Total Cost |
|---|---|---|---|---|---|
| Coal | 3.02 | 7.48 | 4.16 | 14.66 | 73 percent |
| CCGT | 0.56 | 4.35 | 0.45 | 5.36 | 27 percent |
| Diesel | 0.0006 | 0.03 | 0.006 | 0.04 | 0 percent |
| TOTAL | | | | 20.06 | 100 percent |

Source: Authors' calculation.

While ideally carbon taxes should reflect the true global social cost of carbon, there are those who argue that the optimal carbon tax should only address the "domestic social cost of carbon" [Gayer and Viscusi 2016]. This means that for a relatively small economy like the Philippines, the social cost of carbon should be lower. Table 11 presents a scenario where a lower carbon tax of USD 10/MT$CO_2$ is imposed. With a lower carbon tax, the cost of operating the grid is only USD 3.74 billion or 26 percent above the cost in Table 10. However, the reduction in $CO_2$ emissions will not be as drastic as that in Scenario 3.

**TABLE 11. Cost of satisfying demand for Luzon grid in 2040 with a lower carbon tax (USD 10 per MT of $CO_2$)**
**Total Cost (Billion USD)**

| Generation Technology | Fixed | Variable | Carbon Tax | Total | Percent of Total Cost |
|---|---|---|---|---|---|
| Coal | 3.15 | 7.65 | 2.13 | 12.93 | 72 percent |
| CCGT | 0.52 | 4.06 | 0.21 | 4.79 | 27 percent |
| Diesel | 0.0006 | 0.34 | 0.003 | 0.34 | 2 percent |
| TOTAL | | | | 18.06 | 100 percent |

Source: Authors' calculation.

The optimal energy mix from these different scenarios shows the advantages of natural gas in terms of flexibility as a baseload or mid-merit source of power. As NG plant technology advances, future NG power plants may also be used during peak load. This will be crucial to address the intermittency problem of renewable power plants. Hence, power from natural gas plants complements the development of renewable energy technology. Clearly, NG plays a role in a diversified fuel mix that is both cleaner and cost-efficient. We showed in Scenario 2 that the price advantage afforded by developing the PUINGI can reduce the cost of meeting future demand in 2040. This is important to achieve DOE's goals of energy security and a low-carbon future.

## 4. An industrial policy for the PUINGI

In a dual economy that starts with a large agricultural sector, an industrial structure that describes many developing economies like the Philippines, the development problem is industrialization, which is commonly understood as transforming an economy from one that is largely agricultural into one that is considered industrializing in the sense of the four Asian miracles or newly industrializing economies (NIEs), namely: Singapore, Hong Kong, Taiwan, and South Korea (see Table 12).

Among the Southeast Asian countries in Table 12, the Philippines is at the bottom, trailing Indonesia, Thailand, and Malaysia. This underscores the importance of broadening the role of indigenous NG based on the growth experience from the MGPP. If the Philippines is to stand a chance of catching up with other middle-income countries in the list, its fuel mix must diversify with gas and renewables therein.

**TABLE 12. Per capita income in East and Southeast Asia (in USD, PPP)**

| Economy | GDP Per capita |
|---|---|
| Malaysia | 28,900 |
| Thailand | 17,800 |
| Indonesia | 12,400 |
| Philippines | 8,200 |
| Singapore | 90,500 |
| Hong Kong | 61,000 |
| Taiwan | 49,800 |
| South Korea | 39,400 |

Source: US Federal Government, Central Intelligence Agency, as reported in Wikipedia.org/List of Asian Countries by GDP (PPP); PPP stands for Purchasing Power Parity (Downloaded January 20, 2019).

Starting in the 1970s, the four NIEs emerged as exporters of manufactured products on an international scale. Today, these economies are considered models of successful industrialization (see Johnson [1967]; Lucas [1988]). For the Philippines, the experiences of Taiwan and South Korea are highly relevant since both economies started with large agricultural sectors and got transformed into NIEs. The output and employment shares of agriculture in both Taiwan and South Korea pale in comparison to the shares of industry and services.

The accepted strategy is to raise productivity in all sectors of the economy, whether agriculture or non-agriculture (e.g., industry and services). However, as productivity increases in agriculture, some farm workers are released; fewer farmers are needed to produce the food and other agricultural products that the economy requires. Hence, industry and services must grow at a sufficiently rapid rate to be able to create jobs that can gainfully absorb the workers released from agriculture. The problem is not quite solved yet in the Philippines: many unemployed and underemployed workers are in agriculture; meanwhile, most of the employed are trapped in low-wage, subsistence farm activities. As a result, the majority of individuals and families considered poor are in the rural agricultural sector.

The absorption of excess agricultural workers by the non-agricultural sector is not automatic. At the most basic level, such workers must be equipped with skills that enable them to master the advanced production techniques of the non-agricultural sector. They must also develop the industrial discipline that is markedly different from that called for by, say, crop production (see, e.g., Oshima [1987]). Even off-farm activities in the rural areas need to invest in skills for processing manufactured products. In addition, small agro-based food manufacturing needs adequate power to process raw materials from the farm, and farm-to-market roads to transport the surplus to be marketed in urban food markets.

In this context, transforming an agricultural economy has opened a debate about whether or not the Philippines should embrace an industrial policy (IP). By IP, following Rodrik [2004] and Harrison and Rodriguez-Clare [2010], we refer to a package of economic policies consisting of foreign-trade tariffs, subsidies, tax exemptions, and other fiscal and investment incentives that go beyond the theoretical conditions of optimal taxation for raising government revenues. To be sure, however, the Philippine government has since 1986 been embracing structural policy reforms that include import liberalization and tariff reduction.

The government has likewise privatized several formerly monopolistic government corporations, while rationalizing regulation of industries like power, petroleum, telecommunications, transport, and commercial banking. Following the end of martial law in the Philippines in 1986, the government dismantled the monopolistic marketing boards in sugar and coconut. The Philippine National Bank (PNB), a wholly owned government commercial bank that used to be the largest in terms of assets, was privatized. In addition, other major government corporations like the Philippine Long Distance Telecommunications Company (PLDT) and Petron, the largest refinery and distributor of refined petroleum products, were privatized. Then Electric Power Industry Reform Act of 2001 was enacted, ending the monopoly of National Power Corporation in power generation and transmission. In short, the government's policy reform program, though by no means complete at this point, has been moving toward policy neutrality, instead of adopting IP. How then do we justify an IP for PUINGI?

It's widely recognized that the growth of the NIEs, like Japan, relied heavily on government support. Industrial policy underpinned their industrialization (for a collection of varying perspectives on this matter, see Stiglitz and Yusuf [2001]). Export-led manufacturing, for instance, generally received some trade protection through tariffs and some investment incentives given to special economic zones (SEZs). The NIEs started by subcontracting the labor-intensive stages of manufacturing in enterprises located in SEZs and re-exporting their products to firms abroad. Being electricity intensive, the host governments made sure that they could get stable and affordable electricity prices.

In addition, we note that the Philippine government has shown receptivity to foreign direct investments (FDIs) in view of the advanced technologies and managerial techniques they carry. FDI entry into the Philippines has progressively been liberalized since 1991. In sectors where 100 percent foreign equity participation is not allowed, the lists of industries with equity restrictions are spelled out in the so-called Negative Lists A, B, and C. Over time, those lists are being trimmed down. In general, participation of foreigners in natural-resource development is limited by the Constitution. However, there is an exception for "large-scale exploration, development, and utilization of minerals, petroleum, and other mineral oils." Thus, it is possible for a foreign-owned corporation to be awarded a petroleum service contract under Presidential Decree (PD) 87. The special investment incentives that IP allows are quite material in this regard.

At the same time, the enterprises that FDI establishes are vehicles for learning-by-doing with knowledge spillovers to other sectors of the economy (see, e.g., Arrow [1962]), resulting in increasing returns). This may be termed soft industrial policy, to use a term of Harrison and Rodriguez-Clare [2010]. The benefits derived from FDI are the same forces responsible for long-run growth as emphasized in endogenous growth theory (see, e.g., Romer [1986]; Lucas [1988]). Romer [1986] and Lucas [1988], for instance, emphasize introduction of advanced technology, formation of a skilled workforce equipped with modern managerial techniques, learning-by-doing, and knowledge spillover effects to other sectors that yield increasing returns or scale economies. The act of investing yields knowledge that can be used in other sectors without diminution.

This study advocates a soft industrial policy in support of the PUINGI. Based on lessons learned from MGPP, we find profound benefits from developing the upstream natural-gas industry in the Philippines, specifically, technology innovation, formation of a scientific and technical manpower, and sector complementarity that facilitates learning-by-doing with knowledge spillovers, all of which heighten productivity, the building block of industrialization.

The Malampaya Fund, established from the MGPP, should be a feature of the soft industrial policy, to be earmarked for developing PUINGI. Indigenous NG serves the long-term objectives of the Philippine Energy Plan (PEP). A key consideration is to make use of the Fund binding across political administrations. A law to tie the hands of administrations in succession must back the Fund.

Furthermore, laws are also needed to bind future administrations to the commitments under the Paris Agreement on Climate Change (PACC) and ensure that the Philippines transits inexorably to sustainable and clean energy.

### *4.1. Sector complementarity and interdependence*

In this section, we show some evidence bearing on the importance of MGPP as an input in the output of the various sectors of the economy. This is in the nature of further highlighting the microeconomic foundations of the macroeconomic growth that NG use from MGPP supported. The transmission mechanism stems from the use of MGPP gas to generate electricity, which in turn is used by all the other industries in the economy.

The gas-fired power plants using gas from MGPP generate up to 3,211 MW, a sizable share of the total electricity demand in Luzon, the island that accounts for at least 60 percent of the country's GDP. A look at the 2000 and 2006 Input-Output (I-O) Accounts of the Philippines released by the Philippine Statistics Authority [PSA 2006;2014] reveals the significance of electricity to other industry sub-sectors, in agriculture, industry, and services.[15]

[15] Ravago et al. [2021] discuss the potential of natural gas use beyond the power sector, more specifically in manufacturing sectors where natural gas has the potential to replace diesel in production processes that require heating.

I-O analysis uses a general-equilibrium approach to the empirical analysis of production in the economy. It takes account of the interdependence of the various industry sectors. Each sector uses outputs of the other sectors as (a) raw materials or intermediate inputs and as (b) primary inputs representing payments to factors of production like labor and capital. Table 13 shows the intermediate and primary input structures from the 11x11 industry classification of the Philippine economy in 2000 and 2006. We adopt the industry classifications in 2006.

**TABLE 13. Sectoral intermediate and primary input structures, 2000 and 2006**

| Industry | Intermediate | Primary | Intermediate | Primary |
|---|---|---|---|---|
| 1. Agriculture, Hunting, Forestry, and Fishing | 0.2489 | 0.7511 | 0.3193 | 0.6807 |
| 2. Mining and Quarrying | 0.3611 | 0.6389 | 0.3122 | 0.6878 |
| 3. Manufacturing | 0.6087 | 0.3913 | 0.7247 | 0.2753 |
| 4. Construction | 0.4632 | 0.5368 | 0.4396 | 0.5604 |
| 5. Electricity, Gas, and Water Supply | 0.3070 | 0.6930 | 0.3202 | 0.6798 |
| 6. Transport, Storage, and Communication | 0.4580 | 0.5420 | 0.4460 | 0.5540 |
| 7. Trade and Repair of Motor Vehicles, Motorcycles, Personal and Household Goods | 0.3382 | 0.6618 | 0.3238 | 0.6762 |
| 8. Financial Intermediation | 0.3443 | 0.6557 | 0.3071 | 0.6929 |
| 9. Real Estate, Renting, and Business Activities | 0.1050 | 0.8950 | 0.2601 | 0.7399 |
| 10. Public Administration and Defense; Compulsory Social Security | 0.2768 | 0.7232 | 0.3224 | 0.6776 |
| 11. Other Services | 0.4668 | 0.5332 | 0.4154 | 0.5846 |

Source: PSA [2006;2014].
Note: The industry classification follows the 2006 industry nomenclature.

Focusing on industry structure no. 5 (electricity, gas and water supply), we note that its output as an intermediate input to the other industries increased from 0.3070 to 0. 3202. MGPP started its operations only in 2001. In 2000, the nomenclature for industry structure no. 5 in the I-O accounts was "electricity, steam, and water", as gas was not yet in the fuel mix. This is to be expected in the course of industrialization. To enhance productivity, all sectors of the economy, including agriculture, begin to mechanize and automate, thereby becoming intensive in the use of electricity.

### *4.2. Sector shocks and business fluctuations*

Economic growth is never smooth across time. Business fluctuations, consisting of upturns and downturns, intervene every now and then. We have seen that energy-price shocks have triggered undesirable economy-wide downturns in the Philippines. For example, the deepest recession in the post-World War II history of the Philippines was the 1984-1985 recession. The latter can be traced to the two oil-price shocks in the latter half of the 1970s.

To ward off the expected downturns from the 1974 and 1975 oil-price shocks, the fiscal and monetary authorities of the government engineered expansionary fiscal and monetary policies, which resulted in large and chronic deficits in the national government budget. To finance the budget deficits, the government resorted to heavy foreign borrowing, thereby swelling the public debt.

When interest rates increased worldwide in 1981, the government faced serious difficulties in servicing its debt. In 1983, the debt servicing became unsustainable, forcing the government to default on its foreign debts. The subsequent tightening of fiscal and monetary policies under an International Monetary Fund (IMF) standby credit arrangement eventually led to the recession of 1984-1985.

The oil-price shocks of the 1970s forced cabinet secretaries in charge of energy policy to start a program lessening dependence on imported crude oil. In 2001, NG from the MGPP got into the fuel mix. In addition, Congress legislated the 2008 Renewable Energy Act, bringing in wind and solar energy into the mix.

Another energy-price shock occurred in 2018 from a newly enacted tax-reform program that raised excise taxes on fuel and other energy products. In October 2018, inflation rose to 6.4 percent, overshooting the target inflation rate of two to four percent under the inflation-targeting monetary policy rule of the Bangko Sentral ng Pilipinas. The rise in the inflation rate triggered some social unrest. Workers demanded wage hikes while drivers of public utility vehicles sought fare increases, to the consternation of the riding public. Real GDP did not contract, but its growth rate slowed down. The presence of gas and renewable fuels in the mix helped the economy escape a recession, an outcome that argues for accelerating the energy development program that seeks to broaden the role of gas and renewable fuels in the energy mix.

### *4.3. Sustainable energy*

The current PEP aims for a low-carbon future. Heavy dependence on coal-fired power plants detracts from this goal. Coal plants are heavy polluters and if the costs that they inflict on the environment are not reflected in energy prices, excessive pollution is bound to be result. One fiscal measure to mitigate this is to levy a pollution tax on coal. The government is well advised to levy such a tax. Coal producers do not care about the huge costs to the environment and health hazards that coal emits. Emission capping through tax and nontax measures are indicated.

While the legislation needed to levy a carbon or pollution tax may take time to pass due to political economy issues, there are certain policy actions in the short run that can be implemented to accelerate exploration and to sustain the development of the natural gas industry, namely:

- Award more petroleum service contracts, through the successful implementation of the Philippine Conventional Energy Contracting Program (PCECP) led by the DOE;
- Explore onshore natural gas sources, particularly in Southern Philippines;[16]
- Ensure strong inter-agency cooperation, and comprehensive support to petroleum service contractors, so that exploration activities can be implemented speedily and efficiently;
- Assure potential investors and participants on the clarity and stability of the fiscal terms offered under the PCECP; and
- Ensure energy security, and avoid potential disruptions to power supply and/or potential power rate increases that could be harmful to the economy as a whole.

## 5. Summary and concluding remarks

Industrialization requires a sustainable, affordable, and low-carbon fuel mix. In this connection, the PUINGI is critical. Natural gas is an important complement in transiting to renewable energy. It is clean and competitive with oil and coal provided the right environmental tax, along with other nontax emission capping measures, is levied on dirty fuels.

Based on the country's experience with MGPP, the country's gas and electricity sector raised the productive capacity of the economy. Real GDP growth peaked at more than seven percent following the MGPP's start of operations. The high-growth path that the Philippines was able to mount was made possible by technological innovation, knowledge creation, and the development of a growing technical and scientific manpower that the MGPP ushered in.

These positive developments from the MGPP must be exploited to the fullest. But this calls for an industrial policy—the package of trade policies, tariffs, and special fiscal and investment incentives that lead to the realization of scale economies in the PUINGI. The vital role of electricity and gas as input in all the other sectors of the economy creates benefits that far exceed the costs, whether direct or indirect.

[16] According to Clarete (2024), Lake Buluan meets the geological characteristics of an area that may have natural gas underneath in commercial quantities. Lake Buluan is in Sultan Kudarat in the Bangsamoro Autonomous Region of Muslim Mindanao (BARMM). He asserts that exploration costs can be significantly less expensive compared to offshore exploration in the West Philippine Sea. The explorer may drill a wildcat/exploratory well of about 5,000 feet deep in Lake Buluan.

The MGPP is a real-world experiment that works, whose economic and social benefits have been touching the lives of all Filipinos, rich and poor alike. It is in the service of the aspiration of the country to industrialize and, hence, deserves to be replicated.

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# Comment on "Natural gas and transitioning to renewable fuels: considerations from industrial policy"

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The paper articulates correctly the unlikely rise of renewables (REs) to a dominant role in the energy mix of the Philippines in the next few years or more. Committed to meet its obligation to reduce greenhouse gases (GHG) by 12 percent by 2040, the Department of Energy (DOE) has targeted a 35 percent share of REs by 2030. Through a moratorium of new coal fired plants, authorities have conveyed to producers that the share of coal must be reduced.

REs account for nearly a fourth of the country's electricity production. Geothermal and hydropower plants generate 80 percent of their electricity. Contributions from both sources, however, have recently slowed down or declined. After the largest geothermal plant was installed in Leyte, recent capacities are significantly smaller. Hydropower output growth was observed to have declined recently.

Solar and wind power are observed to have the stronger growth among the REs. DOE plans to double solar power's share in the energy mix to 5.6 percent and to quadruple that of wind power to nearly 12 percent of the country's energy mix by 2030. However, until technology would have made solar power farms more efficient, including their improved storability and their lower displacement of other uses of space, producers may find the current target in the next five years challenging. Additionally, infrastructure investments are needed to overcome grid integration problems of both solar and wind power plants.

The paper correctly calls for a transitional need of fossil fuels, citing natural gas and not coal to move the energy mix to a lower carbon footprint and keeps the country energy secure. Natural gas has 60 percent lower carbon footprint and does not leave by-products harmful to our health and to the environment.

Gas-fired plants are no strangers to the country since the discovery of the Malampaya offshore gas field in northeast Palawan. The country has five gas-fired plants, generating about a fifth of the country's electricity. First Gen owns four natural gas-fired power plants, producing nearly 2,000 megawatts. These are the Santa Rita (1000 MW), San Lorenzo (400 MW), Avion (97 MW) and San Gabriel (450 MW) power plants. Santa Rita, San Lorenzo, and San Gabriel deliver

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baseload power, while Avion capitalizes on the growing demand for peaking power in the Luzon grid. The fifth, called the Ilijan plant which is in Batangas, is owned by the National Power Corporation.

The paper fails to mention that the indigenous natural gas option has a serious problem. The Malampaya gas field's reserves are expected to start declining in 2024. It may continue to provide gas for three more years or so as geologists had advised DOE. Except for these, the Malampaya gas field is ready for decommissioning.

The country does not have a new indigenous gas field to replace Malampaya. The DOE has called for investors to explore another offshore gas field in the West Philippine Sea. But investors are apparently taking their time to respond to this need because offshore exploration is significantly more costly and because of China which mistakenly claims ownership of the West Philippine Sea.

With the exhaustion of Malampaya's gas reserves, the gas-fired plants have recently started importing liquified natural gas (LNG). Last year, the country completed its capacity to receive and re-gasify LNG to be fed to the five gas-fired plants. The capacity of the two LNG import terminals is 8.2 MTPA, and last year the country began importing LNG at about 0.6 MTPA.

It may still take more years before actual LNG imports could fill up the combined capacity of the two LNG terminals commissioned last year. More such terminals are going to be constructed to feed the nearly 2,000 MW gas fired plants of the country.

The outlook of LNG import trade is positive. The Philippines started to join other East Asian countries, like Japan and China, in importing LNG from the Middle East and North America. The imports last year were transacted in spot markets, but long-term import contracts are likely through the years.

Notwithstanding the downsides of LNG, the country has no other choice but import LNG. LNG is more costly than coal because of liquefaction and regasification. Liquefaction cost can range from USD two to four per one million British thermal units (MMBTU) and transport cost is significant at about 60 percent more than the cost of LNG in exporting countries.

The other disadvantage is that the country is vulnerable to the fluctuation of gas prices in the world market. With indigenous gas, the price of gas is protected from such price volatilities.

Another idea is exploring onshore natural gas sources, particularly in Southern Philippines. I talked to Gilbert Clarete, a graduate of the University of the Philippines in electrical engineering. He migrated to the US then to Canada. He has a long experience in exploring and mining oil and natural gas in both countries. He informed me that Lake Buluan meets the geological characteristics of an area that may have natural gas underneath in commercial quantities. Lake Buluan is in Sultan Kudarat in the Bangsamoro Autonomous Region of Muslim Mindanao (BARMM).

Exploration costs can be significantly less expensive compared to offshore exploration in the West Philippine Sea. The explorer may drill a wildcat/ exploratory well of about 5,000 feet deep, say in Lake Buluan. Findings of brine from the well at 5,000 feet deep can be analyzed by companies such as Schlumberger. With its office in nearby Indonesia, the company can bring their sensors to measure a few indicators to verify if natural gas is available. If verified, a geologist may then analyze the indicators to determine the amount of reserves. The whole exploration cost can run to just in few million pesos.

It is possible that drilling may yield a lack of commercial supply of natural gas. But the exploration cost is relatively low compared to the benefit the explorer/ developer obtains if gas supply is verified in commercial quantities. This onshore gas can be highly competitive. Being onshore, the gas can be transported to the gas plants without need of liquefaction and regasification. The gas-fired plant can be near the gas field to reduce transport costs. Being indigenous, it is protected from price volatilities of fossil fuels.

Screening curve analysis may likely place onshore natural gas to be everywhere below that of other fossil fuels, such as LNG or even coal. That would make the gas fired plants with onshore gas as fuel take on base load role in the energy mix.

But the country does not yet have a ready onshore natural gas field. In the meantime, LNG imports have a significant role in transitioning to an energy mix with lower carbon footprint.

Lastly, the paper calls for a carbon tax on coal to incentivize the shift to natural gas. But I have another idea, as the carbon tax will raise the price of electricity. The other intervention is a subsidy on LNG imports and in exploration of onshore natural gas fields.

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# How might China-US industrial policies affect the Philippines?: a quantitative exercise

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The recent industrial policy competition between the two economic hegemons, US and China, prompts developing countries to consider if and how they should respond. Using a multicountry, multisector Ricardian trade model with sectoral scale economies, we simulate different scenarios when a developing country like the Philippines takes a passive and active stance. We find welfare gains for the Philippines when it responds by implementing its own industrial policy, and welfare losses from inaction. Timing, however, matters. If the Philippines moved earlier before China and US engaged in industrial policy competition, the welfare gains are larger. Although the magnitude of gains is small, the results suggest an increased demand for industrial policy when the guardrails of the international trading system are lost due to the defiance of its benefactors.

**JEL classification**: F12, F13, F17
**Keywords**: Industrial policy, scale economies, new quantitative trade models

## 1. Introduction

For decades, developing economies were admonished to abide by the "Washington Consensus", a set of market-based policy prescriptions that include trade and financial liberalization. But as the global landscape and zeitgeist evolve with geopolitical frictions, so has the mantra of development crusaders. In the corridors of Washington, Beijing, and Brussels, building national industries through government subsidies and trade restrictions—"the policy that shall not be named"[1]—is having a revival, after past rebuke from academics and policymakers [Cherif and Hasanov 2019].

Industrial policy (IP), referring to targeted government measures to promote specific firms, industries or sectors for national economic development or competitiveness, is ubiquitous. The Global Trade Alert (GTA) reports that nearly

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[1] This phrase is attributed to Cherif and Hasanov [2019].

half (48 percent) of market interventions in 2021 qualify as IP, against a mere eight percent in 2010 [Juhász et al. 2023]. Between 2010 and 2022, more than 18,000 IP measures were tracked globally. Three out of four measures originated from Western Europe and longstanding OECD members; the balance came from rest of the world including Asia and Africa.[2] In 2023, GTA logged a total 1,806 IP interventions—15 percent more than the previous year. Significantly, China, US and EU accounted for 48 percent of these interventions [Evenett et al. 2024].

Arguably, all governments implement some form of IP. But the surge of IP interventions began in 2018 when the US abandoned free market rules and weaponized trade against economic rival, China. In 2015, China launched a medium-term industrial plan called Made in China 2025 (hereafter, MIC 2025), to catapult the country into the position of "leading high-end manufacturing superpower" [Glaser 2019:2]. The EU announced in 2020 the Green Deal Industrial Plan to support manufacturing industries that would be instrumental in achieving the region's ambitious climate targets, including achieving net-zero greenhouse gas emissions by 2050. In 2022, the US sealed its break from rules-based trading system by dangling subsidies to reshore production of semiconductors and by adopting restrictive local content regulation on electric vehicles (EV).[3]

What might explain the IP renaissance is a change in perspective. Instead of posing IP as correction to market failures (such as infant industry, knowledge spillovers and coordination problems), the new IP is framed as a means to shape markets, create positive externalities, direct innovation, and supply missing public inputs. In brief, the new IP is a "policy with purpose" [Mazzucato 2023]. That purpose could take several forms: climate change mitigation, protection of supply chain, national security, countering risk from geopolitical frictions, and competitiveness in strategic sectors.

Yet there is little difference between traditional and new IP with respect to policy instruments. Domestic subsidy (financial grant and state aid), import tariff, export subsidy, export barrier and localization are still the main forms of intervention to provide targeted support. Thus, even while the new IP can stimulate desired changes (such as reducing the cost of green transition), it can entail the same costs, including fiscal ones, and create the same market distortions that earned it bad repute in the past.

Acceptance of new IP logic, therefore, comes with a fair amount of skepticism on whether it could deliver the intended outcome. But such skepticism seems to be directed more on developing economies than advanced economies. IP is seen as a riskier and more precarious proposition for developing economies than it is for developed economies. The usual criticisms of government's inability to

[2] Specifically, the share of Eastern Europe and Central Asia was nine percent; Latin America and Carribean, 6.8 percent; East Asia and Pacific, 3.7 perent; South Asia, 3.1 percent; and Africa, 3.2 percent [Juhász et al. 2023].

[3] Evenett et al. [2024] report the stated motivations for IP interventions in 2023 are competitiveness of strategic sectors (37 percent), climate change (28 percent), supply chain resilience (15 percent), and geopolitical risk and national security (20 percent).

pick winners, ineffectiveness in stimulating desired behavioral changes and vulnerability to political capture are perceived to apply more in developing economies than in richer economies. Tighter fiscal condition in the former adds to the apprehension, and elicits suggestion that scarce public funds are better directed to infrastructure and other social goals than dispensed to domestic industries.

The issue at hand is whether developing economies should venture on, or refrain from, undertaking a similar policy experiment as advanced economies have done. When foremost hegemons, US and China, undermine the multilateral guardrails on the use of subsidies and trade barriers by their policies, developing countries face a dilemma about how to respond. Should it fence-sit or bandwagon? Conceptually, Harrison and Rodriguez-Clare [2010] show that a small, price-taking economy may realize its latent comparative advantage using Pigouvian subsidy if it could target the sector that can survive on its own after the support is withdrawn (Mill test) and the policy can generate discounted future benefits greater than its cost (Bastable test). The possibility of hurdling these conditions builds a case for implementing IP. On the other hand, the risks of wasting scarce resources in case of failure, of causing additional resource misallocation and market distortions, and of sacrificing gains previously reaped from participating in the global trading system loom large in the decision to remain passive.

This paper examines the dilemma of the Philippines, a developing economy, caught in the crosshair of US-China rivalry and yet remains deeply integrated with these two economies. China is the largest source of Philippine imports, while US is the largest market for Philippine exports. Since China is the hub of factory Asia, nearly half of its gross trade with the Philippines is in intermediates, making China the country's critical link to the global value chain. On the other hand, US is the country's fourth largest source of foreign direct investments and a military ally against China's increasing aggression in the South China Sea.

We compare the simulated welfare effects of sticking to laissez-faire principles and joining the bandwagon of IP implementers. We find welfare gains from implementing own IP, albeit small, and welfare losses from inaction. Timing, however, matters. If the Philippines moved earlier before the China-US IP competition, the welfare gains would have been larger.

In the next section, we discuss the recent tit-for-tat dynamics between US and China, how it undermines multilateral agreements in trade and investments, and how it induces other governments to behave in a similar way. Section 3 describes the Ricardian model with industry-level economies of scale of Ju et al. [2024]. This model is simulated to assess the impact on the Philippines of the US-China IP competition and to identify optimal responses for the country. Section 4 presents the results of simulation, showing the negative cumulative impact of US-China rivalry on the Philippines and how it could fend off such impact. The final section discusses caveats in reading the results. Depending on one's perspective, the results may be regarded as either support for, or counsel against, the use of IP. Yet they clearly signal the potential of ongoing US-China tiff to spread and deepen geoeconomic fragmentation.

## 2. The race for technological supremacy

The US-China trade friction began almost as soon as China acceded to the World Trade Organization (WTO) in 2001. Since then, US has initiated 23 disputes against China, while China has filed 18 cases against US. The first US complaint against China in 2004 was triggered by the latter's policy allowing a refund of value-added tax (VAT) to local producers and designers of integrated circuits. That policy was deemed inconsistent with the principles of most-favored nation (MFN) and national treatment (NT) and obligations of state trading enterprises in the 1994 General Agreement on Trade and Tariffs (GATT). In 2009, US complained about China's export restraints on mineral products that are critical inputs in manufacturing technology products. US argued that the restraints were designed to create scarcity so as to raise prices of raw materials in the global market. This allowed Chinese producers to take advantage of domestic supply in order to forge ahead of market competition. Earlier in 2002, China disputed the additional duties that US imposed specifically on Chinese aluminum and steel, in contravention of MFN and NT principles. These disputes were, however, mere harbingers of the IP competition between the two economic hegemons that followed.

In 2015, China launched MIC 2025, purportedly in response to the reindustrialization strategies (notably Germany's Industry 4.0) of several developed countries post-2008 financial crisis. The new industrial plan aims to turn China into a high-end manufacturing powerhouse by promoting ten key sectors, namely: information technology, smart manufacturing, aerospace, maritime engineering, advanced rail, electric vehicles, electrical equipment, new materials, biomedicine, and agricultural machinery and equipment. Central to the plan is the semiconductor industry, specifically chips manufacturing. China's foundries specialize in producing legacy chips for low profit margins. Leading chip makers like Taiwan Semiconductor Manufacturing Company and South Korea's Samsung manufacture more advanced and profitable chips. It is widely held in the industry that advances in chip technology would be the foundation of breakthroughs in other technologies. Thus, if China were to become the global leader in manufacturing by 2049, the 100th founding anniversary of the People's Republic of China, it should have the capacity to produce the best chips.

MIC 2025 had been in the wings for quite a while because of rising labor costs and slowdown in investment and export growth. China needed to shift production focus from cheap low-tech goods to more value-added high-tech products, hence a new industrial plan was expected. What was unexpected and a blow to the trading order is the plan's bold defiance of multilateral rules. It calls for indigenizing key technologies by requiring local content of 40 percent by 2020 and 70 percent by 2025—conditions that potentially violate the Agreement on Trade-Related Investment Measures (TRIMS). To develop national champions in these technologies, the plan wields the power of the state to facilitate technology transfers, and mergers and acquisitions of foreign technology companies. More importantly, subsidies are provided through tax incentives, loans, state-funding of R&D and equity investments. There is difficulty ascertaining if these initiatives are consistent with the Agreement on Subsidies and Countervailing Measures (SCM) because of the "overall lack of transparency" in China's use of public resources [WTO 2024:12]. But it appears that China is prepared to use the full weight of the state to achieve its goals.

At the onset, MIC 2025 was perceived by US as threat to national security. To counter the plan, US implemented several measures to decouple technologically from China. These include banning the use of Chinese-made technology in universities, preventing Chinese companies from participating in US infrastructure projects, investigating certain Chinese companies participating in MIC 2025 over concerns of technology theft, limiting transfer of aerospace technology from the US to China, and closely examining China's involvement in US government-funded research. Until the Trump tariffs, these responses to the MIC 2025 challenge were ad hoc and within bounds of multilateral rules.

Backed up by an investigation report (under Section 301 of the 1974 US Trade Act) that found China's technology practices unfair and distortive, amounting to "state-sanctioned theft", the Trump administration imposed additional duties on selected imports from China. The first in the series of tariff impositions consisted of 25 percent additional duties on a set of products with an approximate annual trade value of USD 34 billion (List 1) in July 2018, and on imports worth USD 16 billion (List 2) in August 2018. China implemented retaliatory tariffs, initially on goods under List 1; later, on other goods covered in subsequent lists. In September 2018, Trump imposed ten percent additional duties on imports valued at USD 200 billion (List 3); these additional duties were increased to 25 percent in June 2019. Another round of tariff adjustment was implemented in September 2019—additional 15 percent on USD 102 billion worth of imports (List 4A), lowered to 7.5 percent after the US-China Phase One trade deal was signed in February 2020. The rest of US imports from China, estimated at USD 160 billion, would have formed List 4B and subjected to additional duties effective December 2019. But in anticipation of the Phase One deal, that plan was scuttled.

Lists 1, 2 and 3 cover semiconductors, auto parts, furniture and selected IT hardware and consumer electronics, while List 4B includes clothing and footwear, personal protective equipment and COVID-19 products, exercise equipment, lithium batteries for electric vehicles. These selective tariff impositions against China remained under the Biden administration; a few more were added recently. Following the statutory review of the Section 301 tariffs, published in May 2024, the Biden administration imposed higher rates on USD 18 billion worth of imports that include semiconductors, steel and aluminum products, electric vehicles, batteries and battery parts, natural graphite and other critical materials, medical goods, magnets, cranes, and solar cells. Some of the new tariff adjustments will be implemented in 2025 or 2026 yet.

Underlying the trade war is a race for technological supremacy. Popular press reports that China has gained global leadership in five key technologies (high-speed rail, graphene, unmanned aerial vehicles, solar panels, and electric vehicles and lithium batteries), and is closing the gap in others. The US reckoned that it could not arrest China's technological ascent without an industrial plan to counter MIC 2025.

While retaining the Trump-era tariffs, the Biden administration unveiled the American IP, without the label. The plan consists of three legislations that are seen as parts of an integrated strategy to improve US competitiveness, innovation and industrial productivity, while achieving sustainable and inclusive economic growth. These are the Bipartisan Infrastructure Law (BIL), Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act, and the Inflation Reduction Act (IRA). These initiatives have overlapping objectives, with a total budget of USD 2 trillion over a ten-year period. But the centerpiece program is the IRA that aims to mobilize investments in domestic manufacturing and spur R&D in leading-edge technologies to reduce carbon emissions.[4] Hence, even those availing themselves of incentives for non-climate concerns are expected to contribute to the goals of IRA. For example, a company seeking funding from CHIPS must commit to climate and workforce development plans [Mazzucato 2023].

Like MIC 2025, subsidies under the IRA are linked to domestic-production or domestic-procurement requirements. To illustrate, the eligibility of electric vehicle manufacturers to consumer tax credit is conditional on manufacturing or assembling the battery in North America or in a country that has a free-trade agreement with the US [McKinsey and Co. 2022]. Thus, the design of IRA lends itself to dispute complaint before the WTO.

As expected, China has recently manifested its concern that IRA subsidies are contingent on the use of domestic inputs or goods from selected origins. China deemed these provisions discriminatory against Chinese producers, hence inconsistent with MFN and NT principles, TRIMS Agreement, and SCM Agreement. Ironically, the same violations could have been used by the US against MIC 2025. But by framing IRA as a tool to transition the country to a clean energy economy, the US might be able to defend its policy by invoking public and environmental health under Article XX or national security exception under Article XXI of GATT.

With the US and China ignoring multilateral rules that constrain IP choices of WTO members, several members are now emboldened to follow their lead. Indonesia's export ban of nickel ore despite an earlier WTO decision against this

[4] The IRA is not only a "green industrial plan" [Reenen 2023] as it also provides for lowering healthcare costs, funding the Internal Revenue Service and improving taxpayer compliance [McKenzie and Co. 2022].

practice is a case in point. The South Korean government is reported to have made its subsidy for electric vehicle conditional on the recipient firm running a service center in the country, thereby excluding most foreign companies. And in the EU, there is an increasing clamor to relax state-aid rules so that more subsidies can be directed to strategic sectors.

In view of the foregoing, it is sensible to inquire whether a developing country like the Philippines stands to gain from implementing IP to pursue its development goals. We explore this possibility using a general equilibrium framework described in the next section.

## 3. The model and calibration

### *3.1. Structure of the model*

This section presents the model of Ju et al. [2024] that extends Caliendo-Parro [2015] in an increasing returns-to-scale environment. The model accounts for the presence of external scale economies in the manner of Lashkaripour and Lugovskyy [2023] and Bartelme et al. [2024]. Consider an economy consisting of $N$ countries, each with $J$ sectors. Countries are indexed by $i$, $n$ and $h$; sectors by $j$, $s$ and $k$.

#### *3.1.1. Preferences*

In each country, there are $L_i$ households whose preference is represented by a nested utility function

$$U_i = \Sigma_{j=1}^{J} \alpha_i^j log \left[ \left( [(\textstyle\int_0^1 [C_i^j(\omega)]^{\frac{\sigma^j-1}{\sigma^j}} d\omega \right)^{\frac{\sigma^j}{\sigma^j-1}} \right] \quad (1)$$

with an outer Cobb-Douglas nest for final goods $C_i^j$ and an inner CES nest for varieties $\omega$ within sector $j$.[5] The parameter $\sigma^j$ is the elasticity of substitution across product varieties in sector $j$. Household income $Y_i$ emanates from labor supply $L_i$ at wage $w_i$ and from lump-sum transfers.

#### *3.1.2. Technology*

Each sector is a mass of single-good firms, producing a continuum of intermediate goods $\omega^j \in [0,1]$ that uses intermediate inputs (materials) and labor.[6] The former may be tradable or not, while the latter is perfectly mobile across sectors but completely immobile across countries. The production of $\omega^j$ in country $i$ is

$$q_i^j(\omega^j) = z_i^j(\omega^j) E_j (L_i^j) [l_i^j(\omega^j)]^{\beta_i^j} \left[ \textstyle\prod_{s=1}^{J} \left( m_i^{s,j}(\omega^j) \right)^{\gamma_i^{s,j}} \right]^{1-\beta_i^j}, \ \Sigma_{s=1}^{J} \gamma_i^{s,j} = 1 \quad (2)$$

[5] Consumer perceives $\omega^j$ as product variety, while the sector or industry perceives the same $\omega^j$ as intermediate good.

[6] This feature is equivalent to single-variety firms in Krugman [1980] model.

where $z_i^j(\omega^j)$ is the efficiency of producing $\omega^j$; $E_j(L_i^j)$ represents external economies of scale that depends on $L_i^j$, total labor employed in the sector; $l_i^j(\omega^j)$ is labor input in the production of $\omega^j$; and $m_i^{s,j}(\omega^j)$ is the amount of $\omega^s$ required by a unit of $(\omega^j)$. The parameters $\beta_i^j$ and $\gamma_i^{s\,j}$ are, respectively, shares of labor value-added and of intermediate good from sector s that goes into production of $\omega^j$.

To allow for differences in Hicks-neutral productivity across countries and sectors, the efficiency factor $z_i^j(\omega^j)$ is drawn from Frechet distribution

$$Pr\,[z_i^j(\omega) \le z] = exp\{-T_i^j z^{-\theta j}\},\, z > 0 \tag{3}$$

with location parameter $T_i^j \geq 0$ and shape parameter $\theta^j$. The parameter $T_i^j$ also denotes the average productivity of sector $j$ in country $i$, while $\theta^j$ measures the degree of productivity dispersion in sector $j$. A lower value of $\theta^j$ implies higher dispersion of productivity across goods $\omega^j$.

Without loss of generality, external scale economies are assumed sector-specific even as they can be both country- and sector-specific, thus $E_j = E_{j,k}$ [Bartelme et al. 2024:11]. Further, as in Bartleme et al. [2024], $E_j$ takes the functional form

$$E_j(L_i^j) = (L_i^j)^{\psi j} \tag{4}$$

Accordingly, scale elasticity $\psi_j \geq 0$ is unique within each sector but may vary across sectors.

Following Caliendo and Parro [2015], the intermediate goods in sector $j$ of country $i$ are aggregated a la Dixit and Stiglitz [1977] or Ethier [1982] into

$$Q_i^j = \left[\int r_i^j(\omega^j)^{\frac{\sigma^j-1}{\sigma^j}} d\omega^j\right]^{\frac{\sigma^j}{\sigma^j-1}} \tag{5}$$

with $r_i^j(\omega^j)$ representing the demand for intermediate good $\omega^j$ and $\sigma^j$ denoting the elasticity of substitution across intermediate goods in sector j. The composite intermediate good $Q_i^j$ is used as input to the production of $\omega^k$ and as final consumption good $C_i^j$. Thus, the market for the composite intermediate good in sector $j$ clears when supply $Q_i^j$ satisfies demand by households and firms, hence

$$Q_i^j = C_i^j + \Sigma_{k=1}^j \int m_i^{j,k}(\omega^j)\, d\omega \tag{6}$$

Given the production function in equation (2), the unit cost of intermediate good $\omega^j$ is

$$c_i^j(\omega) = \frac{1}{z_i^j(\omega)(L_i^j)^{\psi_j}}\, w_i^{\beta_i^j}[\Pi_{s=1}^J (P_i^s)^{\gamma_i^{s,j}}]^{1-\beta_i^j} \tag{7}$$

where $P_i^s$ is the price of composite intermediate good $Q_i^s$. Any exogenous change in the price of sector $s$ affects the cost (hence price) of sector $j$ because of sectoral linkages.

*3.1.3. Trade costs and prices*

If $\omega^j$ is tradable, its price is also affected by Samuelson's [1954] iceberg trade cost, which is expressed in physical units of $\omega^j$. Transporting $\omega^j$ from country $n$ to country $i$ requires more than one unit of $\omega^j$, or $d^j_{in} \geq 1$, while $d^j_{ii}=1$.

Besides transport cost, industrial and trade policy instruments change price also. Import tax $t^j_{in}$ imposed by country i on good j from country $n$ raises price, while industrial subsidy $e^j_{in}$ ($e^j_{in}<0$) levied by country $i$ on good $j$ destined to country $n$ reduces it. The latter specification accommodates export subsidy that is applied to all destinations except $n=i$. The total trade cost is then represented by

$$K^j_{in} = \tilde{t}^j_{in} \tilde{e}^j_{in} d^j_{in} \tag{8}$$

where $\tilde{t}^j_{in}= 1+ t^j_{in}$ and $\tilde{e}^j_{in}= 1+ e^j_{in}$. Triangular inequality is assumed, hence $K^j_{in} K^j_{hn} \geq K^j_{in}$.

Firms seek the lowest cost supplier for their materials input, therefore the price of intermediate good $\omega^j$ is $p^j(\omega^j)= \min_n\{c^j_n K^j_{in}\}$.

For nontradable $\omega^j$, the condition $K^j_{in}=\infty$ is imposed so that local supply or $q^j_i$ has the lowest cost. Thus, $p^j_i(\omega^j)=c^j_i$ and $r^j_i(\omega^j)=q^j_i(\omega^j)$.

A crucial assumption in the Caliendo-Parro [2015] model is the distribution of productivities are independent across goods, sectors and countries. Further, $1 + \theta^j > \sigma^j$ [Caliendo-Parro 2015:10]. In the Ricardian tradition, trade outcomes are driven by productivity differences. A larger $\theta^j$ implies smaller change in trade flow due to a change in trade policy, e.g., higher tariff. This follows as narrower productivity differences across goods means cheaper substitutes are less easy to find. Conversely, a lower value of $\theta^j$, thus larger productivity differences, suggests a policy change can lead to larger adjustment in trade flows as there are more substitutes available.

Beyond Ricardian, the presence of external scale economies provides additional trade driver. The substitutability of goods across countries depends also on the employment size of the sector $L^j_i$, as it affects cost based on $\psi^j$. Differences in labor allocation matters if sectors with higher-than-average scale elasticity are favored in some countries.

The price of composite intermediate good $Q^j_i$ can then be expressed as

$$P^j_i = [\Sigma^N_{n=1} T^j_i (c^j_i K^j_{in})^{-\theta^j}]^{-\frac{1}{\theta^j}} \; \textit{if } Q^j_i \textit{ is tradeable};$$

$$P^j_i = (T^j_i)^{-\frac{1}{\theta^j}} c^j_i \quad \textit{if } Q^j_i \textit{ is nontradeable.} \tag{9}$$

Since consumers buy at $P^j_i$ prices, the consumer price index is

$$P_i = \Pi^J_{j=1} (P^j_i)^{\alpha^j_i} \tag{10}$$

### *3.1.4. Equilibrium*

The general equilibrium is attained if in every country $i \in N$, goods and labor markets clear. The conditions required to reach the equilibrium state are outlined below.

Denote total expenditure on goods $j$ in country $i$ by $X_i^j = P_i^j Q_i^j$. Let $K_{in}^j$ stand for expenditure in country $i$ of goods $j$ exported by country $n$. Then the share of expenditure in sector $j$ of goods from country $n$ is $\pi_{in}^j = (X_{in}^j)/(X_i^j)$. From Eaton and Kortum [2002], the expenditure shares can be written as function of technologies, prices and trade costs

$$\pi_{in}^j = T_n^j \left[ \frac{c_n^j K_{in}^j}{P_i^j} \right]^{-\theta^j} \tag{11}$$

This expression leads to the following inference: smaller $\theta^j$ implies larger change in the share of goods supplied by country $n$ in response to a change either its cost $c_n^j$ or trade cost $K_{in}^j$. In this sense, $\theta^j$ determines the elasticity of trade with respect to production or trade cost.

The total demand for goods $j$ in country $i$ consists of demand by foreign and domestic firms for composite intermediate goods and of demand by households for final goods

$$X_i^j = \Sigma_{s=1}^J (1-\beta^s)\gamma_i^{j,s} \Sigma_{n=1}^N X_n^s \frac{\pi_{ni}^s}{(1+t_{ni}^s)(1+e_{ni}^s)} + \alpha_i^j Y_i \tag{12}$$

where $Y_i$ is the sum of labor income $w_i L_i$, and lump-sum transfers from government revenue $R_i$ and deficit $D_i$. Government revenue $R_i$ is net of output taxes and import tariffs[7]

$$R_i = \Sigma_{j=1}^J \Sigma_{n=1}^N \frac{e_{in}^j}{(1+e_{in}^j)} X_{in}^j + \Sigma_{j=1}^J \Sigma_{k=1}^N \frac{t_{ki}^j}{(1+t_{ki}^j)\,(1+e_{ki}^j)} X_{ki}^j \tag{13}$$

National deficit $D_i$ is the sum of sectoral deficits given by[8]

$$D_i = \Sigma_{j=1}^J \left( \Sigma_{n=1}^N X_i^j \frac{\pi_{in}^j}{(1+t_{in}^j)\,(1+e_{in}^j)} - \Sigma_{i=1}^N X_n^j \frac{\pi_{ni}^j}{(1+t_{ni}^j)\,(1+e_{ni}^j)} \right) \tag{14}$$

Since aggregate deficits $\sum_{(i=1)}^N D_i = 0$, total expenditure in country $i$ minus national deficit equals the sum of all countries' expenditure on goods produced by country $i$,

$$\Sigma_{j=1}^J \Sigma_{n=1}^N X_i^j \frac{\pi_{in}^j}{(1+t_{in}^j)\,(1+e_{in}^j)} - D_i = \Sigma_{j=1}^J \Sigma_{n=1}^N X_n^j \frac{\pi_{ni}^j}{(1+t_{ni}^j)\,(1+e_{ni}^j)} \tag{15}$$

It can be shown that plugging the sum of equation (12) across sectors in equation (15) yields the condition for clearing the labor market in country $i$

$$w_i L_i = \Sigma_{j=1}^J \beta_i^j \Sigma_{n=1}^N \frac{X_{in}^j}{(1+t_{in}^j)\,(1+e_{in}^j)} \tag{16}$$

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7 Ju et al. [2024] assumes that output taxes are levied before import tariffs.

8 Following Caliendo and Parro [2015], national deficits are considered exogenous in the model, but sectoral deficits are endogenous.

In sum, given parameters ($\sigma^j$, $\alpha^j_i$, $\beta^j_i$,$\gamma^{j,s}_i$,$\theta^j$,$\psi^j$, $L_i$, $d^j_{in}$, $e^j_{in}$, $t^j_{in}$, $T^j_i$), an equilibrium under industrial and trade intervention structure $\mathbf{\Gamma}$ is a wage vector $\boldsymbol{w} \in \mathbf{R}^N_{++}$ and prices $\{P^j_i\}^{J,N}_{j=1,i=1}$ that satisfy equations (7), (9), (11), (12), (15) and (16). This equilibrium is perturbed by an exogenous change in $\mathbf{\Gamma}$ that causes recursive changes in prices and costs. An intervention that raises the cost of goods $j$, for example, could diminish its competitiveness and prompt producers and consumers to substitute other goods. Trade and expenditures adjust instantaneously to return the system to equilibrium.

Solving for the equilibrium of the system involves finding $3NJ+N$ unknowns, which is challenging since the equations are nonlinear and many parameters are difficult to calibrate, e.g. productivities $T^j_i$ and iceberg trade costs $d^j_{in}$. A parsimonious approach in handling a similar problem has been suggested by Dekle et al. [2008]. Referred to as "exact-hat" algebra, the system is solved for changes in wages and prices after a policy shift from $\mathbf{\Gamma}$ to $\mathbf{\Gamma}'$, instead of solving for levels of wages and prices under a particular policy $\mathbf{\Gamma}$. This approach has the advantage of matching the model to the data, without the need to estimate parameters that are difficult to discern from available information. Thus, the change in variable $x$ is hereafter denoted by $\hat{x} = x'/x$ where $x'$ and $x$ are new and old values, respectively.

Representing national welfare $W_i$ by the real income of an average consumer $Y_i/P_i$ , with $P_i$ given by Equation 10, Ju et al. [2024] decompose the impact of policy change in five parts:

$$ln\left(\frac{\hat{Y}_i}{\hat{P}_i}\right) = -\sum_{j=1}^{J} \frac{\alpha^j_i}{\theta^j}\, ln\hat{\pi}^j_{in} - \sum_{j=1}^{J}\left(\frac{\alpha^j_n}{\theta^j}\frac{1-\beta^j_i}{\beta^j_i} ln\hat{\pi}^j_{ii} + \frac{\alpha^j_n}{\beta^j_i} ln\prod_{s=1}^{J}\left(\frac{\hat{P}^s_i}{\hat{P}^j_i}\right)^{\gamma^{s,j}_i}\right)$$
$$+\sum_{j=1}^{J} \alpha^j_i \frac{\psi^j}{\beta^j_i} ln(\hat{L}^j_i) - \Sigma^J_{j=1}\frac{\alpha^j_i}{\beta^j_i} ln(\hat{e}^j_{ii}) - ln(\widehat{1-\frac{R_i}{Y_i}}) \tag{17}$$

This decomposition highlights the input-output linkages in the economy. The first two terms represent the aggregate effect on trade in final goods and intermediates, respectively. The third term refers to the scale effect as it measures the productivity change following sectoral resource reallocation. The fourth term is the direct effect of production subsidy on prices. The last term captures the welfare effect through income by the change in government revenues.

### *3.2. Optimal policy intervention*

The case for industrial and trade intervention in distorted open economies has been explored in new quantitative trade models that include Costinot and Rodriguez-Clare [2014], Ossa [2014], Bagwell and Lee [2018], Campolmi et al. [2014], and Haaland and Venables [2016]. The underlying triggers for intervention are the wedge between private and social marginal costs in sectors with external economies of scale and the presence of market power in a monopolistic competitive setting. The Pigouvian subsidy closes the gap between social and marginal costs, while trade taxes exploit market power through improvement in terms of trade (TOT). This section delves into the optimal combination of industrial and trade policies in the presence of these distortions, as derived by Lashkaripour and Lugovskyy [2023] and Bartelme et al. [2024].[9] These two papers also provide alternative estimates for scale elasticity $\psi^j$ and trade elasticity $\theta^j$ that Ju et al. [2024] use in their counterfactual simulations.

To relate these papers to the model described in the preceding section, note that the specifications of policy instruments of country $i$, namely $t^j_{ni}$ and $e^j_{ni}$, are flexible to import tariff/subsidy, export tax/subsidy and production tax/subsidy. Prices faced by consumers in country $i$, $\{P^j_{ni}\}$, diverge from prices faced by producers in country $n$, $\{\tilde{P}^j_{ni}\}$, by

$$P^j_{ni} = \frac{(1+t^j_{ni})}{(1+e^j_{ni})}\tilde{P}^j_{ni}, \forall i, n \in N, j \in J.$$

Scale economies and product differentiation generate economic rents that allow firms to maintain markups or profit margins. Kucheryavyy et al. [2023] show that the relation between scale elasticity $\psi^j$ and elasticity of substitution across product varieties $\sigma^j$ is $\psi^j = 1/(\sigma^j - 1)$. It allows for interpretation of $\bar{\psi}^j$ as uniform firm-level profit margin in sector $j$.[10] Because labor is mobile across sectors within a country, the average profit margin in country $i$ across all sectors $\psi_i$ adjusts the wage by $\grave{w}_i \equiv (1+\bar{\psi}_i)w_i$. Producer prices incorporate profit-adjusted wage $\grave{w}_i$.

The government in country $i$ chooses a set of industrial and trade policy instruments, $\mathbf{\Gamma}$, that maximize national welfare ($W_i$), while consistent with $\boldsymbol{w}$, wage vector satisfying labor market clearing condition (Equation 16) in every country $i \in N$. Lashkaripour and Lugovskyy [2023] show the optimal policy design is affected by the availability of instruments, where the first-base case corresponds to having all policy instruments at the government's disposal. It permits the assignment of instruments to specific distortions. Pigouvian subsidy addresses domestic resource misallocation due to industry-level scale economies. Import taxes exploit country $i$'s import market power by marking down the producer price of imported goods. Export taxes take advantage of country $i$'s export market power to mark up the consumer price of exported goods. Thus, trade taxes are designed to improve a country's TOT by raising export prices and lowering import prices.

Importantly, Lashkaripour and Lugovskyy [2023] show that while domestic subsidy $e^j_{ii}$ depends only on $\psi^j$ and import tax-cum-subsidy $t^j_{ni}$ is a function only of (inverse) supply elasticity of $j$ from country $n$, the export tax-cum-subsidy depends on a set of own- and cross-price demand elasticities.

[9] This paper has undergone several versions since 2019. Ju et al. use the estimates in the 2021 version.

[10] Lashkaripour and Lugovskyy [2023:2767] notes that this relation is only an offshoot of the Krugman [1980] specification of product variety and may not be true elsewhere.

It is as if the government is pricing its exports as a multiproduct monopolist rather than a single-product monopolist.

The second-best case, according to Lashkaripour and Lugovskyy [2023], is when the government cannot apply domestic industrial subsidy but can use trade policy instruments. Optimal import tax under this environment is designed to restrict competition in sectors with relatively high-$\psi^j$, while optimal export subsidy promotes exports in high-$\psi^j$ sectors. The welfare benefits under this scenario are lower than in the first-best case.

When both industrial and export subsidies are unavailable to the government, import taxes are optimally set to address resource misallocation and to extract market rents on imported goods. Since import tariffs are only substitutes to export subsidies, the welfare gains in this third-best case are less than realizable in the previous case.

Notwithstanding potential gains in any of the three cases, the threat of foreign retaliation has held off some countries from taking unilateral interventions. Retaliatory actions from other countries (especially competitors) can minimize or reverse the welfare gains expected from stand-alone policies. Although global efficiency is served if all countries implement scale-correcting Pigouvian subsidies, each country has an incentive to withhold implementation and free ride on the correction of others. A way out of the classic prisoners' dilemma situation is coordination of industrial policies across countries, as suggested by [2023].

But apart from the risk of setting off ruinous subsidy competition, unilateral scale correction can worsen a country's TOT when scale and trade elasticities have strong negative correlation, i.e., $cov(\psi^j, \theta^j) \ll 0$ [Lashkaripour and Lugovskyy 2023:2781]. In this case, a tension emerges between the imperative of correcting misallocation that requires expanding high-$\psi$ sectors and the incentive to improve the TOT by contracting exports in low-$\theta$ industries. Thus, when a sector is both high-$\psi$ and low-$\theta$, the policymaker is in a bind—whether to improve the country's TOT but worsen the resource misallocation or correct the misallocation and lose on the TOT. Bartelme et al. (2024) also caution on realizing limited, "hardly transformative" gains because of constraints in reallocating resources across sectors, low elasticities of substitution and trade barriers.

### *3.3. Calibration*

To take the model to the data, we utilize the Inter-Country Input-Output (ICIO) compiled by the Organization for Economic Cooperation and Development (OECD) to deduce bilateral trade shares $\pi^j_{in}$, sectoral consumption shares $\alpha^j_i$, sectoral value-added shares $\beta^j_i$, sectoral expenditure $X^j_i$ and input expenditure shares $\gamma^{sj}_i$. The crucial policy parameters, trade elasticity $\theta^j$ and scale elasticity $\psi^j$, are taken from Lashkaripour and Lugovskyy [2023]. Bartelme et al. [2024] present alternative estimates of $\theta^j$ and $\psi^j$.

The ICIO is comprised of 61 countries and 45 sectors, of which 22 sectors produce goods, while the rest are services. Including all countries and sectors is computationally challenging since the dimension of the problem increases multiple fold with the number of countries and sectors included. This prompted the application to six countries and a residual, Rest of the World (ROW), as in Ossa [2014] and Ju et al. [2024]. The world is envisioned to comprise of US, China, EU, India, Japan, the Philippines and ROW.[11]

Sectors are defined by the International Standard Industrial Classification of All Economic Activities (ISIC) Revision 4 at two-digit level of aggregation. All services are assumed nontradable, hence industrial and trade instruments are applied to only 22 goods sectors. Trade and tariff data are accessed from the World Integrated Trade System (WITS).

MIC 2025 was promulgated in May 2015. Fittingly, the baseline environment matches the ICIO data in 2015 sans MIC 2025. The general equilibrium of the model is then solved several times; each round builds on the preceding solution to mimic the evolution of the world economy from 2015 to present.

The first perturbation is the exogenous application of subsidies to seven MIC sectors. As an upper bound estimate of actual subsidies, a uniform optimal subsidy is calculated and applied to these sectors. The second round imposed Trumpian tariffs on 2017 trade. The third round added China's retaliatory tariffs on 2018 trade. The fourth round implemented uniform optimal subsidy on IRA-priority sectors on 2019 trade.[12] In each round, the impact of US-China industrial and trade interventions on the Philippines and other economies are estimated and decomposed as in equation (17).

The trading system after the fourth round of recalibration serves as base scenario for evaluating the response of the Philippines to US-China policies. Four options are explored: do nothing; use optimal subsidy sans import taxes; apply optimal import tariffs sans subsidy; and combine optimal subsidy and import tariffs. The base scenario is interpreted as outcome of the do-nothing option. The subsidy and import tariffs are applied exclusively on sectors that the Philippine Department of Trade and Industry (DTI) identified as priority for industrial development.[13] Optimal import tariff is capped at the lowest MFN bound rate among the priority sectors.

Next, the four Philippine options are reconceived in a hypothetical setting where the US-China industrial and trade interventions since 2015 did not happen. Here, the baseline is the 2015 ICIO before MIC interventions. The welfare effects of implementing optimal industrial policies are examined, assuming passive response from other economies.

[11] This is the same set of countries in Ossa [2014] and Lashkaripour and Lugovskyy [2023], except for the Philippines, replacing Brazil in the cohort.

[12] Note that the trade volumes used in the simulation do not match the actual dates of intervention, but only their chronological order.

[13] "DTI's Industrialization Plan for 2022-2028" [Pascual 2022].

Finally, the Philippine options are recalibrated by changing the target sectors from DTI-priority to MIC-priority. The changes in welfare are calculated relative to their levels post-IRA scenario.

## 4. Results and discussion

We present the simulation results of 13 scenarios described in the previous section. Scenario 1 corresponds to the 2015 trade environment following China's implementation of MIC 2025. Scenario 2 mimics the condition when Trumpian tariffs were imposed. Section 3 adds China's retaliatory tariffs to the previous scenario. Section 4 reproduces the environment when US IRA was implemented.

The next scenarios explore the options for the Philippines amid US-China IP competition or post IRA. In Scenario 5, the Philippines applies optimal uniform subsidies to DTI-priority sectors; in Scenario 6, optimal tariffs on competing imports are applied; in Scenario 7, a mix of uniform subsidies to DTI-priority sectors and tariffs is implemented. Scenarios 8 to 10 replicate the exercise in Scenarios 5 to 7 in a pre-MIC environment. Lastly, Scenarios 11 to 13 replace the DTI-priority with MIC-priority sectors in Scenarios 5 to 7.

Of the 22 tradeable goods sectors included in the analysis, 11 are targeted under at least one of the following industrial policy programs: China's MIC 2025, the United States' IRA, and the Philippines' industrial plan. Accordingly, sectors are tagged as MIC, IRA or DTI. Applying Ju et al.'s [2024] method for calculating heterogeneous optimal subsidies,[14] sectors with relatively higher scale elasticities receive relatively larger subsidies.

For completeness, Table A.1 in the Appendix exhibits the changes in welfare and scale on the seven economies under each of the 13 scenarios. Table A.2 presents the sectoral distribution of optimal subsidies under the different scenarios, while the changes in Philippine tradeable outputs in each scenario are shown in Table A.3.

We focus on the Philippine policy options when taken either post-IRA or pre-MIC, and when subsidies are provided to either to DTI-priority and MIC priority sectors.

### 4.1. The simulated effects of China-US industrial and trade policies

The impact of US-China IP competition on Philippine welfare is summarized in Table 1.

[14] We used (and modified when necessary) Ju et al.'s [2024] replication files to run our simulations. These are posted on Wang's [n.d.] personal webpage .

**TABLE 1. Simulated effects of China-US policies on the Philippines (in percent changes unless otherwise specified)**

| | Scenarios (Implementer/s) | | | | |
|---|---|---|---|---|---|
| | MIC subsidies (China) | Tariffs (US) | Tariffs (US & China) | IRA subsidies (US) | Cumulative effect - relative to the baseline prior to Scenario 1 |
| | (1) | (2) | (3) | (4) | |
| **Welfare** | -0.550 | 0.012 | 0.014 | -0.116 | -0.641 |
| **Components (ppt):** | | | | | |
| Final Goods | 0.535 | -0.005 | -0.012 | 0.080 | 0.599 |
| Intermediates | 1.065 | -0.009 | -0.027 | 0.166 | 1.195 |
| Scale Economy | -2.170 | 0.025 | 0.054 | -0.364 | -2.455 |
| Direct Price Effect + Tax Revenue | 0.021 | 0.001 | -0.001 | 0.001 | 0.022 |
| **Trade shares (ppt change):** $\pi_{origin,destination}$ | | | | | |
| $\pi_{PHL,WLD}$ | -0.013 | 0.000 | 0.001 | -0.002 | -0.014 |
| $\pi_{PHL,CHN}$ | -0.014 | 0.000 | 0.000 | -0.001 | -0.015 |
| $\pi_{PHL,USA}$ | -0.007 | 0.001 | 0.002 | -0.009 | -0.013 |
| $\pi_{WLD,PHL}$ | 0.863 | 0.013 | -0.033 | 0.086 | 0.929 |
| $\pi_{CHN,PHL}$ | 2.043 | 0.015 | -0.015 | 0.043 | 2.086 |
| $\pi_{USA,PHL}$ | -0.079 | -0.003 | -0.010 | 0.235 | 0.143 |

Source: Authors' calculations.

### *4.1.1. China's MIC Subsidies (Scenario 1)*

As in Ju et al. [2024], subsidizing the MIC 2025 target sectors—in the manner of our stylized exercise—is expected to generate welfare gains for China, as well as small and varied aggregate welfare effects for its partners (Table A.1). With 2015 as baseline year in this scenario, the Philippines' small aggregate welfare loss of 0.550 percent (Scenario 1 in Table 1) is driven by a decrease in its aggregate production scale (-2.170 percentage points or ppt) and mitigated by gains from lower cost imports of final and intermediate goods (0.535 and 1.065 ppt, respectively). This drop in scale is consistent with the influx of Chinese goods displacing domestic production, as seen in the 2.043-ppt increase in the trade share of Chinese imports in Philippine spending on tradeable goods ($\pi_{CHN,PHL}$), as well as with the Philippines' lower trade share with China (a 0.014-ppt decrease in ($\pi_{PHL,CHN}$), with the US (a 0.007-ppt decrease in $\pi_{PHL,USA}$), and with all its trade partners taken together (a 0.013-ppt decrease in $\pi_{PHL,WLD}$). Some of the sector-specific effects are nontrivial, with the Philippines' "Chemical" and "Computer" industries—directly affected by MIC as these are part of the MIC-targeted sectors—each registering a decrease in production larger than 35 percent (Table A.3)[15].

### *4.1.2. US-China trade war tariffs (Scenarios 2 and 3)*

In a post-MIC world, the first round of trade-war tariffs imposed by the US against China, or the so-called US "Wave 1" tariffs,[16] lead to a 0.012 percent welfare gain for the Philippines, mainly driven by the 0.025 ppt increase in its economies of scale (Scenario 2 in Table 1). This increase in scale appears to be mediated by a higher trade share of Chinese imports in Philippine spending (up by 0.015 ppt), possibly reflecting the fact that more intermediates are needed for the latter's increase in scale, concomitant with a small increase (0.001 ppt) in the trade share of Philippine goods in US spending.[17]

When the US and China simultaneously impose tariffs against each other at the height of the trade war (which was also examined by Ju et al. [2024] in a scenario they label as "Wave 5 tariffs"), the Philippines enjoys a small welfare gain of 0.014 percent, once again due to an increase in scale economies (Scenario 3 in Table 1). As expected, both trade war scenarios result in Philippine losing access to cheaper imports, as reflected in the "Final Goods" and "Intermediates" components of welfare; however, these effects are also relatively small—all such declines are less than 0.03 ppt. Due to the Wave 5 tariffs, the share of foreign goods in Philippine spending declines, whether viewed in terms of Philippine imports from all its trade partners ($\pi_{WLD,PHL}$), or imports from China($\pi_{CHN,PHL}$) and from US($\pi_{USA,PHL}$). The shares of Philippine goods in foreign countries' spending go up, but the magnitudes are small.

### *4.1.3. US IRA subsidies (Scenario 4)*

Similar to Scenario 1, but to a lesser degree, subsidies granted under IRA cause a welfare loss to the Philippines of 0.116 percent, with 0.364 ppt of this loss coming from decreases in economies of scale, and where the said loss is mitigated by gains from access to cheaper final and intermediate goods of 0.080 and 0.166 ppt, respectively (Scenario 4 in Table 1). Effects on sectors targeted by IRA are arguably non-trivial: of the IRA sectors in the Philippines, "Other transport equipment" stands to contract the most at 7.4 percent (Table A.3). The "Computer" and "Electrical equipment" industries also register notable production contractions of 5.5 and 5.9 percent, respectively (Table A.3). Like the Scenario 1 results, the implementer's trade share in Philippine spending increases

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[15] In percentage terms, the most salient production loss is incurred by "Machinery not-elsewhere-classified (nec)" sector at 99.5 percent, but this loss is due to the sector's small calibrated production value at the baseline.

[16] "Wave 1 tariffs" is the term used by Ju et al. [2024] to refer to the first round of Trumpian trade-war tariffs.

[17] These echo some of the findings of Freund et al. [2024]: for instance, they find that Chinese technology products' share in Vietnam's imports went up as import shares of Vietnamese products in US imports also went up, suggesting that supply chains remain dependent on China. In other words, there is some decoupling, but US tariff increases seemed to have strengthened "indirect linkages between the US and China through the industrial supply chains of their trade partners" [Freund et al. 2024:8].

(specifically, $\pi_{USA,PHL}$) is up by 0.235 ppt). While Philippine trade shares in foreign goods go down, the magnitudes are all below 0.01 ppt.

### *4.2. The simulated effects of Philippine industrial and trade policies, post-IRA (Scenarios 5 to 7)*

We simulate the following stylized Philippine policies in a world where the US has already granted IRA subsidies: granting output subsidies to priority sectors (Scenario 5); raising tariffs on competing imports in all targeted sectors up to the bound rate of 13.66 percent[18] (Scenario 6); and doing both (Scenario 7). Table 2 compares these alternative policies with the passive stance (Scenario 4).

First, we note that other countries are hardly affected by any of the Philippines' policy options, with all welfare effects smaller than 0.01 percent in magnitude (Table A.1). Among the options, raising tariffs (Scenario 6) generates the smallest welfare gain (0.333 percent), while combining subsidies and tariffs (Scenario 7) yields the largest benefit for the Philippines (0.766 percent). This result is consistent with the first-best and third-best cases of Lashkaripour and Lugovskyy [2023]. The gains in Scenario 5 (0.512 percent) are intermediate as it only uses subsidies. Moreover, when tariffs are added to subsidies as a policy instrument, the resulting optimal subsidies are lower than when only subsidies are used (compare subsidies under Scenarios 5 and 7 in Table A.2).

Among the three options, the Philippines' trade shares in foreign spending increase the most under the subsidies-only option (see the ppt changes in $\pi_{PHL,WLD}$, $\pi_{PHL,CHN}$, and $\pi_{PHL,USA}$) under Scenario 5 compared to Scenarios 6 and 7 in Table 2), while foreign shares in Philippine spending (i.e., $\pi_{WLD,PHL}$, $\pi_{CHN,PHL}$, and $\pi_{USA,PHL}$) decrease the most under the subsidies-cum-tariffs policy compared to the other two options. This trade-share effect under Scenario 7 is consistent with the country losing access to cheaper goods: -0.659 ppt for final goods and -0.743 ppt for intermediate goods (Table 2).

Certain sectoral effects under the said third policy option are quite pronounced: "Basic metals", "Electrical equipment", "Manufacturing not elsewhere classified", and "Pharmaceuticals" all register gains higher than 65 percent, while some non-targeted sectors, namely some parts of the mining sector and the paper sector, register losses (Scenario 7 in Table A.3).

[18] This magnitude is the smallest bound rate among targeted sectors (the simple tariff line average at the sector level) calculated using data from the World Trade Organization's Integrated Database (WTO-IDB), downloaded via the World Integrated Trade Solution (WITS) website (https://wits.worldbank.org/) of the World Bank.

**TABLE 2. Philippine trade and industrial policies' effects—targeting DTI-priority sectors vs. MIC sectors (in percent change unless otherwise specified)**

| | Scenarios (Implementer) | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Policies targeting DTI-priority sectors (Philippines) | | | Policies targeting MIC sectors (Philippines) | | |
| | No action post-IRA | Subsidies | Tariffs | Subsidies and tariffs | Subsidies | Tariffs | Subsidies and tariffs |
| | (4) | (5) | (6) | (7) | (11) | (12) | (13) |
| **Welfare** | -0.116 | 0.512 | 0.333 | 0.766 | 0.811 | 0.441 | 1.066 |
| **Components[c] (ppt):** | | | | | | | |
| Final Goods | 0.080 | -0.587 | -0.143 | -0.659 | -0.807 | -0.383 | -0.938 |
| Intermediates | 0.166 | -0.439 | -0.353 | -0.743 | -1.883 | -0.781 | -2.152 |
| Scale Economy | -0.364 | 2.515 | 0.308 | 2.627 | 4.039 | 0.994 | 4.192 |
| Direct Price Effect + Tax Revenue | 0.001 | -0.978 | 0.521 | -0.462 | -0.539 | 0.610 | -0.043 |
| **Trade shares (ppt change):** $\pi_{origin,destination}$ | | | | | | | |
| $\pi_{PHL,WLD}$ | -0.002 | 0.021 | 0.000 | 0.020 | 0.044 | 0.001 | 0.040 |
| $\pi_{PHL,CHN}$ | -0.001 | 0.017 | 0.000 | 0.017 | 0.023 | 0.001 | 0.021 |
| $\pi_{PHL,USA}$ | -0.009 | 0.023 | 0.001 | 0.022 | 0.061 | 0.001 | 0.053 |
| $\pi_{WLD,PHL}$ | 0.086 | -1.752 | -1.033 | -2.438 | -2.076 | -1.225 | -2.964 |
| $\pi_{CHN,PHL}$ | 0.043 | -0.482 | -0.307 | -0.702 | -0.841 | -0.502 | -1.190 |
| $\pi_{USA,PHL}$ | 0.235 | -0.187 | -0.131 | -0.260 | -0.102 | -0.082 | -0.162 |

Source: Authors' calculations.

### *4.3. The cumulative effects of industrial policies*

The cumulative effect[19] of China's MIC subsidies, US-China trade wars, and IRA subsidies on Philippines welfare is negative, or a 0.641 percent loss relative to the pre-Scenario 1 or the pre-MIC baseline (See the last column of Table 1, reproduced in the "No action post-IRA" column in Table 3). This may seem small but the cumulative loss in production scale amounts to 2.455 ppt, although countervailed by gains from access to cheaper foreign final and intermediate goods (0.599 and 1.195 ppt, respectively). Cumulatively, without a Philippine response to China-US IP, foreign shares in Philippine spending all increase ($\pi_{WLD,PHL}$, $\pi_{CHN,PHL}$, and $\pi_{USA,PHL}$ up by 0.929 ppt, 2.087 ppt and 0.143 ppt, respectively), and Philippine shares in foreign spending all decrease ($\pi_{PHL,WLD}$, $\pi_{PHL,CHN}$, and $\pi_{PHL,USA}$ down by 0.014 ppt, 0.015 ppt and 0.013 ppt, respectively).

When the Philippines chooses to grant optimal subsidies to target sectors in the previous post-IRA scenarios, the country's cumulative welfare loss, again relative to the pre-Scenario 1 baseline, is smaller at -0.131 percent (Table 3). This is mediated by industrial subsidies essentially "recovering" some of the decreases in scale,[20] but at the cost of smaller tax revenues. The tariff-only policy option hardly helps recover scale, although it is still a better choice than doing nothing (with tariffs, scale cumulatively goes down by 2.147 ppt instead of 2.455 when doing nothing) (Table 3). The largest (though still small) cumulative gains are expected to come from the IP that uses both subsidies and tariffs: welfare grows by 0.122 percent cumulatively, as tariffs help mitigate tax revenue losses while subsidies help rebuild scale.

Cumulative effects on trade shares show that Philippine subsidies—whether used together with tariffs or not—would ultimately increase the share of Philippine goods in foreign spending (see the ppt changes in $\pi_{PHL,WLD}$, $\pi_{PHL,CHN}$, and $\pi_{PHL,USA}$ under the "Subsidies" and "Subsidies and tariffs" columns for the "post-IRA implementation results" in Table 3) whereas a tariff-only policy fails to "recover" the trade-share losses of Philippine goods in foreign markets (see the ppt changes in Philippine trade shares under the "Tariffs" column in Table 3). Also, the cumulative effect on the share of Chinese goods in Philippine spending is positive and above one ppt under any of the policy options.

Now consider the case of the Philippines implementing its IP before China and the US implement theirs (see the "pre-MIC implementation" scenarios in Table 3). Compared to the previous results of Philippine implementation of IP post-IRA, the welfare gains from executing policies earlier are larger, despite smaller access to

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[19] The cumulative effect for percent changes is calculated using the following formula: $100 \times \ln((1 + x_1/100) \times \ldots \times (1 + x_4/100))$, where $x_i$ is the percentage change due to $i$th scenario relative to its own immediately preceding baseline. For percentage-point (ppt) changes, the cumulative effect is the sum of the individual scenarios' ppt changes.

[20] Cumulatively, scale economy gains total 0.060 ppt when subsidies are granted to Philippine priority sectors post-IRA, compared with -2.455 ppt cumulative effect mentioned earlier when the Philippines does nothing post-IRA (see the first and second column of results in Table 3).

When the Philippines uses both subsidies and tariffs pre-MIC, welfare can grow by up to 0.644 percent, as opposed to 0.641 cumulative welfare loss from doing nothing post-IRA. This result is explained by the 2.161 ppt increase in scale that more than offsets the tax revenue losses and effects of higher prices (Table 3). In sum, it matters when a country implements IP. There first-mover benefits that could accrue to the implementer.

### *4.4. Targeting DTI-priority sectors versus those directly affected by MIC Project*

To what extent the reported welfare effects depend on the sectors targeted by IP? Table 2 compares the welfare changes when targeting DTI-priority sectors versus MIC-priority sectors. The welfare changes are measured relative to the post-IRA baseline. Targeting sectors directly affected by China's MIC subsidies result in higher welfare gains compared to targeting sectors identified in the Philippine Industrialization Plan under each of the three policy options for the Philippines. This pattern is evident when we compare results between Scenarios 11 and 5, 12 and 6, and 13 and 7 in Table 2.[21] For example, under the subsidies-and-tariffs option, DTI-targeting results in a 0.766 percent increase in welfare, which is less than the 1.066 percent increase under MIC-targeting by the Philippines (Table 2). These aggregate effects are consistent with the higher increases in sectoral production of certain sectors when the country targets MIC industries rather than the DTI-priority sectors. For instance, the "Chemical" and "Pharmaceutical" industries increase production by 10.9 and 46.5 percent, respectively, when DTI sectors receive optimal subsidies, whereas they register production gains of 147.8 and 73.5 percent when MIC sectors are targeted.

While it might appear that employing a "rebuilding strategy" by supporting MIC-priority sectors is a Pareto improvement to targeting DTI-priority sectors, decomposing the welfare effects once again reveals a more nuanced story. Targeting MIC sectors leads to larger decreases in access to cheaper imports (i.e., decreases in the "Final Goods" and "Intermediates" components of welfare) compared to targeting DTI sectors (Table 2). Under the subsidies-and-tariffs policy option, the loss of access to cheap imported final goods has more negative welfare effects (-0.938 ppt) when targeting MIC sectors than when targeting DTI sectors (-0.659 ppt). MIC targeting also results in larger ppt decreases in foreign countries' trade shares in Philippine spending, but higher increases in Philippine trade shares in foreign markets. Using again the subsidies-and-tariff policy option as reference, MIC targeting reduces foreign countries' trade share in Philippine spending ($\pi_{WLD,PHL}$) by 2.964 ppt, while DTI targeting lowers the same metric by

[21] In this subsection, we again stress that these results are based on stylized exercises—optimal subsidies granted to an entire targeted sector and calculated proportional to sectoral scale economies a la Ju et al. [2024] (Table 1)—and are not the actual subsidies stipulated in any official government document. As such, this is more of an exercise illustrating how results might change depending on sectoral targets, rather than an actual evaluation of or prescription for the Philippine government regarding which sectors to target.

2.438 ppt; MIC targeting increases the Philippine trade share in foreign countries' spending ($\pi_{PHL,WLD}$) by 0.04 ppt versus 0.02 ppt under DTI targeting (Table 2). All told, the choice of target sectors matters.

**TABLE 3. Philippine trade and industrial policies' effects—different implementation times (in percent change unless otherwise specified)**

| | | Policies targeted at DTI-priority sectors, by time of implementation | | | | | |
|---|---|---|---|---|---|---|---|
| (cumulative effects relative to the pre-MIC baseline) | | post-IRA implementation (cumulative effects relative to the pre-MIC baseline) | | | pre-MIC implementation (effects relative to the pre-MIC baseline) | | |
| | No action post-IRA | Subsidies | Tariffs | Subsidies and tariffs | Subsidies | Tariffs | Subsidies and tariffs |
| | | | | | (8) | (9) | (10) |
| **Welfare** | -0.641 | -0.131 | -0.309 | 0.122 | 0.437 | 0.267 | 0.644 |
| **Components[c] (ppt):** | | | | | | | |
| Final Goods | 0.599 | 0.012 | 0.455 | -0.060 | -0.410 | -0.106 | -0.465 |
| Intermediates | 1.195 | 0.756 | 0.841 | 0.452 | -0.256 | -0.251 | -0.499 |
| Scale Economy | -2.455 | 0.060 | -2.147 | 0.172 | 2.085 | 0.222 | 2.161 |
| Direct Price Effect + Tax Revenue | 0.022 | -0.956 | 0.543 | -0.440 | -0.983 | 0.402 | -0.555 |
| **Trade shares (ppt change):** $\pi_{origin,destination}$ | | | | | | | |
| $\pi_{PHL,WLD}$ | -0.014 | 0.007 | -0.013 | 0.006 | 0.020 | 0.000 | 0.019 |
| $\pi_{PHL,CHN}$ | -0.015 | 0.003 | -0.014 | 0.002 | 0.020 | 0.000 | 0.019 |
| $\pi_{PHL,USA}$ | -0.013 | 0.009 | -0.013 | 0.008 | 0.018 | 0.000 | 0.017 |
| $\pi_{WLD,PHL}$ | 0.929 | -0.824 | -0.104 | -1.510 | -1.207 | -0.843 | -1.802 |
| $\pi_{CHN,PHL}$ | 2.087 | 1.604 | 1.779 | 1.384 | -0.232 | -0.205 | -0.378 |
| $\pi_{USA,PHL}$ | 0.143 | -0.044 | 0.012 | -0.117 | -0.155 | -0.112 | -0.231 |

Source: Authors' calculations.

## 5. Conclusion

We analyze quantitatively the implications of IP competition between China and US on the Philippines, a developing economy with deep links to the rivalling superpowers. Our quantitative exercises suggest that IP interventions conducted by large economies can have negative spillovers on small economies. Although the overall impact on the Philippines is modest, the contraction in production of sectors targeted by China's IP is nontrivial.

Should the Philippines fend off these negative externalities by implementing its own IP? Between doing nothing and providing Pigouvian subsidy to firms, the latter can potentially help the country recover its lost production scale, without having much effect on the welfare of its trade partners. At least for a small country, the need to rebuild lost production scale can justify the policy in a world where external scale economies exists. But this also means there will be greater demand for IP especially when multilateral restraints in designing IP (e.g., localization requirement) are attenuated.

The current IP competition between economic hegemons presents a real danger that can escalate into a subsidy war. When this happens, IP can beggar-thy-neighbor in the sense that production is diverted to whoever pays the biggest subsidy. Small economies with very limited fiscal firepower are likely collaterals of this war.

Our simulations suggest there is an advantage in implementing IP earlier than others. However, this has limited value to a developing country facing much skepticism in its capacity to target correctly, avoid political capture and make IP deliver its promised benefits [McKenzie 2023]. In practice, without a loss of scale as justification, it would be difficult for government of a developing country to rationalize IP and win public support for it, when some sectors are inevitably favored over others and public resources are limited.

We also find gains from IP can be larger by targeting sectors directly affected by foreign subsidies. However, the choice of targets reflects national priorities that often do not align across economies. And subsidizing the same sectors means foregoing gains from accessing possibly cheaper foreign goods that have been benefitted by foreign subsidies.

Finally, we do not consider "soft" IP in the analysis and focus on "hard" IP. Soft IP involves "develop(ing) a process whereby government, industry and cluster-level private organizations can collaborate on interventions that can directly increase productivity" [Harrison and Rodríguez-Clare 2010:4112]; hard IP employs traditional instruments such as subsidy and trade tax. Soft IP is consistent with rules-based international trade, while hard IP is potentially not. It might be the case that the two are complementary to some degree. It is, however, unclear if they are substitutes or one is a more effective strategy than the other to achieve a country's development goals.

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## Annexes

**TABLE A.1 Welfare and scale effects - by country and scenario**

| Countries or regions | Scenarios - by implementer and scenario number[a] | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | China | US | US & China | US | Philippines | | | | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| **Welfare effects (percent)** | | | | | | | | | | | | | |
| China | 2.945 | -0.167 | -0.386 | -0.103 | 0.001 | -0.007 | -0.004 | -0.004 | -0.003 | -0.006 | 0.001 | -0.007 | -0.005 |
| European Union | -0.060 | -0.002 | 0.001 | -0.063 | -0.001 | -0.001 | -0.002 | -0.001 | -0.001 | -0.001 | -0.003 | -0.001 | -0.003 |
| India | 0.338 | 0.008 | 0.043 | -0.085 | -0.002 | -0.002 | -0.004 | -0.002 | -0.001 | -0.002 | -0.004 | -0.002 | -0.005 |
| Japan | -0.129 | -0.005 | -0.005 | -0.103 | -0.003 | -0.007 | -0.008 | -0.003 | -0.005 | -0.007 | -0.010 | -0.007 | -0.015 |
| Philippines | -0.550 | 0.012 | 0.014 | -0.116 | 0.512 | 0.441 | 0.766 | 0.437 | 0.267 | 0.644 | 0.811 | 0.441 | 1.066 |
| Rest-of-the-world | 0.235 | -0.010 | 0.001 | -0.076 | -0.003 | -0.006 | -0.007 | -0.002 | -0.004 | -0.006 | -0.005 | -0.006 | -0.011 |
| US | 0.114 | 0.051 | 0.010 | 0.230 | 0.000 | -0.001 | -0.001 | -0.001 | -0.001 | -0.002 | 0.000 | -0.001 | -0.001 |
| **Scale effects(ppt)** | | | | | | | | | | | | | |
| China | 5.945 | -0.259 | -0.281 | -0.205 | -0.023 | -0.001 | -0.023 | -0.023 | 0.002 | -0.021 | -0.027 | -0.001 | -0.026 |
| European Union | -0.710 | 0.003 | 0.009 | -0.146 | -0.006 | 0.000 | -0.006 | -0.006 | -0.001 | -0.006 | -0.007 | 0.000 | -0.006 |
| India | -3.500 | 0.030 | 0.052 | -0.136 | -0.002 | 0.000 | -0.001 | -0.002 | 0.000 | -0.002 | -0.006 | 0.000 | -0.005 |
| Japan | -1.774 | 0.017 | 0.014 | -0.163 | -0.024 | -0.009 | -0.030 | -0.024 | -0.006 | -0.029 | -0.025 | -0.009 | -0.032 |
| Philippines | -2.170 | 0.025 | 0.054 | -0.364 | 2.515 | 0.994 | 2.627 | 2.085 | 0.222 | 2.161 | 4.039 | 0.994 | 4.192 |
| Rest-of-the-world | -3.367 | 0.024 | 0.047 | -0.517 | -0.017 | -0.010 | -0.023 | -0.017 | -0.006 | -0.022 | -0.029 | -0.010 | -0.036 |
| US | -0.527 | 0.067 | 0.160 | 0.804 | -0.004 | 0.000 | -0.004 | -0.004 | -0.001 | -0.004 | -0.005 | 0.000 | -0.005 |

Source: Authors' calculations

**TABLE A.2 Output subsidies (percent) - tradeable goods sectors - by scenario**

| Sector | Scale elasticity ($\psi$)[a] | Sector tags | | | Scenarios by implementer and scenario number | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MIC | IRA | DTI | China | US | US & China | US | Philippines | | | | | | | | |
| | | | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| Agriculture | 0.14 | | | ✓ | - | - | - | - | 6.0 | - | 5.1 | 4.7 | - | 3.8 | - | - | - |
| Fishing | 0.14 | | | | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Mining, energy | 0.17 | | | | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Mining, non-energy | 0.17 | | | | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Mining support | 0.17 | | | | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Food | 0.39 | | | | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Textiles | 0.22 | | | | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Wood | 0.23 | | | | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Paper | 0.32 | | | | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Petroleum | 1.22 | | | | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Chemical | 0.23 | ✓ | | | 9.6 | - | - | - | - | - | - | - | - | - | 8.5 | - | 8.3 |
| Pharmaceutical | 0.23 | ✓ | | ✓ | 9.6 | - | - | - | 6.8 | - | 6.1 | 5.7 | - | 5.0 | 8.5 | - | 8.3 |
| Rubber | 0.14 | | | | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Non-metallic | 0.17 | | | | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Basic metals | 0.21 | | ✓ | ✓ | - | - | - | 7.6 | 6.6 | - | 5.9 | 5.5 | - | 4.8 | - | - | - |
| Fabricated metal | 0.21 | | ✓ | | - | - | - | 7.6 | - | - | - | - | - | - | - | - | - |
| Computer | 0.55 | ✓ | ✓ | ✓ | 11.4 | - | - | 15.6 | 8.7 | - | 8.5 | 8.4 | - | 8.2 | 8.3 | - | 7.7 |
| Electrical equip. | 0.55 | ✓ | ✓ | ✓ | 11.4 | - | - | 15.6 | 8.7 | - | 8.5 | 8.4 | - | 8.2 | 8.3 | - | 7.7 |
| Machinery nec | 0.12 | ✓ | | | 8.8 | - | - | - | - | - | - | - | - | - | 8.6 | - | 8.6 |
| Motor vehicles | 0.13 | ✓ | ✓ | ✓ | 8.8 | - | - | 5.1 | 5.9 | - | 5.0 | 4.6 | - | 3.7 | 8.6 | - | 8.5 |
| Other transport equip. | 0.13 | ✓ | ✓ | | 8.8 | - | - | 5.1 | - | - | - | - | - | - | 8.6 | - | 8.5 |
| Manufacturing nec | 0.15 | | | ✓ | - | - | - | - | 6.1 | - | 5.3 | 4.8 | - | 4.0 | - | - | - |

Source: Authors' calculations using Ju et al.'s [2024] method for calculating heterogeneous optimal subsidies (see their Equation 13 in p. 51.)
[a] Scale elasticities are from Lashkaripour and Lugovskyy [2023]

**TABLE A.3 Philippine production (percent change) - by tradeable goods sector, scenario, and implementer**

| Sector | Scale elasticity ($\psi$)[a] | Sector tags | | | Scenarios - implementer and number | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MIC | IRA | DTI | China | US | US & China | US | Philippines | | | | | | | | |
| | | | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| Agriculture | 0.14 | | | ✓ | -12.4 | 0.5 | 1.0 | 0.3 | 9.6 | 2.5 | 9.9 | 7.3 | 2.0 | 7.5 | 2.0 | 0.8 | 2.4 |
| Fishing | 0.14 | | | | -13.5 | 0.5 | 1.0 | 0.1 | 1.8 | 0.6 | 2.2 | 1.9 | 0.6 | 2.3 | 5.6 | 1.4 | 6.4 |
| Mining, energy | 0.17 | | | | 32.7 | -3.7 | -8.9 | -14.7 | -56.6 | 8.8 | -49.5 | -68.7 | -5.6 | -67.9 | -84.1 | -20.9 | -84.8 |
| Mining, non-energy | 0.17 | | | | -13.8 | 0.3 | 0.5 | -1.6 | 20.9 | 10.4 | 29.5 | 13.2 | 6.2 | 17.6 | 8.4 | -1.5 | 6.1 |
| Mining support | 0.17 | | | | -16.9 | 0.9 | 1.8 | 0.2 | -10.2 | -2.1 | -10.3 | -7.0 | -1.4 | -7.2 | -17.9 | -6.2 | -19.7 |
| Food | 0.39 | | | | -13.3 | 0.5 | 1.0 | 0.2 | 2.6 | 0.6 | 2.9 | 2.5 | 0.6 | 2.8 | 4.7 | 1.0 | 5.1 |
| Textiles | 0.22 | | | | -10.3 | 0.3 | 1.5 | -0.2 | 1.0 | 0.6 | 1.4 | 1.4 | 0.5 | 1.8 | 5.1 | 0.8 | 5.2 |
| Wood | 0.23 | | | | -14.1 | 0.7 | 2.4 | -2.4 | 4.4 | -1.4 | 1.1 | 1.5 | -0.8 | -0.3 | -14.8 | -3.5 | -16.2 |
| Paper | 0.32 | | | | -15.6 | 0.6 | 1.2 | -0.2 | 0.2 | -2.0 | -0.9 | 0.9 | -1.4 | 0.2 | -1.7 | -1.7 | -2.5 |
| Petroleum | 1.22 | | | | -13.4 | 0.4 | 0.9 | -0.3 | 2.7 | 1.2 | 3.9 | 2.7 | 0.7 | 3.4 | 3.2 | -0.1 | 2.9 |
| Chemical | 0.23 | ✓ | | | -37.4 | 0.3 | 1.3 | -1.7 | 10.9 | -0.9 | 9.8 | 8.7 | 0.0 | 8.4 | 147.8 | 46.7 | 177.0 |
| Pharmaceutical | 0.23 | ✓ | | ✓ | -20.5 | 0.2 | 0.4 | -1.3 | 46.5 | 51.0 | 83.6 | 31.2 | 40.9 | 62.7 | 73.5 | 53.2 | 111.3 |
| Rubber | 0.14 | | | | -26.0 | 0.7 | 2.8 | -1.9 | 4.0 | -3.1 | 1.5 | 5.6 | -1.3 | 4.5 | 67.1 | -2.3 | 62.7 |
| Non-metallic | 0.17 | | | | -12.7 | 0.2 | 0.8 | -1.0 | 2.1 | 0.4 | 2.7 | 4.2 | 0.5 | 4.5 | 13.4 | -0.3 | 11.2 |
| Basic metals | 0.21 | | ✓ | ✓ | -17.8 | 0.7 | 1.3 | -3.4 | 49.6 | 22.6 | 67.8 | 28.7 | 12.2 | 37.4 | 28.5 | -0.5 | 24.5 |
| Fabricated metal | 0.21 | | ✓ | | -21.0 | 0.7 | 1.1 | -3.6 | 30.0 | -0.8 | 28.6 | 21.7 | 0.3 | 21.4 | 75.1 | 0.7 | 66.4 |
| Computer | 0.55 | ✓ | ✓ | ✓ | -38.1 | 1.0 | 1.4 | -5.5 | 63.1 | 4.2 | 65.9 | 59.5 | 3.5 | 62.0 | 62.9 | 4.7 | 62.9 |
| Electrical equip. | 0.55 | ✓ | ✓ | ✓ | -28.9 | 1.2 | 1.3 | -5.9 | 58.2 | 5.7 | 63.4 | 35.3 | 3.5 | 38.0 | 56.0 | 5.8 | 58.1 |
| Machinery nec | 0.12 | ✓ | | | -99.5 | 11.0 | 17.7 | -40.9 | 221.5 | -57.4 | 41.1 | 133.3 | -50.0 | 17.0 | >500[e] | >500[e] | >500[e] |
| Motor vehicles | 0.13 | ✓ | ✓ | ✓ | -19.1 | 0.6 | 1.0 | -0.4 | 27.5 | 0.5 | 24.8 | 20.5 | 0.5 | 18.2 | 35.9 | 0.5 | 36.2 |
| Other transport equip. | 0.13 | ✓ | ✓ | | -30.2 | 1.0 | 1.7 | -7.4 | 20.2 | -6.9 | 13.0 | 18.5 | -5.2 | 13.1 | 71.4 | 2.3 | 73.4 |
| Manufacturing nec | 0.15 | | | ✓ | -15.3 | 1.2 | 3.0 | -2.1 | 67.0 | 13.2 | 66.9 | 42.4 | 8.7 | 43.3 | 53.9 | -0.9 | 46.5 |

Source: Authors' calculations
[a]Scale elasticities are from Lashkaripour and Lugovskyy [2023].

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# Comment on "How might China-US industrial policies affect the Philippines?: a quantitative exercise"

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I read "How might China-US industrial policies affect the Philippines?: a quantitative exercise" with great interest. The study has valuable insights into the implications of third party industrial policy on the Philippines, as well as on the interaction of those industrial policies with Philippines' own industrial policy decisions. I commend the paper for its structured approach. It effectively helps organize thinking around complex international trade dynamics. Let me share a few specific observations about the model and its results.

First, the model attributed substantial importance to the scaling channel relative to price effects, particularly through the intermediate goods channel. Is the model sufficiently capturing the dynamics of international production networks, especially the productivity gains from "learning by importing" that arise when tariffs on intermediates and capital equipment are lowered? Empirical evidence points to the relevance of that channel, and it is often presented as one of the key gains from trade liberalization (e.g., Amiti and Konings [2007]; Lovo and Varela [2022]; and others). If the model doesn't account for these dynamics, it might underestimate the productivity or price effects, overestimating instead the relative importance of the scale benefits. China's subsidies affecting upstream sectors, could reduce prices of intermediate goods and subsequently lower production costs in the Philippines; it could also increase available varieties domestically, altogether contributing to productivity gains that could be better represented in a dynamic model.

Another relevant angle to explore is whether scale effects are mediated by features of comparative advantage in products targeted by US and China's industrial policy. An important reference in this area is the work by Freund et al. [2024] on the impacts of US-China decoupling that shows how various countries gain or lose market share due to shifting trade patterns. While countries like Mexico and Vietnam gain, the Philippines does not appear to benefit. Examining the composition of Philippine exports relative to the products that China previously supplied to the US can help understand if the presence or absence of revealed comparative advantages in targeted products is affecting the extent to which Philippines could benefit or lose out of these policies. This similarity

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in exports, or lack thereof, could help clarify the scale effect's magnitude by assessing how closely the Philippine production profile aligns with that of China in specific sectors.

In terms of Philippines' industrial policies this study is highly relevant, particularly considering current discussions around "Tatak Pinoy", a national industrial policy initiative. The potential role of deep trade agreements in mitigating the negative effects of industrial policies imposed by trade partners is another area worth examining further. Barattieri et al. [2024], for example, point out that agreements with provisions on subsidies can potentially shield countries from adverse impacts or even lead to gains from industrial policy implemented by trading partners. Considering such agreements as potential "shields" for the Philippines then becomes important.

Another area requiring follow up research relates to the types of industrial policy the Philippines might adopt. Evaluating different policy options, such as subsidies or infrastructure investments may be required. Investments in infrastructure, which could address coordination failures for sectors prioritized by the Department of Trade and Industry (DTI), could act as implicit subsidies, possibly aligning with the government's upcoming reforms. The DTI's initiative known as "Tatak Pinoy" might benefit from academic input on prioritizing these policy strategies, whether through coordination-focused infrastructure or targeted tax expenditures.

I would encourage researchers to go beyond the focus on DTI's priority sectors, and provide alternative simulations that concentrate on sectors with high production similarity to China's or to the US. By providing subsidies to these high-potential sectors, the Philippines could gain a greater competitive advantage and enhance scale effects more effectively in this current geopolitical context.

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