



Should high domestic value added in exports be an objective of policy?

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ABSTRACT

Global value chains make it easier for developing countries to move away from export reliance on unprocessed primary products to become exporters of manufactures and services. Global value chains (GVCs) allow countries to specialize in a particular activity and join a global production network. As a developing country moves from export of primary products to export of manufactures and services via GVCs, *the ratio of domestic value added to gross export value tends to fall*. Many developing country policy-makers worry about this trend and aspire to increase their value added contribution to exports. There are a number of reasons why this objective

is not good policy. It may seem like simple math that a higher domestic value added share means more total value added exported and hence more GDP. But that simple idea ignores the reality that imported goods and services are a key support to a country's competitiveness. The chapter documents this via the history of the successful East Asian industrializers as well as more recent evidence from Association of South-east Asian Nations (ASEAN) economies. If a country artificially replaces key inputs with inferior domestic versions, the end result is likely to be fewer gross exports and less, not more, total value added exports.

- In almost all countries, developed and developing alike, the share of domestic value added in exports has tended to trend downwards recently. This reflects the expansion of global value chains.
- Many developing countries worry about this phenomenon and aspire to increase their value-added contribution to exports. This objective should be approached cautiously. Imported goods and services are a key support to a country's competitiveness. If a country artificially replaces key inputs with inferior domestic versions, the result is likely to be fewer gross exports and fewer, not more, total value-added exports.
- China's recent experience is often given as an important counter-example, since its domestic value-added ratio has been rising over the past decade, but our research indicates that this trend is primarily the result of technological advances in China.
- Consequently, the Chinese ratio can be expected to peak and later decline if China further opens up and follows in the steps of other earlier Asian industrializers, such as Japan and the Republic of Korea.

1. Introduction

Global value chains make it easier for developing countries to move away from export reliance on unprocessed primary products to become exporters of manufactures and services. Before the development of GVCs, a country had to master the production of a whole product in order to export it. GVCs allow countries to specialize in a particular activity and join a global production network. As a developing country moves from export of primary products to export of manufactures and services via GVCs, *the ratio of domestic value added to gross export value tends to fall*. Developing countries often start out at the end of value chains, with labor-intensive assembly of parts produced elsewhere. For some individual products the ratio of domestic value added to gross export value can be very small, maybe only a few percentage points. The gross exports from the country can be very large, but this is an artifact of the position in the value chain. The country's value added contribution to the export is much smaller. Many developing countries worry about this phenomenon and aspire to increase their value added contribution to exports. There are a number of reasons why this objective should be approached cautiously. It may seem like simple math that a higher domestic value added share means more total value added exported and hence more GDP. But that simple idea ignores the reality that imported goods and services are a key support to a country's competitiveness. If a country artificially replaces key inputs with inferior domestic versions, the end result is likely to be fewer gross exports and less, not more, total value added exports.

In this chapter we examine this issue. Section 2 looks at the historical experience of the successful East Asian industrializers, Japan, the Republic of Korea, and Chinese Taipei. Section 3 then focuses on the more recent experience of ASEAN economies as well as general literature on the issue of domestic value added content of exports. Section 4 looks at policy measures that economies can consider in order to move up the technological ladder. In general, artificially trying to boost domestic content is going to be a losing strategy. Countries would do better to focus on human capital development, support to R&D, intellectual property rights protection, and opening up remaining closed sectors of the economy, especially services.

2. The decline of domestic value added in exports in Japan, the Republic of Korea, and Chinese Taipei

After two decades of dedicated work among international economists in measuring international fragmentation, a consensus has more or less formed, that the trend of domestic value added in exports is declining. Starting from autarky, when the economy opens to trade, there are several reasons why the domestic content of exports would begin to decline. Opening up to imports of intermediate goods and services means that a country's producers have access to the most competitive inputs

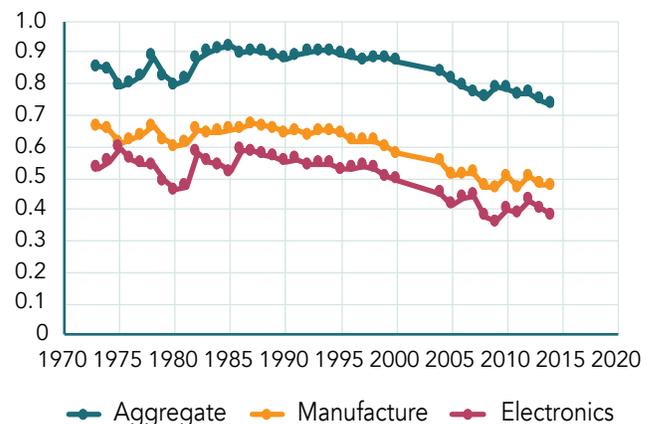
and will make use of some of them. The decline in the share of domestic value added in exports in many cases is also the result of structural change in the export basket. Economies that open up after an autarkic period often start by exporting primary products, which tend to be relatively homogeneous worldwide. Manufactures produced in closed economies are low-quality and find few markets. Over time, however, with openness to imported inputs, a competitive manufacturing sector may emerge. China, Mexico, and Viet Nam are all examples of economies that initially exported primary products after opening up, but soon moved to manufacturing exports. That structural shift will tend to reduce the domestic content share of overall exports because that share is generally higher for primary products and lower for manufactures. So, in general, we observe a declining domestic value added ratio over time. Further, this indicator does not have direct welfare implication, so it is not appropriate to formulate policies around pursuing a higher domestic content ratio in exports.

In this section we examine historical data for three industrializing economies in East Asia to study the development of domestic content in exports. We proceed in three steps of analysis, namely the aggregate trend for the total economy, the trend for manufacturing products, and the trend for the electronics industry, a high-tech sector.¹

2.1 The case of Japan

For Japan, annual input-output tables date back to 1973. It is evident that the domestic content in overall exports has declined, decreasing roughly 0.12 points from 1973 through 2014 (Figure 7.1). Several factors may account for this decline. It can be seen that the domestic value-added ratio (DVAR) in manufactures is always below that of total exports, reflecting differences between

FIGURE 7.1 Domestic value added in Japanese exports



Source: Authors' calculation based on Japan's national IO table.

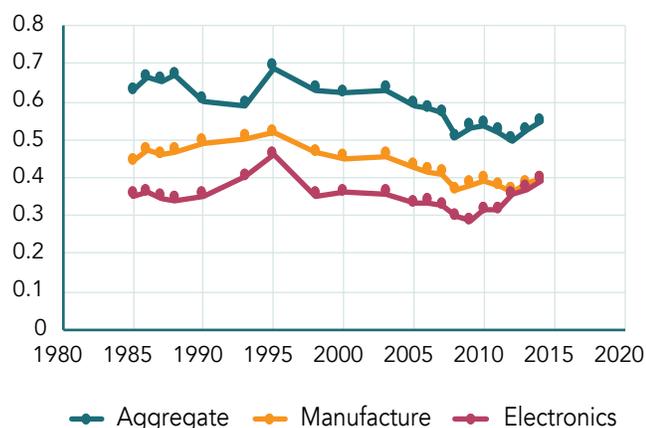
manufactures and primary products. The latter have relatively few intermediate inputs, and hence few imported inputs. The structural shift away from primary exports towards manufactured exports would pull down the DVAR in overall exports. In addition, various waves of trade liberalization gave Japanese producers better access to imported goods and services for production.

Clearly, this decline trend is more pronounced for manufactured products, as well as for the high-tech electronics sector, especially after 1990 when Japan's serious trade liberalization accelerated. The general pattern is similar, while the ratio for manufacturing products and electronics are much lower than the aggregate. In addition, they decrease 0.19 and 0.15, respectively, comparing with 0.12 for the aggregate value. Arguably, the expanding international production fragmentation is well observed in Japan's case. It is also notable that electronics is the most high-technology sector, and here Japan's domestic value added in less than 40% of the gross export value in the most recent year. Thus, success in the high-tech sector goes hand-in-hand with extensive use of imported inputs and services.

2.2 The case of the Republic of Korea

For the Republic of Korea, annual input-output tables date back to 1985. It is observed that the aggregate ratio of the domestic content in exports declined, with most of the change since 1995 (Figure 7.2). Between 1995 and 2014 the ratio dropped roughly 0.15. Next, we observed that the decline was similar for manufactured products; while the general pattern is similar, the ratio for manufacturing products is much lower than the aggregate. DVAR for aggregate exports was about 0.55 in the most recent year, compared to less than 0.40 for manufactures. The trend for the electronics sector is similar.

FIGURE 7.2 Domestic value added in Korean exports



Source: Authors' calculation based on the Republic of Korea's national IO table.

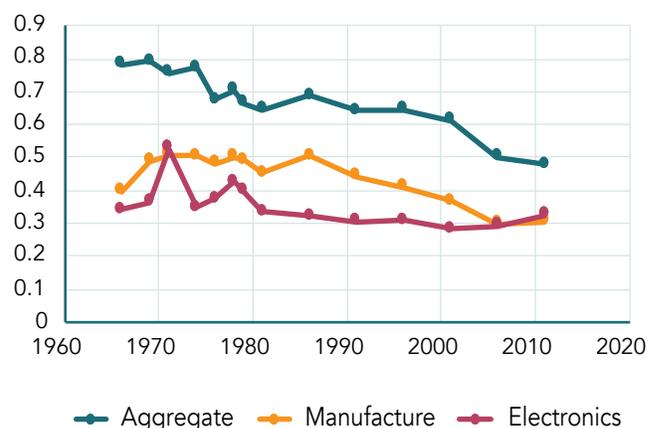
As in Japan's case, several factors may account for the decline in the ratio of domestic value added to export value, such as the continuing trade liberalization, international production fragmentation, and structural shift from primary exports to manufactures. As with Japan, the DVAR in electronics is particularly low. The Republic of Korea has very successfully developed its own brands in televisions and smartphones, yet the DVAR in electronics has generally been below 40%. The Republic of Korea's success results from combining domestic value added with imported components and services.

2.3 The case of Chinese Taipei

For Chinese Taipei, annual input-output tables date back to 1960s, and the domestic content of exports peaked in 1969 with a ratio of roughly 79 percent (Figure 7.3). Domestic content has fallen sharply over time, reaching 48 percent in 2011. Hence, the overall decline was around 30 percentage points (comparing with the world average ratio of value added to exports falling by roughly 10 percentage points, as reported in Johnson and Noguera, 2016), which is remarkable. Different from its Asian peers such as Japan and the Republic of Korea, Chinese Taipei is a typical small open economy. Given the growth of international production fragmentation, along with Chinese Taipei's steady trade liberalization, it is expected that the ratio of domestic content to exports would see a sharp decline.

As a strategy for the developing regions to integrate into the world economy, joining global production is one of the shortcuts. This is particularly true for small open economies. In this way, the domestic industry structure is no longer a prerequisite for producing internationally competitive products, as they can specialize in some particular stage of production, e.g. processing and assembly activities.

FIGURE 7.3 Domestic value added in exports of Chinese Taipei



Source: Authors' calculation based on Chinese Taipei's IO table.

3. Developing countries' experience of joining GVCs

This section will analyze the recent experiences of developing countries by comparing the domestic value-added (DVA) in exports and its implications for the labor market. In the last few decades, we have noticed that many developing countries have been joining at the lower end of the value chain and have been able to increase their gross exports, achieve higher GDP per capita growth, and generate employment opportunities despite the reduction in DVA in gross exports. However, the policymakers in some of these economies are now targeting to increase the DVA in gross exports by using tariff and non-tariff barriers to imported inputs. They believe that the best way to utilize the exporting activity for development is by increasing the DVA content in gross exports as it will create more and better job opportunities for domestic workers, given everything else remains constant.

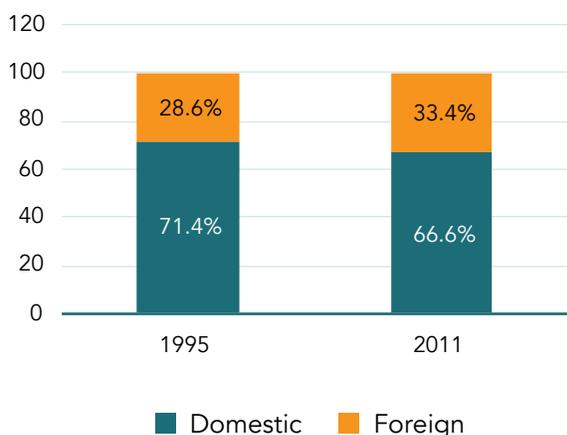
Figure 7.4 compares the ASEAN exports in 1995 and 2011. From 1995 to 2011, DVA share in exports dropped from 71% to 67%, though, it can be seen that the absolute value of exports increased many folds. Much of this increase has been attributed to increase in the intermediate exports i.e. exports related to the GVCs. This tremendous increase in gross exports also led to remarkable growth in jobs. Using empirical evidence, Lopez-Gonzalez (2016) has shown that the foreign value-added, in form of intermediate imports as well as services, plays a significantly positive role in enhancing the employment as well as productivity (value-added per worker) in the ASEAN countries.

Intuitively, importing better quality intermediates as well as services, increases the competitiveness of the domestic firms in the international market and leads to higher demand for the product as well as employees in exporting sector.

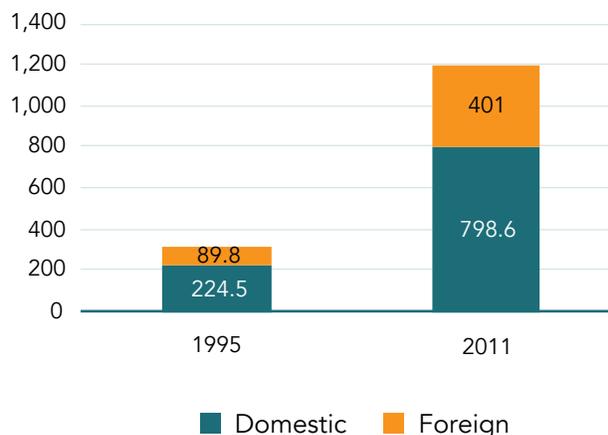
There is no single strategy that works for every economy. Each country has to realize the economic activity that can be integrated into the GVCs. Figure 7.5 shows backward and forward GVC linkages for Asian economies in 1995 and 2011. Viet Nam, for example, has increased the backward linkages, that is, the use of imported goods and services in its production of exports. Viet Nam has primarily participated at the production and assembly stage of manufacturing sector (light manufacturing, electrical equipment, electronics etc.) in the GVCs. Viet Nam's DVA share in gross exports fell from 79.1% to 63.7% during this period. During the same period, GDP per capita in Viet Nam increased from \$288 in 1995 to more than \$1500 in 2011. Viet Nam has been able to shift a significant proportion of workers from the relatively less productive agricultural sector to the more productive manufacturing and services sectors. This remarkable progress has been achieved by embracing trade and investment openness by signing a Bilateral Trade Agreement with USA in 2002 and joining the WTO in 2007. These agreements encouraged Viet Nam to reduce the import tariffs and improve infrastructure to attract foreign direct investment (FDI). These policies resulted in importing better quality inputs as well as related services and focusing on the stage of production (primarily assembling and processing) where the Vietnamese firms/workers have comparative advantage. In 2017, nearly a third of

FIGURE 7.4 Enjoying a smaller share of bigger pie, ASEAN exports

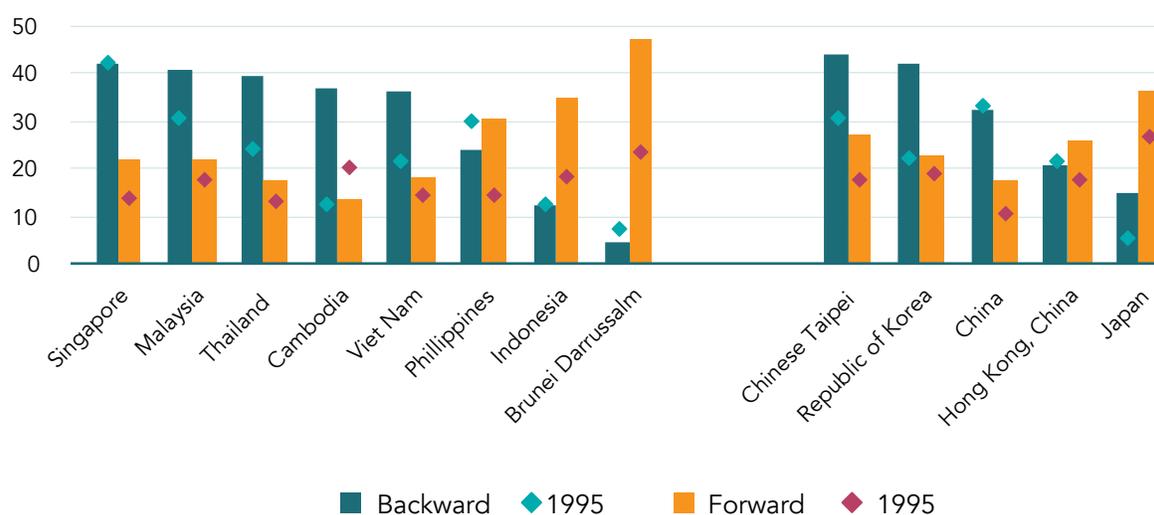
Value added content of exports (share)



Value added content of exports (Value in billion USD)



Source: Lopez-Gonzalez (2016).

FIGURE 7.5 GVC participation in Factory Asia

Source: Lopez-Gonzalez (2016).

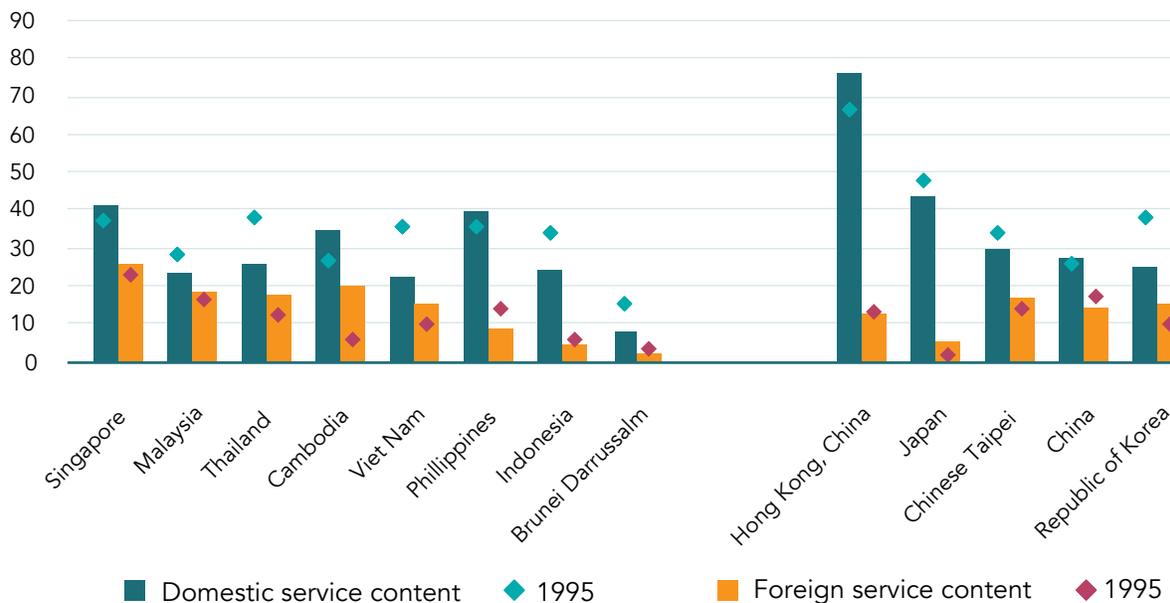
the Viet Nam's exports as well as imports consisted of electrical and electronics equipment despite having a shortage of skilled workers in the labor force. This has been possible only by joining the GVCs in electronics and electrical equipment.

In contrast, Indonesia has not seen much change in backward linkages since 1995 as its specialization lies in natural resources and hence, it has strengthened its forward linkages since then. Indonesia joined the global value chains in relatively upstream industries. Indonesia's GDP per capita has also grown three times during the same period, though, this phenomenal growth has come through forward linkages in GVC participation. We can also notice that most of the other countries in ASEAN followed a similar pattern of achieving higher growth in GDP per capita as well as exports related to the GVCs.

Figure 7.6 shows that the share of foreign value added in gross exports of the domestic economy is not only increasing through importing more intermediate products but also through utilizing foreign services in exports. These foreign service providers, being much more efficient than the domestic providers, also play a significant role in enhancing the competitiveness of the exports. It must be emphasized that different economies in ASEAN entered at different stages of GVCs and specialized in different industries (or possibly within the same industry but at different stages of production) based on the comparative advantage of the domestic economy. Most of the ASEAN economies have integrated well into the regional as well as global value chains depending on the relative comparative advantage of the domestic economy. This integration helped these economies to achieve much higher GDP growth and create millions of job opportunities for their workers and helped a significant proportion of the population to lift out of poverty.

In order to highlight the implications of directly targeting the DVA in exports as a national policy for development, we can compare Bangladesh and Pakistan's approach towards the exports in the textile and clothing sector. The biggest exports of both countries have been textiles and clothing. In 1990, Bangladesh's exports (\$1.09 bn) were a third of Pakistan's exports (\$3.5 bn) in textiles and clothing. Since then, Pakistan, being a cotton producer, incentivized the textile producers to use the local inputs and export the finished products. Bangladesh, mostly importing the raw materials for textile and clothing, focused more on the trade reforms and opening up the economy to foreign investors. Bangladesh integrated its textile and clothing sector in the global value chains, sourcing most of the raw material from abroad and exporting readymade garments to the developed world. This helped Bangladesh to slowly convert its comparative advantage in *clothing* into competitive advantage over time by using better quality inputs as well as foreign services by collaborating with the leading garments manufacturers. In 2016, Pakistan's textile and clothing exports (\$12.4 bn) were less than half of Bangladesh's exports (\$28.3 bn).² Using Johnson (2018), we can calculate the DVA in the Textile and Clothing sector for these two economies in 2014.³ Bangladesh's DVA in the Textile and Clothing sector was 64.5% as compared to 80.3% for Pakistan.⁴ It can be seen that Bangladesh's exports have risen much faster as compared to Pakistan despite having lower DVA in exports. As the labor costs are rising in China, many garment producers might look for opportunities abroad to relocate their plants. Bangladesh, being well integrated into the GVCs in textile and clothing, the second biggest exporter of garments and offering lower wages, will be the first choice of these firms to relocate. The textile and garment sector in Bangladesh has also

FIGURE 7.6 Service content of exports in Factory Asia



Source: Lopez-Gonzalez (2016).

helped to achieve twice the female labor force participation rate as that of India and Pakistan as nearly 85% workers are females in this sector. Bangladesh’s GDP per capita also surpassed Pakistan’s GDP per capita in 2017.

Another good example of the contrast between global integration and import substitution comes from the auto sector in Malaysia and Thailand, neighboring countries at similar stages of development. Malaysia tried to develop an indigenous auto industry and a national champion brand through protectionist policies, whereas Thailand strove to join GVCs around existing brands by attracting FDI from Japanese and American companies. Thailand’s strategy enabled it to integrate into successful value chains and become a significant exporter of auto value added, primarily via parts. Malaysia’s effort did not produce a globally competitive car and eventually had to be abandoned (Wad 2009).

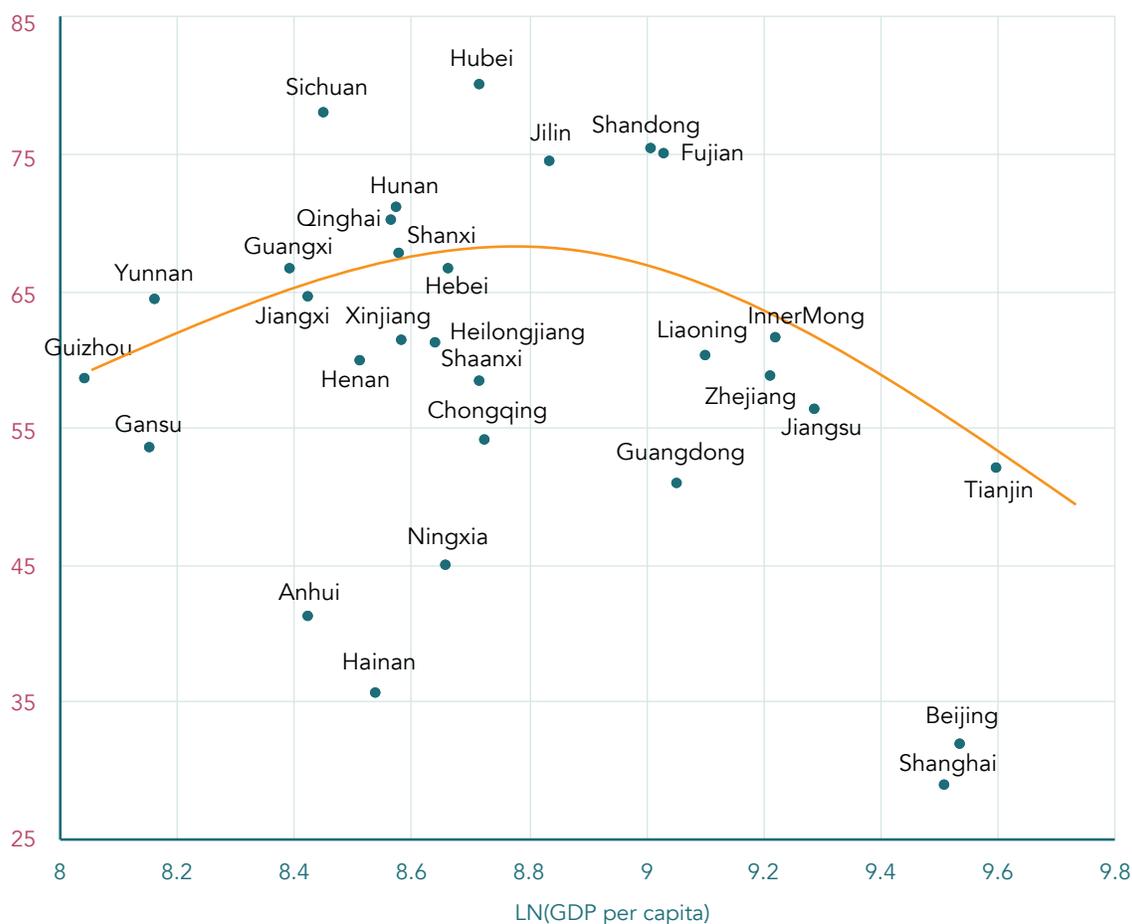
All the examples discussed above suggest that participation and integration into the GVCs help the economies to improve their trade competitiveness, achieve higher GDP per capita growth and improve female labor force participation despite falling DVA in gross exports. Global technological advancement as well as falling trading costs have resulted in the fragmentation of production across borders. This reduction in trade costs helps the firms to exploit the comparative advantage of each country in the specific stage of production and hence, there is a reduction in DVA in gross exports. The only country that has been able to buck the trend of global decline in DVA in gross exports despite increasing GDP per capita as well as rising exports has been China. China has been able to increase the DVA in exports

as well as achieve higher GDP growth rate since joining WTO. Tang et al. (2018) have suggested that the substantial improvement in technology in China, along with falling trade costs, have been the reason for the rising DVA in gross exports recently. China has also invested hugely in improving human capital in the last two decades to complement the advanced technology adoption by Chinese firms. Though, as we can see from the experiences of the Republic of Korea and Japan, this might be a short-lived phenomenon. Once the Chinese economy catches up in technology with other economies and achieves the maximum DVA in exports, rising labor costs and stringent environmental standards might push the firms to outsource the low value added segment in production to the other regions in the world to maintain competitiveness by the exporting firms.

The regional experiences within China provide some additional perspective on the relationship between DVA and level of development. Across Chinese provinces there is an inverted-U shape relationship in which DVA tends to rise with per capita GDP and then decline beyond a certain threshold (Figure 7.7). In general, the richest provinces in China have low ratios of domestic value added to exports. Beijing and Shanghai have particularly low ratios. But the export powerhouse of Guangdong also has a low domestic value-added ratio, and hence a high ratio of imported inputs. This is consistent with the view that export success requires access to the best inputs in terms of manufactured parts and supporting services. As more Chinese provinces develop in the direction of the already successful ones, the national ratio of domestic value added to gross exports is likely to fall.

FIGURE 7.7 Relationship between per capita GDP and the provincial VA rate of exports

Intra-provincial VA rate of export: %



Source: Li et al. (2018).

These results have also been supported by the empirical analysis for other developing countries in the literature. Using the manufacturing firms' data from Indonesia, Amiti and Konings (2007) find that a 10% reduction in import (input) tariffs would lead to 12% productivity gains for the importing firms, at least twice as high as gains from reducing the output (final goods) tariffs. Interestingly, Goldberg et al. (2010) show that removing (or lowering) the import tariffs on newer inputs also assists the domestic firms to introduce newer products. They show that the lower input tariffs accounts for an average of 31 percent of the newer products introduced by domestic firms in India. Kugler and Verhoogen (2012) study the impact of quality of inputs and outputs on the plant size, in terms of employment, for Colombian manufacturing sector. They found that the more productive plants use higher-quality imported inputs as indicated by comparing the price of domestic input in the same category by the same plant. They also showed that there is positive correlation between the quality of inputs and the plant size and the price of the output, an indicator of quality of the product. Since reducing

the import tariffs on intermediates will help the firms to import higher quality inputs, it will also help to increase the employment in the plant, along with improving the quality of the output, irrespective of the firm being an exporting firm or producing for the domestic market. These results from the existing literature suggest that adding tariffs on the imported inputs will not only adversely affect the quality, employment and number of products of the firms in exporting sector but also of the domestic firms.

4. Policies for technological upgrading

Technological upgrading is an important part of the convergence process. Developing countries that are integrated into the global economy generally have had more rapid total factor productivity growth – our best way to measure technological advance – than the already developed economies. Developed economies are at the frontier and have to invent new technologies, which is costly and difficult. Developing countries can absorb already existing

technologies through direct foreign investment and learning. As they progress, it is natural for developing countries to begin spending resources on inventing new technologies so the more advanced developing economies are both absorbing existing technologies and innovating new ones.

We have seen earlier in this chapter that, at certain stages of development, technological advance goes hand-in-hand with higher domestic value added content of exports. We see the causality here running from technological advance to GVC structure, not from domestic content to technological advance. The reason for this conclusion is that, for Japan, the Republic of Korea, and Chinese Taipei, as well as for the other technologically advanced economies such as Germany and the U.S., the clear trend is for DVAR to fall. The most advanced technological economies are all extremely open, capitalist economies. Firms are choosing in competitive markets which inputs – goods and services – to source locally and which to source internationally. The result in all of these economies is more international sourcing over time.

We conclude from these patterns that it is reasonable for a developing economy to aspire to more rapid technological advance, which will contribute to higher living standards both directly and indirectly (because technological advance raises the return to investment and encourages capital accumulation). In certain periods, this may lead to an increase in the DVAR, but in the long run it is likely to lead to declines in DVAR as has been witnessed in all of the advanced economies. It is an easy mistake for developing countries to see the causality going the other way. If all else were equal, then increasing DVAR would mean more total value added and typically higher productivity. The problem with this thinking is *all else will not be equal*.

Firms in competitive economies source goods and services internationally if they are superior in quality and/or lower cost. If a country artificially induces firms to source locally, it will reduce their competitiveness and lead to less total value added and productivity. From a policy point of view then, developing countries should encourage technological advance but remain indifferent to whether inputs are sourced locally or internationally. That is a choice best left to the firm. There are policies that countries can use to encourage technological innovation, such as support for STEM (science, technology, engineering, and mathematics) education, subsidies to R&D, intellectual property rights (IPR) protection, and openness to foreign trade and investment.

The leading countries in the world producing STEM graduates are now China and India. In 2016 China produced almost 5 million STEM graduates (undergraduate and graduate combined), and India, nearly 3 million (Figure 7.8). This was far in excess of the 568,000 graduated in the U.S. Russia, Iran, and Indonesia also produced significant STEM graduates. This increasing pool of technical labor in emerging markets naturally encourages hi-tech industries to expand there, including the establishment of research centers. Aside from quantity of graduates, there is also the important issue of *quality*. Most of the top research universities in the world are in the U.S. and Western Europe, but Chinese and Indian universities are starting to climb the ranks. In 2018, 43 of the top 100 research universities in the world were in the U.S., followed by Continental Europe, Australia and Canada (Figure 7.9). China came next. The highest ranked universities from China were Peking University (#27) and Tsinghua University (#30). No Indian university has yet cracked the top 100.

FIGURE 7.8 Countries with the most STEM graduates (2016)

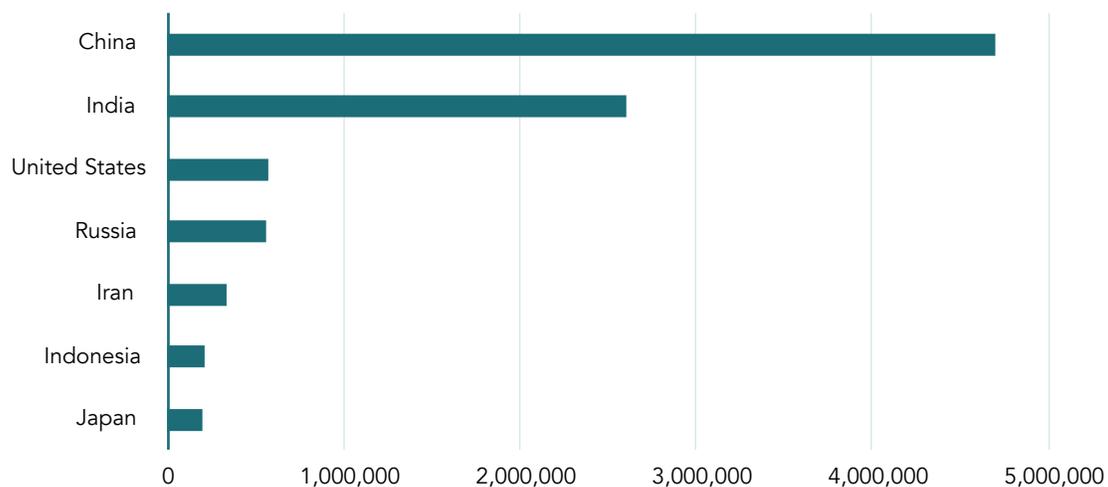
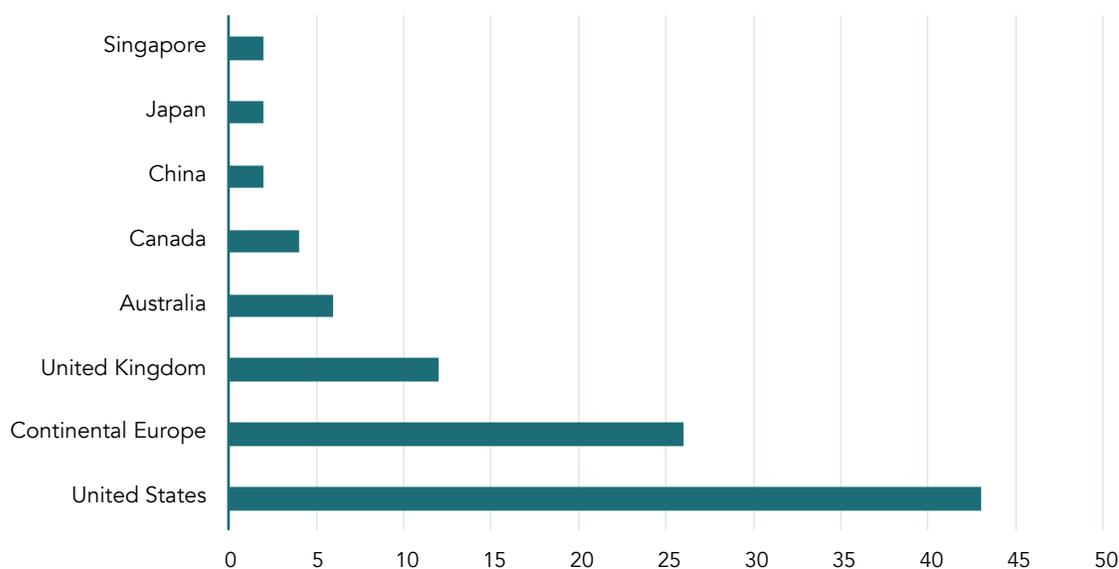


FIGURE 7.9 Top 100 world research universities, by area (2018)

Source: The Times Higher Education World University Rankings 2018.

Emerging markets in general still spend very little on research and development. India, despite its success in certain hi-tech areas, spends only about half a percent of GDP on R&D. In fact, most emerging markets do not even report consistent data on R&D because it is such a small part of their economies. China is the notable exception. As recently as 2001 China spent less than 1% of GDP on R&D, but that figure has been climbing steadily in recent years and in 2015 China spent more than 2% (Figure 7.10). The advanced economies generally spend between 2 and 3% of GDP on R&D, and China has now joined that club. In both China and the U.S., about one-fifth of R&D is financed by the government, with the rest primarily coming from industry. This reveals that it is difficult for the government to have much direct effect on R&D. Subsidies, usually in the form of tax breaks, play some role. But, in general, R&D is based on corporate decisions which are influenced by availability of technical labor and other aspects of the policy environment.

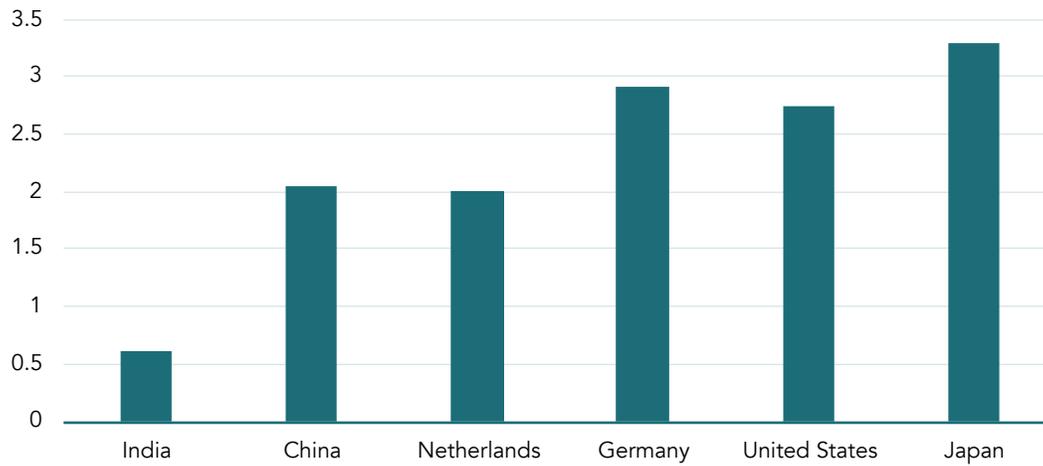
One of the most important aspects of the policy environment for R&D is intellectual property rights protection. Since the vast majority of R&D funding comes from industry, it is aimed at developing commercial innovations – new technologies for providing goods and services. The logic of IPR protection is to provide a *temporary* monopoly for the innovator. This is necessary to create a financial incentive to innovate. If innovations could be instantly copied, then there would be no incentive for R&D. On the other hand, once innovations exist it is socially optimal for them to diffuse, and for that reason IPR protection tends to be temporary and imperfect, allowing reasonable offshoots to develop quickly. One of the striking

differences between the advanced economies and emerging markets is in the quality of IPR protection. All of the top innovative economies score very highly on an index of IPR protection from the Intellectual Property Rights Alliance (Figure 7.11). Emerging markets such as Argentina, Brazil, China, India, Indonesia, and South Africa lag well behind. For countries like China that have made progress with the *inputs* of innovation, such as STEM graduates and R&D spending, improving IPR protection should be a key priority in order to get the greatest innovation output from the effort.

The most technologically advanced countries have seen their DVARs decline in recent years as they make proportionally more use of imported inputs. These economies also tend to have large shares of services in their exported value added. This rising service share reflects two factors: first, there is growing service content embodied in manufactured products, such as software in automobiles and appliances; second, as value chains become more fragmented, services such as finance, telecom, and transport are increasingly important in managing value chains. Given these trends, it is not surprising that the most technologically advanced countries tend to be very open to trade and investment in services. In these sectors trade and investment tend to go together because it is hard to trade most services without an investment presence.

The OECD calculates a direct investment restrictiveness index for whole economies and for particular sectors. The advanced economies that make up the OECD are open in virtually all sectors. Emerging markets, on the other hand, tend to be fairly open in manufacturing but still somewhat closed in services such

FIGURE 7.10 R&D as a share of GDP (2015)

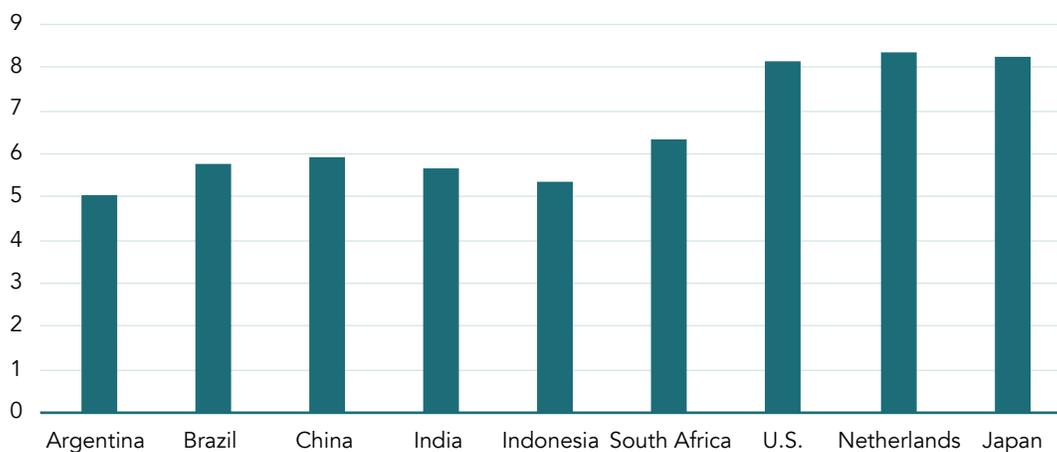


Source: World Bank (2018).

as telecom and finance (Figure 7.12). This is particularly true for China, which overall is the most closed among major emerging markets. Countries such as India and Indonesia are not as closed as China, but far from OECD levels. Argentina, Brazil, and South Africa all tend to be more open. In the case of China, there is

firm-level evidence that the closed service sectors have low productivity levels and growth rates. Hence, the protected strategy consigns China to poor-quality services that then make it more difficult for other sectors, including manufacturing, to reach international quality.

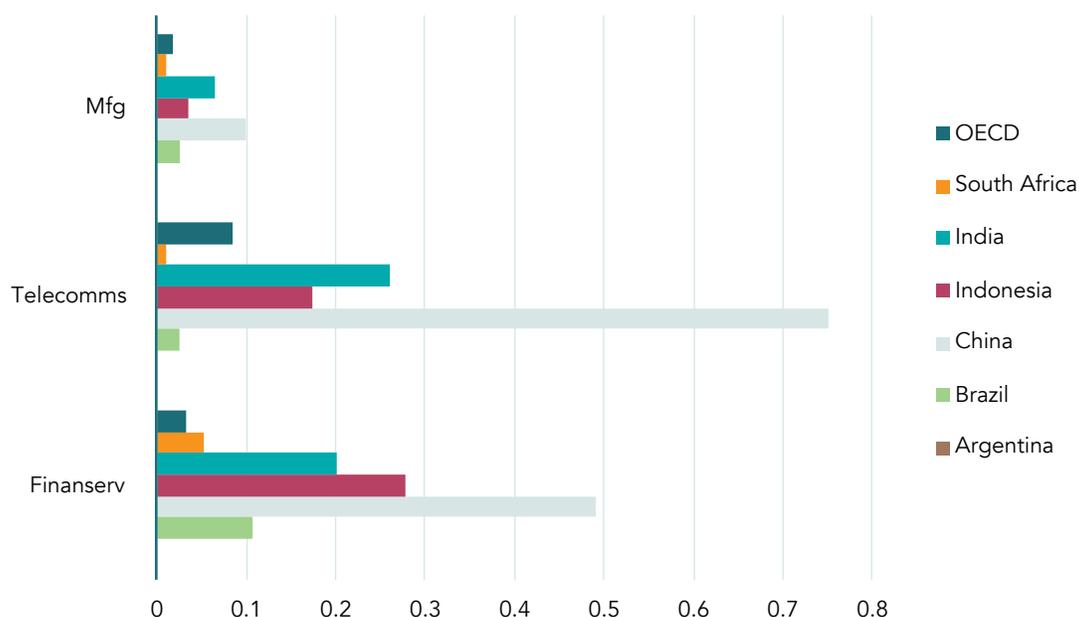
FIGURE 7.11 IPR protection index (2018)



Source: <https://www.internationalpropertyrightsindex.org/>

FIGURE 7.12 FDI restrictiveness index for manufacturing, telecom, and financial services (2018)

(0= open, 1= closed)



Source: <https://stats.oecd.org/Index.aspx?datasetcode=FDIINDEX#>

Concerns that China is not as open as other major economies have been compounded by the *Made in China 2025* program. This plan, from the Ministry of Industry and Information Technology (MIIT), aims to transform China into a hi-tech powerhouse and focuses on ten industries:

- Artificial intelligence and quantum computing
- Automated machine tools and robotics
- Aerospace
- Maritime equipment
- Modern rail transport equipment
- Self-driving and new energy vehicles
- Power equipment
- Agricultural equipment
- New materials
- Biopharma and advanced medicine

MIIT's plans call for rising domestic content for these sectors. Other Chinese officials emphasize that these are indicative, not mandatory targets. Mandatory domestic content requirements would be a WTO violation. The IMF discussed these issues with Chinese authorities during the 2018 Article IV consultation: "The authorities stressed that their plan to develop strategic sectors would be market-based.... The authorities clarified that the government did not set mandatory targets for domestic content.... They emphasized that domestic and foreign companies would be treated equally in China's effort to update its industrial sector, noting that industrial policies needed to be market-oriented." (p. 22)

Still the *Made in China 2025* program, along with China's ongoing investment restrictions, have created some confusion about the direction of policy. China is likely to get the most out of its impressive investment in STEM students and R&D if it opens the remaining sectors of the economy and continues to improve IPR protection. If, alternatively, it tries to artificially pump up the domestic content of favored sectors, that is likely to be a recipe for slow technological advance and ongoing trade conflicts.

Every economy in the world has an opportunity to join GVCs irrespective of the type of human and physical capital available in the economy. If the domestic economy has relatively higher skilled workers like Singapore or Hong Kong, China, they will join the GVCs at higher value-added segment like designing or high-end services (like marketing, financial etc.). On the contrary, if the economy has relatively more unskilled workers, it would join the GVCs in lower value added segments like assembly and packaging. Even if the economy joins at the lower value-added segment, it still helps the economy to generate more and better job opportunities for the unskilled workers. Every country needs to assess how skilled (or unskilled) the workforce is, which region it is located in and what comparative advantage it can exploit to join the GVCs in a specific sector. Once it is integrated, to enhance the value-addition (or move up the value-chain), following the Chinese example, the domestic economy needs to invest in upskilling workers, R&D and technology adoption by firms, as well as supporting ICT and physical infrastructure by converting comparative advantage into competitive advantage. If the

economy tries to increase the DVA in exports by artificially supporting the inputs/intermediates by using tariffs and non-tariff measures, it will increase the cost of production and make the product less competitive in the international market, resulting

in reduced demand for the product as well as workers in the exporting sector and will also affect the productivity and quality of the domestic firms as well, adversely affecting the welfare in the society.

Notes

1. It is common practice to present the aggregate trend for domestic content in exports, and then for manufacturing as most trade take place in this sector. Following Johnson and Noguera (2016), the total economy is grouped into four categories, Agriculture, Forestry, and Fishing, Non-Manufacturing Industrial Production, Manufacturing, and Services.
2. Though, this difference in policy is not the only reason for poor exporting performance by Pakistan but one of the primary reasons. During the same period, Pakistan experienced many security issues and crippling power outages.
3. We are using 2014 as it is the latest year in GTAP (version 10) database, recording the data for these two economies
4. The aggregate DVA for Bangladesh (67.6%) is also lower as compared to Pakistan (82.6%) despite having higher total exports as well.

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