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A Diversification Strategy for South Asia

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Asia and Pacific Department

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Abstract

While South Asia has gone a long way in diversifying their economies, there is substantial scope to do more. Some countries – India, Nepal, and Sri Lanka – can build on their existing production capabilities; others – Bangladesh, Bhutan, and the Maldives – would need to undertake a more concerted push. We identify key policies from a large set of potential determinants that explain the variation in export diversification and complexity across 189 countries from 1962 to 2018. Our analysis suggests that South Asia needs to invest in infrastructure, education, and R&D, facilitate bank credit to productive companies, and open to trade in order to diversify and move up the value chains. Given the COVID-19 pandemic, investing in digital technologies as part of the infrastructure push and improving education are of even greater importance to facilitate the ability to work remotely and assist resource reallocation away from the less viable sectors.

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I. INTRODUCTION

Diversification and structural transformation play important roles in the process of economic development. Increases in income per capita, especially at the early stages of development, are often accompanied by a transformation of production and export structures, diversification into new products and trading partners, and increasing the quality of existing products – quality upgrading. This relationship has been found and discussed in "Sustaining Long-Run Growth and Macroeconomic Stability in Low-Income Countries: The Role of Structural Transformation and Diversification" (IMF 2014). Cherif et al. (2018) found that export sophistication is the only robust determinant of growth among standard growth determinants such as human capital, trade, financial development, and institutions, and that other growth determinants may be important to the extent they help improve export sophistication.

More recently, the COVID-19 pandemic has given an even greater impetus for countries to diversify and, as the permanent impact on sectors becomes clearer, creating the need to facilitate the reallocation of resources from less viable to more viable sectors.

In this paper, we document South Asia[1]'s progress on diversification and explore policy options to promote greater export diversification and economic complexity. The main findings of this paper are as follows:

- South Asia's liberalization path has been associated with greater diversification of exports – from raw agricultural to garments and services. However, there is still substantial scope to increase the diversity of South Asian exports to catch up with its neighbors. India, Nepal, and Sri Lanka are especially well positioned to improve the complexity of their exports, given their existing production facilities. Bangladesh, Bhutan, and the Maldives have more clustered product space and would need to undertake a more concerted push, integrating economic diversification strategy into their national development plans.

- To improve the diversity and complexity of its exports, South Asia needs to invest in infrastructure, education, and R&D, facilitate bank credit to productive companies, and increase openness to trade, even if reducing trade barriers could lead to greater specialization by accelerating the reallocation of resources towards the country's comparative advantage at the time of opening. Other factors – such as a stable macroeconomic environment and the level of investment more broadly – could also potentially assist the process of increasing diversification and complexity of exports.[2]

[1] In this paper, South Asia includes Bangladesh, Bhutan, India, the Maldives, Nepal, and Sri Lanka.

[2] These other factors do not have a statistically significant link to diversification and complexity in regressions controlling for other structural indicators.

- Given the COVID-19 pandemic, adopting and investing in digital technologies as part of the infrastructure push and improving education are of even greater importance to facilitate the ability to work remotely and assist resource reallocation away from the less viable sectors.

The rest of the paper is structured as follows. Section II explores the benefits of diversification, and Section III assesses South Asia's progress on diversification. Section IV discusses the conceptual framework of diversification drivers and studies what policies can have a significant impact on diversification and complexity in regressions using a large cross-country dataset. Section V links to the current COVID-19 context, and Section VI concludes.

II. DIVERSIFICATION OF EXPORTS: A FIRST LOOK

Diversification is an important element of economic development. Diversification can occur in the structure of the domestic economy more broadly or in the composition of its tradable goods baskets. More diversified trade not only means a richer set of products – it is obviously desired if expanding product sets occurs through moving up the value chain into higher quality products – but also export destinations and sources of imports.

This paper studies the evolution of export diversification and export complexity in South Asia and the structural forces behind their evolution. Both measures are based on trade in goods, whereas in a few places, the analysis is supplemented by information related to service exports. Output diversification, measured by value added of real sectors, and diversification in terms of trading partners are interesting issues, but not the subject we study in this paper.

Export diversification captures how varied a country's export basket is in terms of its products. It is constructed using Theil index, which sums the extensive and intensive margins of diversification (IMF, 2014):

$$Theil\ index = T_b + T_w \qquad (1)$$

For both indices, lower values indicate higher diversification.

The extensive margin index is calculated for each country in a given year as:

$$T_b = \sum_k \frac{N_k}{N} \frac{\mu_k}{\mu} \ln\left(\frac{\mu_k}{\mu}\right) \qquad (2)$$

where k represents each group (traditional, new, and non-traded); N_k is the total number of products exported in each group; $\frac{\mu_k}{\mu}$ is the relative mean of exports in each group.

The intensive margin index for each country in a given year is:

$$T_w = \sum_k \frac{N_k}{N}\frac{\mu_k}{\mu}\left\{\frac{1}{N_k}\sum_{i\in Ik}\frac{x_i}{\mu_k}\ln\left(\frac{x_i}{\mu_k}\right)\right\} \qquad (3)$$

where *x* represents export value.

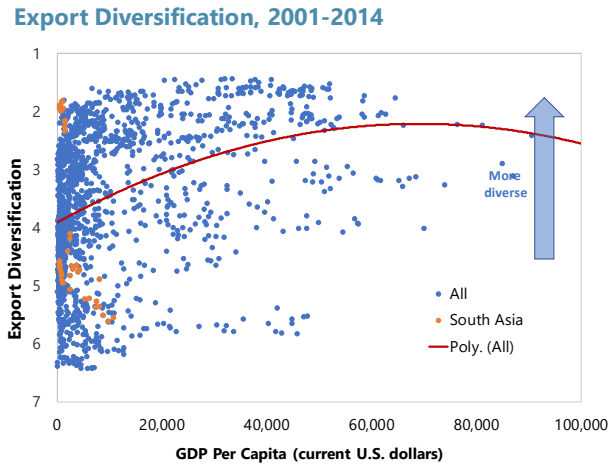
Extensive margin measures diversification in terms of the number of export products—the more types of export products a country has, the more diversified it is in terms of extensive margin. Extensive export diversification thus reflects an increase in the number of export products. Intensive margin considers the role of export volumes across active export products. A country will be less diversified in terms of intensive margin when export revenues are driven by a few products, even though the country might be exporting many different goods. Countries with a more evenly balanced mix of exports will have a higher degree of intensive diversification.

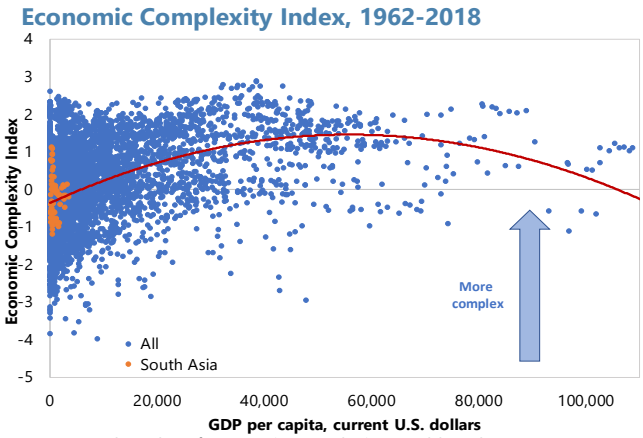
Economic complexity captures both the diversity and complexity of a country's exports. It is a term popularized by Hausmann et al. (2011) and is developed from the concept of revealed comparative advantage (RCA).[3] Economic complexity is a combination of the diversity of an economy (defined as the number of products in which the economy has RCA) and the ubiquity of these products (captured by the number of countries that have RCA in this product). Economic complexity is thus a measure of the knowledge in an economy as expressed in the products it makes.

There is growing evidence, as shown in Figure 1, that until an economy reaches an advanced economy status, higher per capita income is broadly associated with greater export product diversification and economic complexity. IMF (2014) and Cadot et al. (2011) find a positive relationship between export diversification on the one hand and per capita income and growth on the other hand for countries at lower levels of development. Hausmann et al. (2011) and Anand, Mishra, and Spatafora (2012) find a similar link for economic complexity.

[3] An economy has RCA in a specific good if its share in the economy's exports is larger than the good's global export share, based on Balassa's definition

Figure 1. Diversification and Income Per Capita, 2001-2014



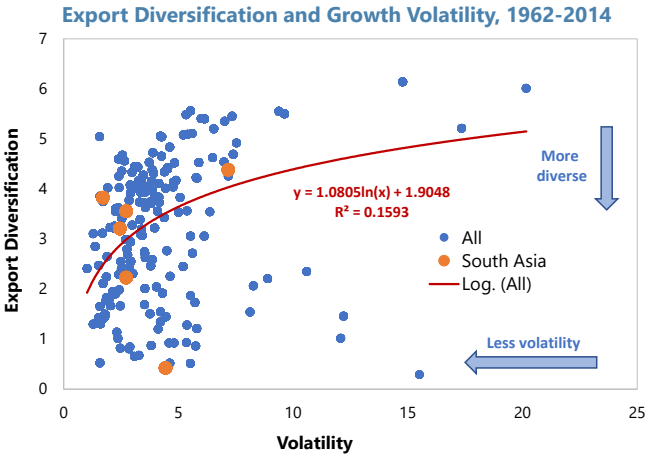


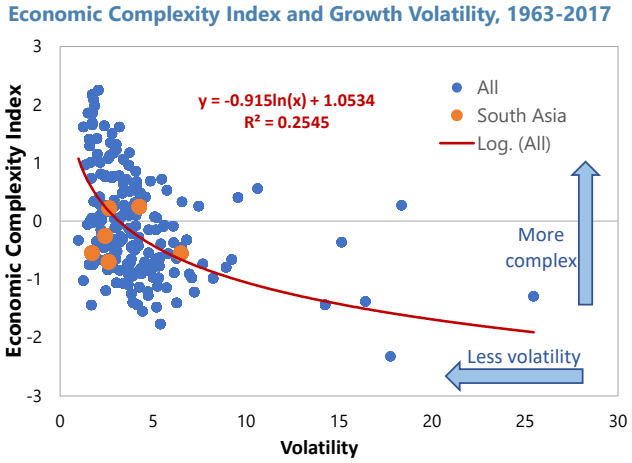
Sources: IMF (2014); World Bank.

Sources: The Atlas of Economic Complexity; World Bank.

Diversification contributes to growth and economic development directly when resources move from low-productivity to high-productivity sectors and the economy accumulates know-how. Indirectly, diversification lifts growth and income levels by shifting resources from sectors where prices are highly volatile and correlated, such as mining and agriculture, to less volatile sectors, such as manufacturing, resulting in greater macroeconomic stability and lower vulnerability to adverse terms of trade shocks (see Koren and Tenreyro, 2007, and Haddad et al., 2013). Figure 2 shows that more diversified and complex countries tend to have lower volatility of output.

Figure 2. Diversification and Volatility, 1962 - 2014

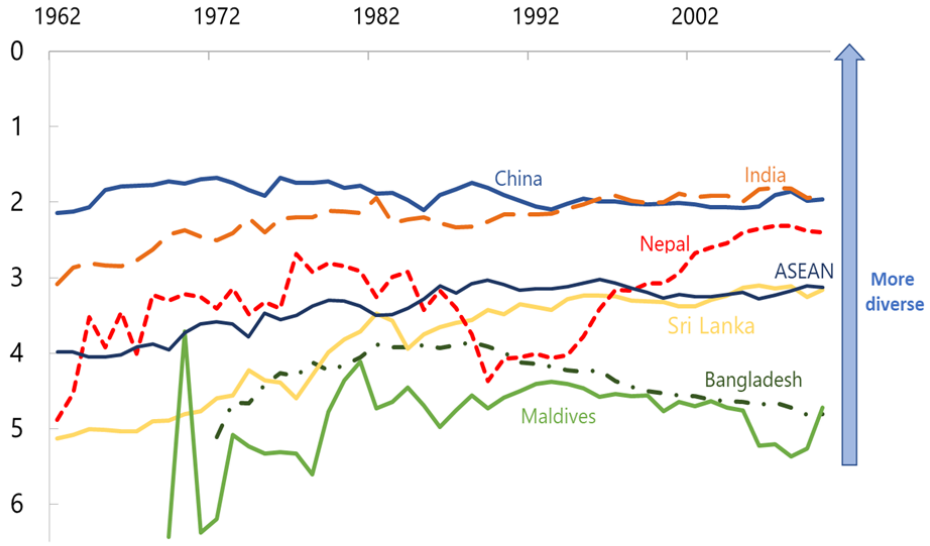




III. South Asia's Progress on Diversification

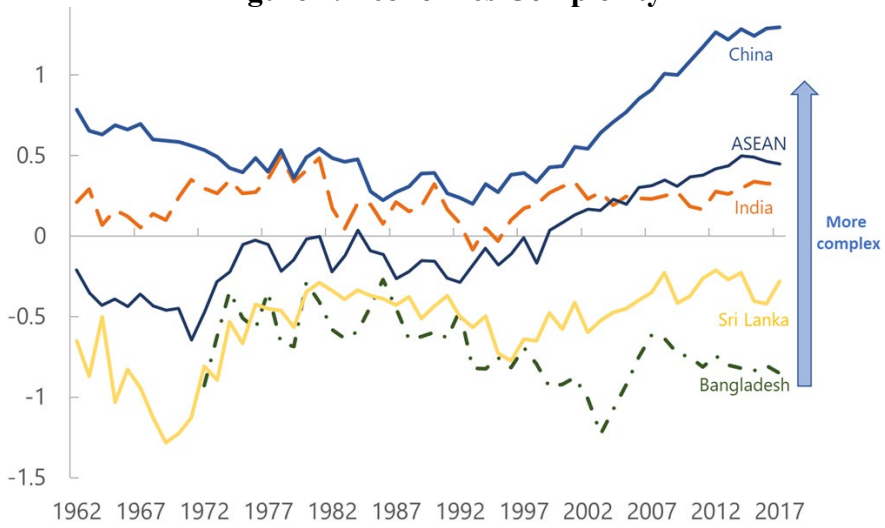
As South Asian economies liberalized in the 1980s and 1990s, creating space for the private sector to grow and opening to trade, their export structure underwent rapid transformation. The export mix changed from raw products to garments and services, and several South Asian countries increased the diversity and complexity of their exported products (Figures 3, 4 and 5). Export diversification improved dramatically in Nepal, and both diversification and complexity increased in India and Sri Lanka.

Figure 3. Export Diversification



Source: IMF (2014).

Figure 4. Economics Complexity



Source: The Atlas of Economic Complexity.

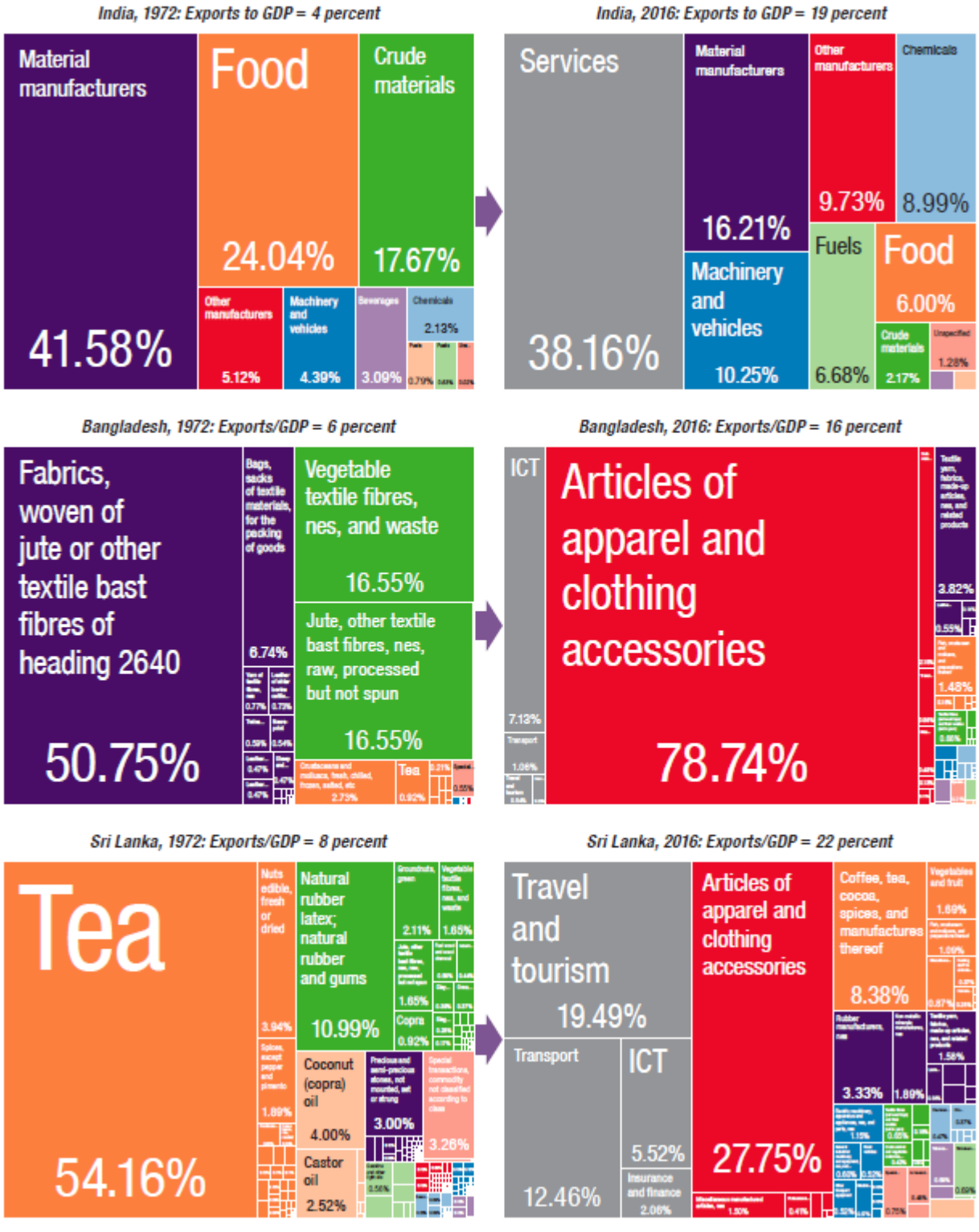
India's pro-business reforms in the late 1980s and early 1990s led to a significant reduction in tariffs and eased controls on the domestic private sector, while the emphasis on tertiary education created a highly educated labor force. As a result, India managed to transition from exporting tea and fabrics in 1970s to a more sophisticated export basket of car parts, capital goods, and pharmaceuticals and laid the foundation for its remarkable service sector–led growth. India's share of world service exports doubled to over 17 percent in a decade through 2010–14, recording the largest increase globally for the sector. All in all, India's export diversification increased to a level broadly comparable to that of regional peers, such as China.

In Bangladesh, reforms and trade liberalization attracted FDI in the ready-made garment sector. This facilitated technology transfer to domestic entrepreneurs, helping Bangladesh diversify from exporting jute and tea to labor-intensive garments, catalyzing export-led growth. Eventually, the export basket became highly concentrated again, with garments accounting for around 80 percent of exports.

Smaller South Asian economies diversified from exporting raw food products and agricultural produce into tourism and information and communications technology (ICT). The Maldives diversified from fish into tourism, Nepal from raw food products (jute and rice) to information and communications technology and tourism, and Sri Lanka from tea to tourism and garments.[4] Bhutan benefited from exporting hydropower electricity, which now accounts for 30 percent of its exports.

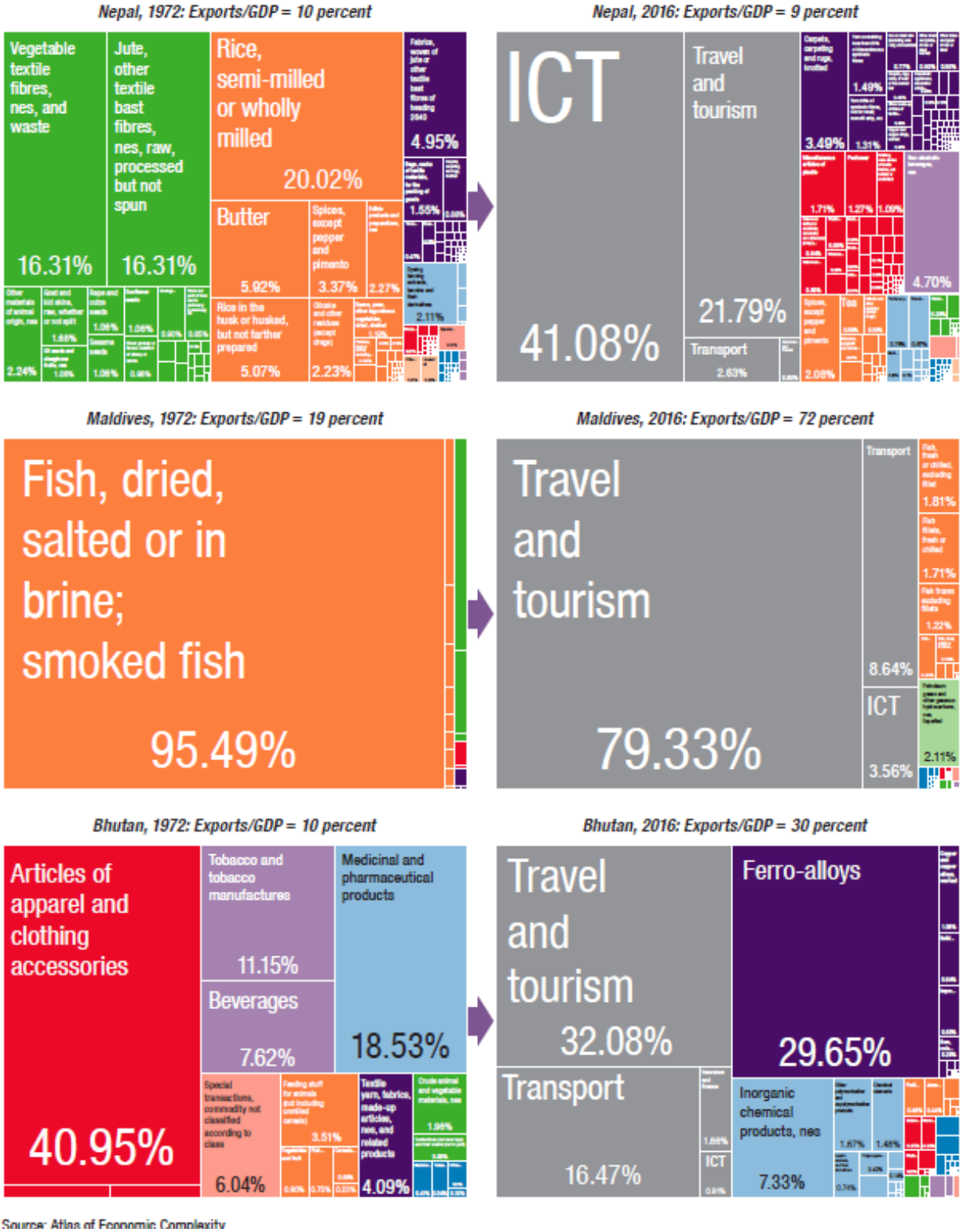
[4] Figure 5 shows exports of goods and services, while diversification and complexity indices presented in Figures 3 and 4 are based on data for goods exports only, because services data is only available from 1980. So while the exports of goods have become more diversified, the overall export mix became more concentrates into services in some countries.

Figure 5. Diversification in South Asia Improved Over Time, 1972 – 2016
(Share of different sectors in export basket)



Source: Atlas of Economic Complexity.

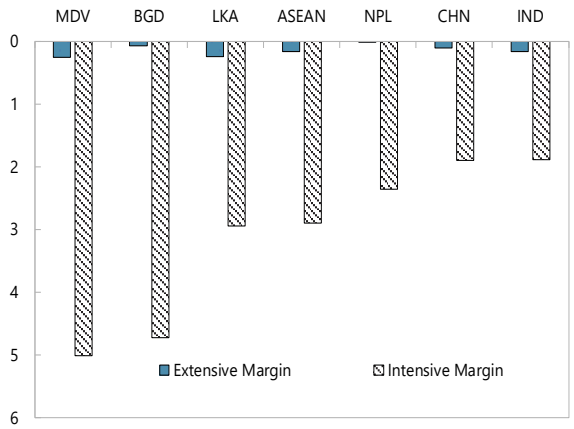
Figure 5. Diversification in South Asia Improved Over Time, 1972 – 2016 (Continued)
(Share of different sectors in export basket)



Source: Atlas of Economic Complexity

There is still substantial scope to increase the diversity of South Asian exports. Most countries in South Asia lag behind China and the ASEAN (Figure 3). This is partly because their export baskets are highly concentrated. The diversification index can be decomposed into the summation of extensive and intensive margins. A country is less diversified when its export revenues are driven by only a few sectors (intensive margin), even though the country might be exporting many different types of goods (extensive margin). While South Asian countries tend to export different types of goods and their extensive margins are similar to those of China and the ASEAN (Figure 6), their export revenues tend to be dominated by specific products. As a result, most have worse intensive margins and diversification than China, with the exception of India. By exporting more of the different types of product for which productive capacities already exist, South Asia could improve on diversification.

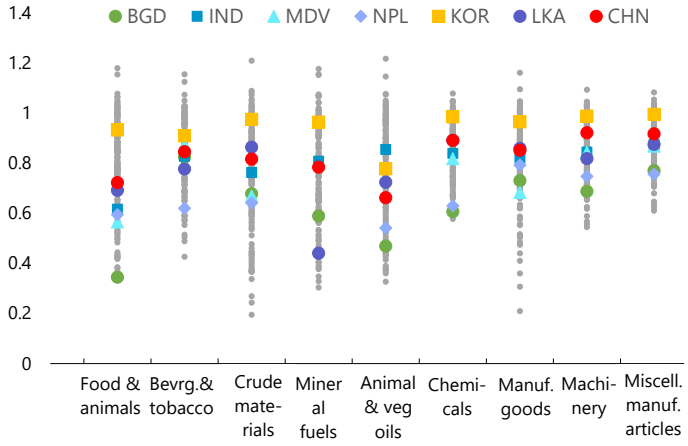
Figure 6. Extensive and Intensive Margin
(Lower values indicate higher diversification)



Source: IMF (2014).

It is important not only to diversify, but also move into more complex products. India is the most diverse in South Asia, with the diversity of its export basket similar to that of China and ahead of that of the ASEAN. However, when one takes account of complexity, China has surpassed India starting from early 2000s (Figure 4), even though both countries had similar levels of complexity for two prior decades. South Asia has a lot of room to climb up the global quality ladder (Figure 7), calculated as the unit value of exported goods adjusted for differences in production costs and for selection bias stemming from relative distance (Henn, Papageorgiou, and Spatafora 2013). Producing higher quality varieties of existing products, building on comparative advantage, is easier than diversifying into completely new areas. For example, in Bangladesh, the complexity of the ready-made garment industry remains relatively low. In India, there is scope to further close the technology gap in the auto component industry.

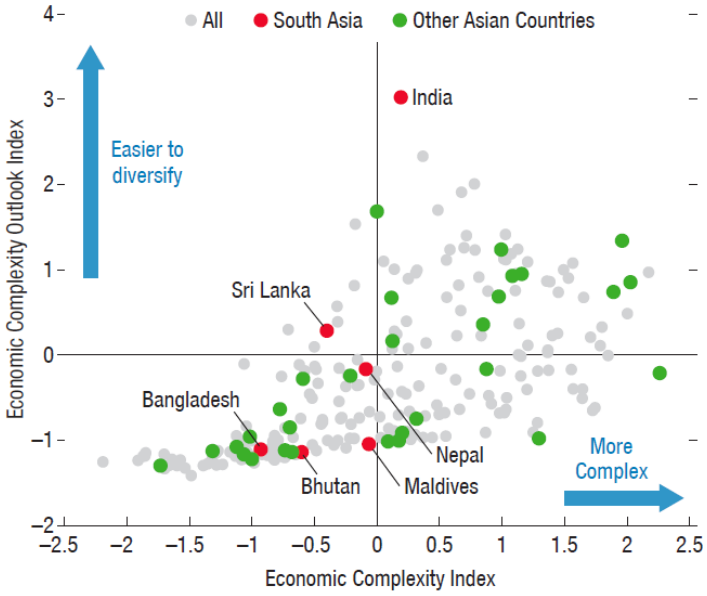
Figure 7. Quality Ladder, 2014



Source: IMF (2014).

India, Nepal, and Sri Lanka are especially well positioned to improve the complexity of their exports as captured by the economic complexity outlook index (Figure 8). The index measures the average complexity of products that are close to the country's current set of productive capacities. It captures the complexity of products into which it is feasible for the country to diversify into – that is, how strategically positioned a country is in its product space. Given the current production structures, it will be easier for India, Nepal, and Sri Lanka to diversify because they have many complex products near their current set of productive capabilities. India has the highest diversification potential in the world.

Figure 8. Economic Complexity Outlook Index, 2016

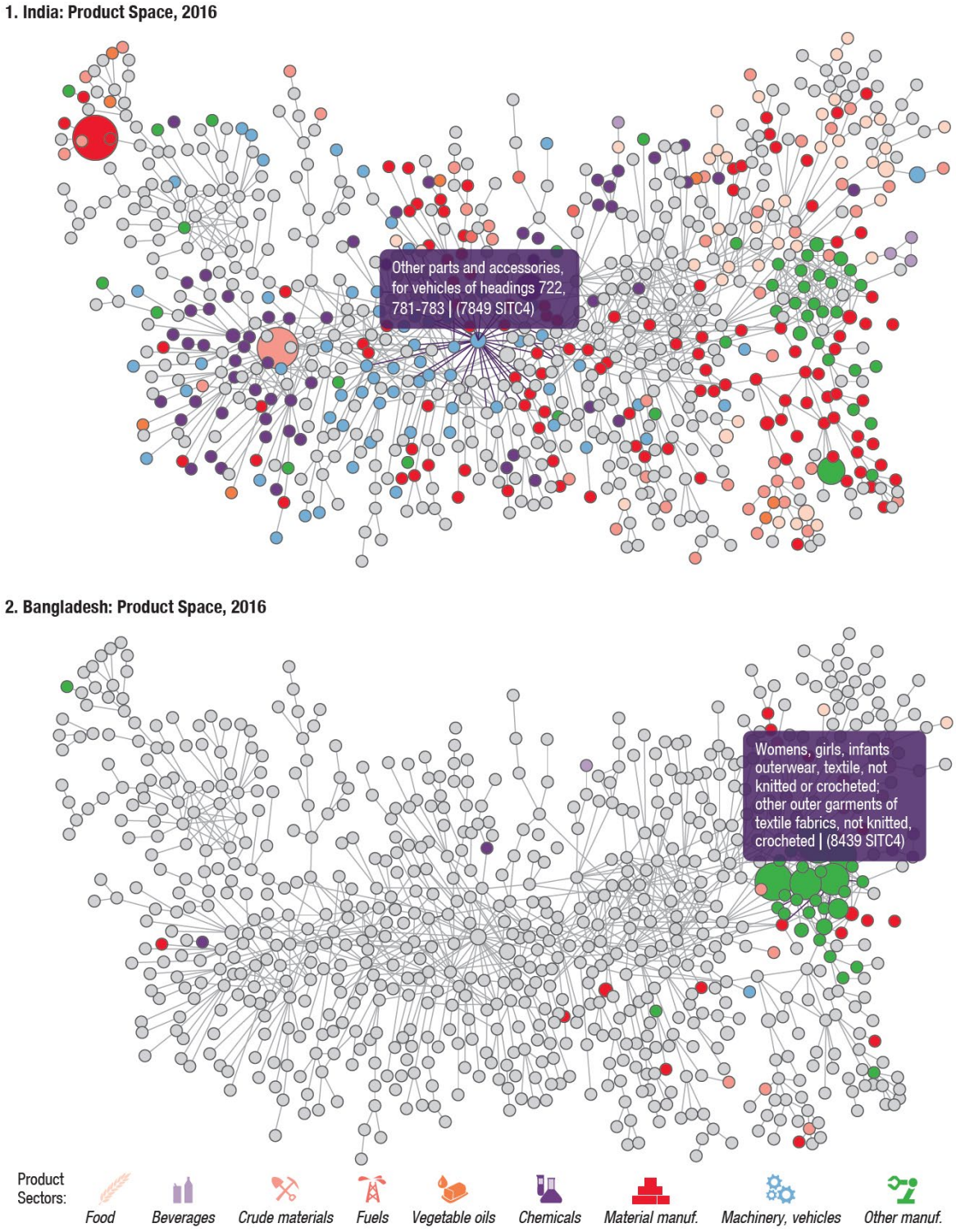


Source: The Atlas of Economic Complexity.
Note: *Economic Complexity Index* measures how diversified and complex a country's export basket is. *Economic Complexity Outlook Index* measures the ease of diversification for a country, captured by how many complex products are near a country's current set of productive capabilities.

This is more intuitively seen through a visualization called product space (Figure 9). The product space depicts the connectedness between products, based on the similarities of know-how required to produce them. For example, India exports several products at the core of the product space, such as cars parts, ships, and mobile phones. In other words, India has RCA in exporting various manufacturing products that are related to more complex goods. The existing facilities make it easier for India to diversify into similar products. On the other hand, although Bangladesh has been successful in dominating the garments sector, it has a lower complexity outlook because the ready-made garment sector is less connected to other, more complex industries. As a result, it would be harder for Bangladesh to move up the complexity scale without concerted policy measures.

Improving economic diversification and complexity requires different strategies tailored to country-specific circumstances. For countries such as India, who are well positioned in their product space, this will involve expanding their existing technological know-how. For countries with relatively clustered product space, such as Bangladesh, it will require taking a longer-term view, expanding product space by addressing bottlenecks and integrating an economic diversification strategy into the national development plans. The next section studies what policies could be more conducive in these efforts.

Figure 9. The Product Space in India and Bangladesh



Source: The Atlas of Economic Complexity.

Note: Colored node is a product the country exports. The size of the node is the share of this product in country's exports.

IV. Which Policies Could Foster Diversification in South Asia?

A. A Conceptual Framework

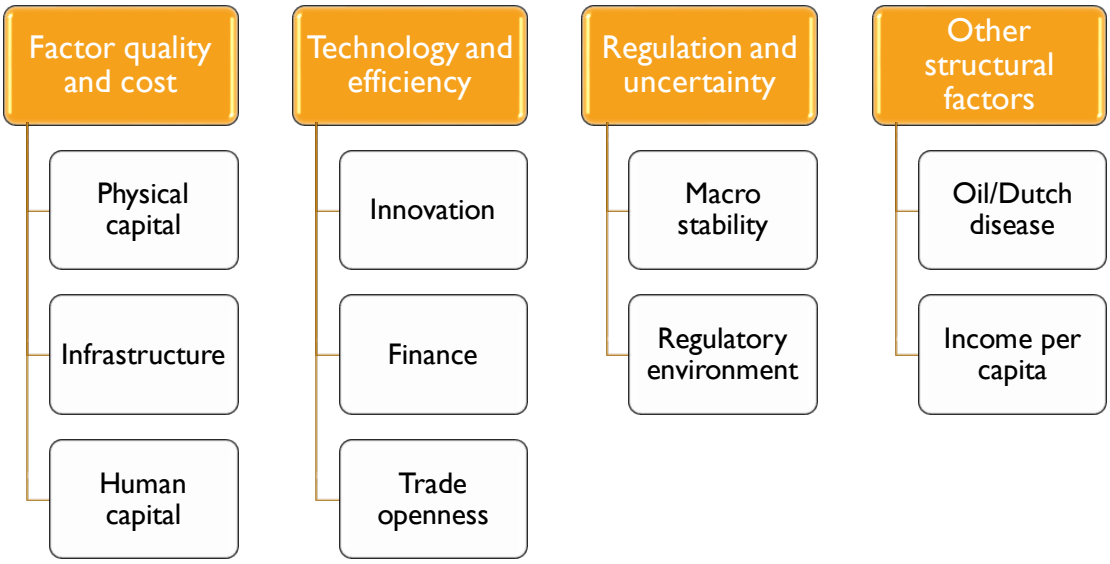
Many routes lead to a more diversified economy. A fundamental force is structural transformation, with resources shifting from agriculture towards manufacturing and further towards services as the country develops (Herrendorf, Rogerson, and Valentinyi, 2014; Hansen and Prescott, 2002; McMillan and Rodrik, 2011). Some may even leapfrog manufacturing altogether (Rodrick, 2016; Carmignani and Mandeville, 2010). A recent study (IMF, 2019) argues that South Asia, especially India, should grow all sectors of the economy in a balanced way, including increasing agricultural productivity, expanding manufacturing in a sustainable way, and building on the relatively strong position of high-skill services, to cope with the challenge of 150 million people entering the labor market by 2030.

Economic diversification and export diversification are intrinsically linked. Imbs and Wacziarg (2003) show that the degree of export diversification over development stages is broadly the same whether one looks at the overall economy or just manufacturing. It has an inverted-U shape, as in Figure 1. Diversification tends to improve up to a certain point, and as countries grow richer, they start to re-specialize. This pattern is not driven by rich commodity exporters.

There could be multiple theoretical explanations for this pattern. First, technological progress – either through innovation or technology adoption – leads to the creation of new products, improves the efficiency of production process, and boosts growth. The marginal boost from these processes peter out as the economy reaches technological frontier. Second, diversification comes from consumers' love of variety, and economic growth to the extent that it increases consumers' purchasing power naturally leads to the production of more varieties if not all of them can be imported. Diversification may also be derived from a hysteresis effect if older industries that are not compatible with a country's comparative advantage continue to linger. In the real world, countries specialize in different types of products and a change in the endowment structure should lead them to shift to new industries (Schott, 2003; Xiang, 2007), but incumbent interests and political protection may slow the destruction of older firms. At higher income levels specialization eventually dominates, as countries reduce external and internal trade costs significantly, so that they could achieve a state of higher income.

What policies could foster export diversification and economic complexity in South Asia? In our regression analysis, we use the following conceptual framework to try to disentangle the intertwined and often mutually reinforcing economic factors (Figure 10). Many of the diversification drivers are similar to the drivers of economic growth. The availability of the needed factor inputs—physical capital and infrastructure, human capital, and technological

Figure 10. What Factors Drive Diversification and Complexity



know-how—as well as their quality and cost determine whether you can engage in a new production process. It is hard for countries to create products that require capabilities they do not have. To produce semiconductors, a manufacturing facility needs the know-how to start out and R&D to keep up with competitors, but also access to power, water, chemicals, and other raw materials, it needs complex machinery and an educated labor force to operate it, and road and port infrastructure to be able to export the final product.

With the factor inputs in place, the ease of resource reallocation determines how fast economic diversification and improvements in complexity take place. Openness to trade and finance and financial development more broadly have the potential to contribute to both factor accumulation and the reallocation of resources to more productive activities by bringing in the foreign know-how, financing investment, and giving a boost to competition. Macroeconomic and political stability and regulatory environment—including low inflation and public debt, absence of conflict and ease of doing business—create an enabling environment, within which firms operate and can either impede or facilitate creative destruction. Presence of a large extractive sector, such as oil and gas, can impede diversification by absorbing the resources that could be used otherwise and inflating the price of non-tradables, leading to Dutch disease. One would also expect that diversification is easier at higher income per capita levels; this factor is important to control for reverse causality.

Multiple studies show that the quality of institutions, innovation and technology adoption, trade openness, political stability, and the right mix of macroeconomic policies are generally associated with higher growth (Acemoglu and Robinson 2008; Christiansen et al., 2013; Ostry et al., 2009; Prati et al., 2013). Nonetheless, important caveats exist, for example, such

positive association was found to exist only in middle-income countries (Christiansen et al., 2013), was shown to be highly heterogeneous and to be influenced by a country's constraints on the authority of the executive power and by its distance from the technology frontier (Prati et al., 2013), and there were significantly different growth effects across alternative reform sequencing strategies (Ostry et al., 2009).

With regard to the impact of these factors on diversification, the economic debate continues. Bayesian model averaging in Giri et al. (2019) finds that human capital accumulation, reducing barriers to trade, improving quality of institutions, and developing the financial sector lead to greater diversification. Macroeconomic stability, access to credit, good infrastructure, a conducive regulatory environment, human capital, and income equality are associated with higher economic diversification (IMF, 2017) and export complexity (Ding and Hadzi-Vaskov, 2017). Oil dependency tends to reduce the degree of diversification (IMF, 2017).

Other studies are less conclusive. For example, on trade openness, many studies find a positive relationship with export diversification, but such a relationship exists with some degree of ambiguity. In an empirical analysis on a wide panel of countries at different levels of development, Di Giovanni and Levchenko (2009) find that trade openness is associated with higher specialization and volatility in countries at lower levels of development. Makhlouf et al. (2015) find that the effect of openness on specialization depends on the type of political regime for developing countries, in autocracies openness is linked with specialization, whilst in democracies it is related to export diversification.

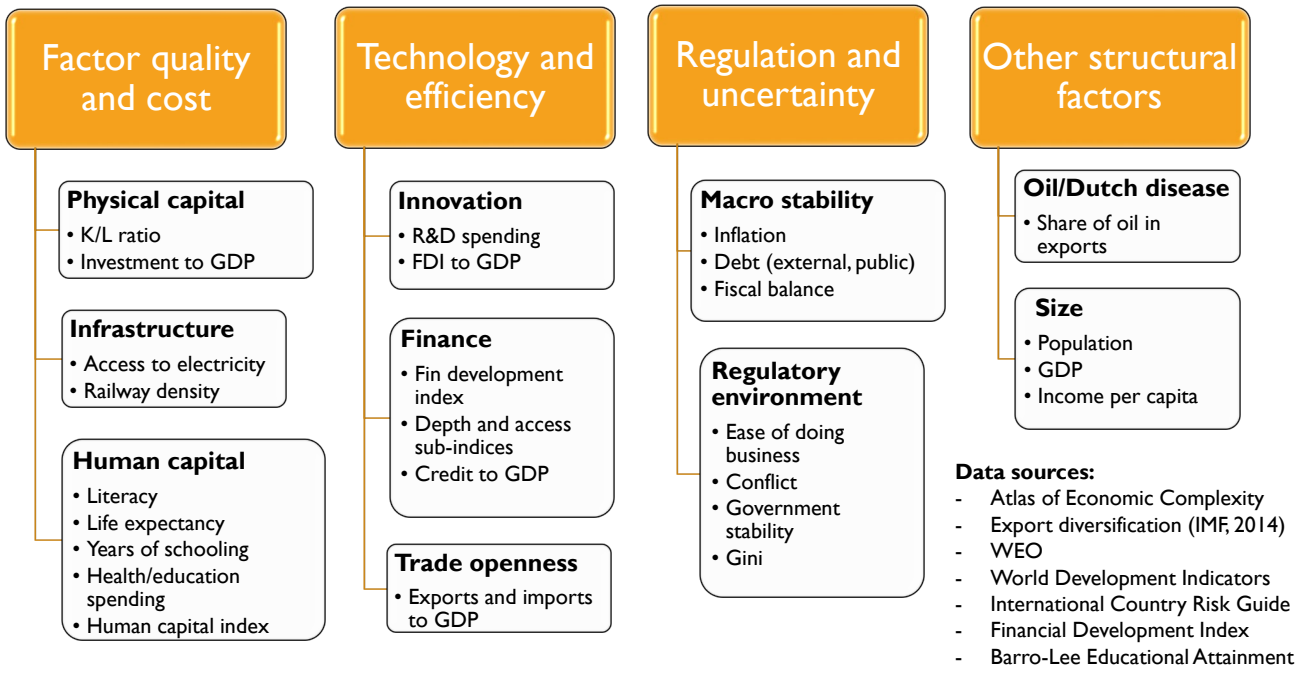
Similarly, though domestic financial reforms are found to be robustly associated with economic growth (Christiansen, et al 2013; Ostry et al. 2009), financial development does not have a statistically significant relationship with export diversification in Agosin et al. (2012). Nonetheless, in the same paper but based on event studies, Agosin et al. find that the trend towards export diversification accelerates after episodes of financial reform, but not in the case of trade reform. Giri et al. (2019) find that although credit to the private sector is not associated with diversification for the sample of all countries, it is associated with increase in diversification among the emerging and developing countries, but only along the intensive margin.

The effect of research and development (R&D) spending on diversification is less clear. Intuitively, R&D leads to innovation and contributes to the production of complex products. Nonetheless, it is also possible that as a country develops, R&D leads to concentration in specific product lines, which occupy resources and hence reduce diversification. Empirical research in this area is relatively scarce. Using firm-level data, Peyrefitte and Brice (2004) find a negative relationship between product diversification and relative R&D intensity, supporting a hypothesis that diversified firms lower R&D investment as they realize economies of scope in R&D activities.

The departure of this paper from the existing literature is two-fold. First, we explore a large set of structural indicators jointly, which is in spirit closer to Giri et al. (2019). Second, we assess the drivers of both export diversification and complexity, building on the literature exploring export complexity (Hausmann et al., 2011; Ding and Hadzi-Vaskov, 2017).

We rely on a number of indicators and data sources to capture the role of these factors on export diversification and economic complexity based on annual data for 189 countries from 1962 to 2018 (Figure 11). See Annex I for more details.

Figure 11. Mapping Factors to Observable Data



B. Regression Methodology

We identify the key drivers of export diversification and economic complexity using a three-step approach. Our end goal is the following econometric model:

$$D_{i,t}^{k} = \sum_{j=1}^{J} \beta^{k,h,j} Z_{i,j,t} + \gamma^{k,h} M_{i,h,t} + \delta_{t}^{k,h} + \varepsilon_{i,t}^{k,h}, \qquad (4)$$

where $D_{i,t}^{1}(D_{i,t}^{2})$ is export diversification (economic complexity) of country i in year t. $\{Z_{i,j,t}\}_{j=1}^{J}$ is the selected list of structural indicators for country i in year t. $M_{i,h,t}$ is one of four control variables: a constant, GDP, population size, and GDP per capita. $\delta_{t}^{k,h}$ is time fixed effects.

The specification controls for GDP, population size, and GDP per capita one at a time as diversification may vary significantly across countries with different market size, population, or development stage.

This specification does not control for country-fixed effects because structural indicators are slow-moving over time and there is not enough within-country variation to capture the impact of structural indicators on diversification and complexity. For example, in the economic complexity regression sample, the variation in years of schooling across countries (standard deviation of 2.75) is seven times higher than that observed within a country over time (0.4). In the export diversification sample, it is 21 times higher, with standard deviation of 2.74 versus 0.13 (Annex 3).

One potential negative consequence of not using country fixed effects is that in cases where omitted time-invariant characteristics are correlated with both dependent and independent variables, the estimates could be biased due to omitted variable bias. While we test a large number of potential regressors (Figure 11), there may be some that we are not including because they are not observable (such as entrepreneurship, risk taking, or tendency to innovate). To the extent that these unobservable factors are correlated both with the tendency of countries do diversify and develop more complex economies and with the structural variables that we use, our estimates may be biased. Our hope is that there are no persistent cultural differences that could prevent countries from diversifying and moving up the value chain.

At the same time, country fixed effects come at a cost. The estimations rely on within country changes and lose out on between-country variation. As a result, the cross-country lessons – what can South Asia learn from successful diversification cases as it aspires to reach the frontier? – no longer apply. This is especially the case when one believes that the long-run response is best captured by cross-sectional variation, rather than the limited time span within each country (we have on average 8 years of data per country). Finally, in cases where the key variables do not vary much over time, fixed effects can lead to imprecise estimates, and we are forced to use pooled OLS or random effects estimation in order to learn anything about the population parameters.

For additional robustness, the baseline estimation is done via robust regression to make sure results are not affected by outliers/influential observations. We check that the results are not driven by reverse causality by lagging explanatory variables by one period and in another check cluster standard errors at the country-level to allow for intragroup correlation within *i* because of the panel data format (Annex 4).

To get to the final econometric specification, we need to pre-select variables from the full list of structural indicators, $\{Z_{i,j,t}\}_{j=1}^{J}$. On the one hand, we want to have as comprehensive list of structural indicators as possible to reduce omitted variable bias. On the other hand,

structural indicators are correlated with each other. In the extreme case, this can affect the precision and sign of the estimates. To mitigate this, we try not to include those that capture similar economic forces simultaneously.

This selection is done via a two-step approach. In the first step, for each structural indicator $Z_{i,j,t}$, we estimate the following two models:

$$D_{i,t}^{k} = \alpha + \gamma^{k,j,1} Z_{i,j,t} + \varepsilon_{i,t}^{k}, \qquad (5)$$

$$D_{i,t}^{k} = \alpha_i + \gamma^{k,j,2} Z_{i,j,t} + \varepsilon_{i,t}^{k}, \qquad (6)$$

The difference here is that country-fixed effects are controlled for in equation (6), but not in equation (5).

Criterion: The sign of $\gamma^{k,j,1}$ is the same as the sign of $\gamma^{k,j,2}$.

The idea behind this criterion is that absent endogeneity issues, the impact of a structural indicator should not be sensitive to whether country fixed effects are controlled for or not. One way to judge this sensitivity is the sign of the coefficients. As country fixed effects are not controlled for in equation (4), we regard structural indicators that switch signs between models (5) and (6) as inferior to those that do not switch signs. Admittedly, this is an ad hoc criterion, but given the challenge of selecting structural indicators from a very large set of possible ones, it should help us get eliminate variables whose coefficients overly rely on cross-country variation to determine the impact on diversification.

For structural indicators that survive the criterion, in the second step, we run a horse race amongst each set of indicators that captures a similar economic force. For example, credit to GDP ratio, depth of domestic financial institutions, and the depth of domestic financial markets can be constructed separately from different data sources, but we regard them as capturing a similar economic force – the extent of domestic financial development. Therefore, we include only one of them in model (4). If more than one of these indicators fulfills the criterion 1, we run a horse race among them to further shrink the list to only one indicator. In our experiments, results are not sensitive to which one we pick, if the horse race does not clearly prefer one specific indicator.

C. Drivers of Export Diversification and Economic Complexity

Tables 1 and 2 report the estimation of model (4). Figures 12 and 13 show standardized coefficients of our baseline specification in the first column of the two tables to gauge the economic significance of the variables. The normalization is done by multiplying the coefficient of a structural indicator by one standard deviation of the structural indicator's distribution in the sample across countries and time and further dividing it by one standard deviation of the distribution of the diversification or complexity index. The figures show

improvement in diversification and complexity in terms of standard deviation as a result of one standard deviation improvement in the dependent variable. We focus on the first column of the two tables, and the results are broadly unchanged in columns two to four.

The results suggest that more developed infrastructure and better educated labor force help not only to diversify the economy, but also to improve the sophistication of products. This is consistent with the findings in the literature and a casual observation that advanced economies tend to have infrastructure of higher quality and more skilled labor force. With the normalization mentioned in the previous paragraph, the quantitative impact of these indicators is among the largest, when compared with those of other structural indicators.

It is not always the case that structural reforms benefit both export diversification and complexity in the same way. Some dimensions of structural change improve export complexity but hurt export diversification or the other way around. Opening to trade tends to lead countries to specialize, rather than diversify their export baskets, but at the same time helps them move up the value chain into more complex products. A more open capital account, on the other hand – as captured by the size of external debt relative to GDP – leads countries to specialize more, but access to foreign capital does not seem to have a significant effect on export sophistication. Higher R&D expenditure and domestic bank credit to the private sector help increase export complexity, without having a significant impact on diversification. The latter might be caused by the offsetting effects of specialization and the country gaining new export varieties.

Several structural indicators have a more nuanced impact on economic complexity and diversification. For example, more stable macroeconomic environment – proxied by lower inflation – contributes to product upgrading and export diversification. The impact, however, is not significant, unless we control for either economic size or income per capita. Investment improves export diversification, but the impact is also not significant, unless we control for income per capita.

Table 1. Impact of Structural Factors on Economic Complexity
(Higher ECI means higher complexity)

VARIABLES	(1) ECI	(2) ECI	(3) ECI	(4) ECI
Railway density	0.0466***	0.0589***	0.0623***	0.0338***
	(0.00819)	(0.00776)	(0.00623)	(0.00728)
R&D expenditure	0.359***	0.329***	0.217***	0.204***
	(0.0305)	(0.0284)	(0.0239)	(0.0292)
Trade openness	0.00133**	0.00218***	0.00362***	0.00180***
	(0.000621)	(0.000592)	(0.000482)	(0.000554)
Average inflation	-0.00371	-0.00608***	-0.00684***	-0.00289
	(0.00245)	(0.00230)	(0.00185)	(0.00219)
log(Credit to GDP)	0.606***	0.316***	-0.288***	0.0258
	(0.105)	(0.103)	(0.0909)	(0.102)
log(External debt to GDP)	-0.103	0.0973	0.0755	-0.332***
	(0.0638)	(0.0631)	(0.0487)	(0.0588)
Oil share in exports	-1.116***	-1.064***	-1.268***	-1.487***
	(0.0945)	(0.0880)	(0.0730)	(0.0901)
Years of schooling	0.104***	0.130***	0.0933***	0.0407***
	(0.0120)	(0.0115)	(0.00908)	(0.0117)
log(Population)		0.138***		
		(0.0160)		
log(GDP in US dollar)			0.249***	
			(0.0117)	
log(GDP in US dollar per capita)				0.340***
				(0.0239)
Constant	-1.019**	-1.662***	-1.687***	-0.357**
	(0.504)	(0.475)	(0.135)	(0.160)
Time FE	Yes	Yes	Yes	Yes
Observations	594	594	593	593
R-squared	0.718	0.752	0.837	0.776

Robust regression. Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2. Impact of Structural Factors on Export Diversification
(Lower values of dependent variable mean higher diversification)

VARIABLES	(1) Export diversification	(2) Export diversification	(3) Export diversification	(4) Export diversification
Quality of infrastructure	-0.257***	-0.239***	-0.211***	-0.224***
	(0.0677)	(0.0615)	(0.0584)	(0.0631)
R&D expenditure	0.0304	0.133*	0.240***	0.202***
	(0.0803)	(0.0741)	(0.0715)	(0.0765)
Trade openness	0.00460***	0.00335**	0.00311**	0.00448***
	(0.00147)	(0.00135)	(0.00127)	(0.00133)
Average inflation	0.0194	0.0246**	0.00861	-0.0129
	(0.0120)	(0.0109)	(0.0104)	(0.0116)
Investment to GDP	-0.0100	-0.00400	-0.00784	-0.0169**
	(0.00764)	(0.00696)	(0.00653)	(0.00695)
log(External debt to GDP)	0.345***	-0.00579	0.159	0.660***
	(0.124)	(0.124)	(0.109)	(0.122)
Oil share in exports	3.089***	3.014***	3.654***	4.217***
	(0.259)	(0.235)	(0.231)	(0.291)
Years of schooling	-0.126***	-0.138***	-0.0776***	-0.0273
	(0.0258)	(0.0235)	(0.0228)	(0.0292)
log(Population)		-0.237***		
		(0.0328)		
log(GDP in US dollar)			-0.258***	
			(0.0284)	
log(GDP in US dollar per capita)				-0.427***
				(0.0740)
Constant	4.244***	5.004***	4.836***	3.881***
	(0.355)	(0.342)	(0.309)	(0.336)
Time FE	Yes	Yes	Yes	Yes
Observations	250	250	250	250
R-squared	0.527	0.608	0.653	0.612

Robust regression. Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

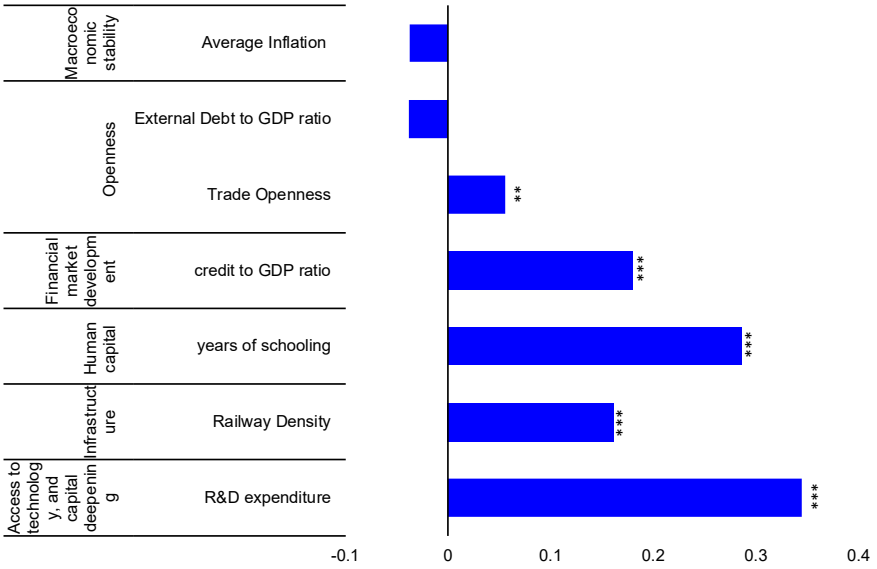
In terms of the magnitude of their impact, R&D expenditure and education seem to offer the greatest bang for the buck in terms of helping to improve economic complexity, followed by bank credit and infrastructure as measured by railway density, followed by trade openness (Figure 12). For export diversification, improvements to education and quality of infrastructure tend to have the greatest impact (Figure 13).

To further assess the economic significance of structural reforms in improving diversification and complexity, we use the distribution of within-country changes in diversification and complexity indices as a benchmark. One reason why this benchmark may be preferable compared to, say, one standard deviation of the distribution of the diversification/complexity indices is that the difference across countries in diversification and complexity is large and stable, and hence one standard deviation of the cross-country sample could be an "unrealistic" benchmark for countries to achieve. Focusing on within-country changes over time instead allows us to create a comparison with "actual" success that had been achieved in the past.

Figure 14 and 15 use this different normalization strategy. Compared to Figure 12 and 13, what is the same is that we multiply the coefficient of a structural indicator by one standard deviation of its distribution. What is different is that instead of further dividing by one standard deviation of export diversification and complexity indices, we divide it by the 75^{th} percentile of the distribution of their within-country annual changes. By doing this, we focus on relatively successful episodes, and the success is defined based on the top 25 percent of historical experiences in terms of changes in these indices.

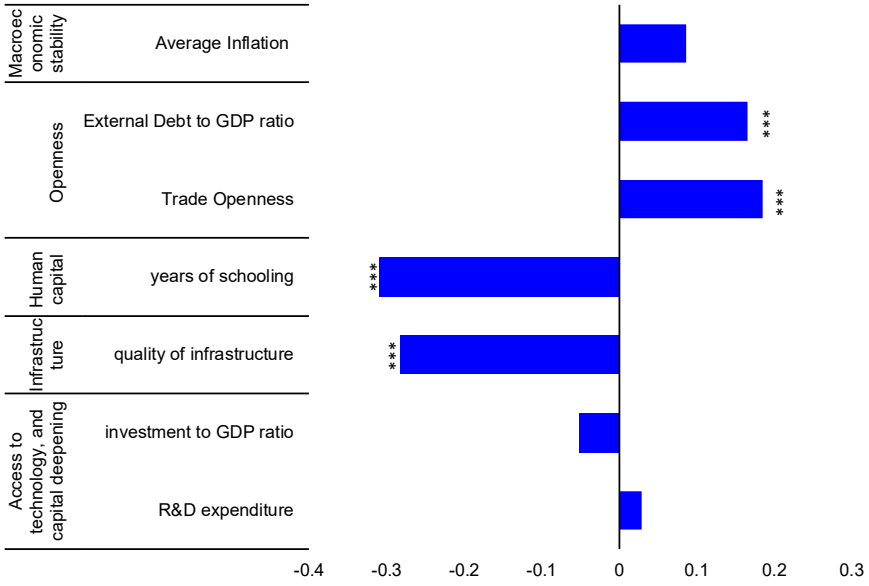
How to interpret the numbers in Figure 14 and 15? For example, a value of 2 for railway density means that if the structural indicator improves by one standard deviation, the improvement of complexity would amount to 2 years' worth of improvements of the scale equal to the top 25 percent of the change in complexity in the past. It is worth highlighting that the impact of structural indicators is estimated after controlling for those of other structural indicators, without considering interaction between them. It implies a possibility that implementing structural reforms on multiple fronts could expand and upgrade export varieties much more than the sum of individual reforms.

Figure 12. Impact of Structural Indicators on Economic Complexity Relative to One Standard Deviation of the Distribution of the Economic Complexity Index
(Positive values mean the factor leads to higher complexity)



Notes:*** p<0.01, ** p<0.05, * p<0.1

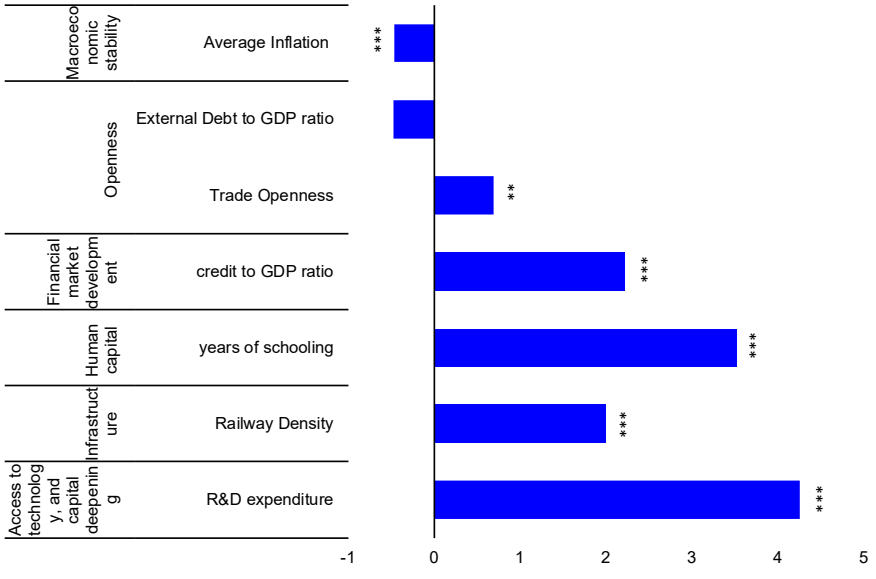
Figure 13. Impact of Structural Indicators on Export Diversification Relative to One Standard Deviation of the Distribution of the Export Diversification Index
(Negative values mean the factor leads to higher diversification)



Notes:*** p<0.01, ** p<0.05, * p<0.1

Figure 14. Impact of Structural Indicators on Export Complexity Relative to 75 Percentile of the Cross-Country Distribution of Annual Changes in Economic Complexity

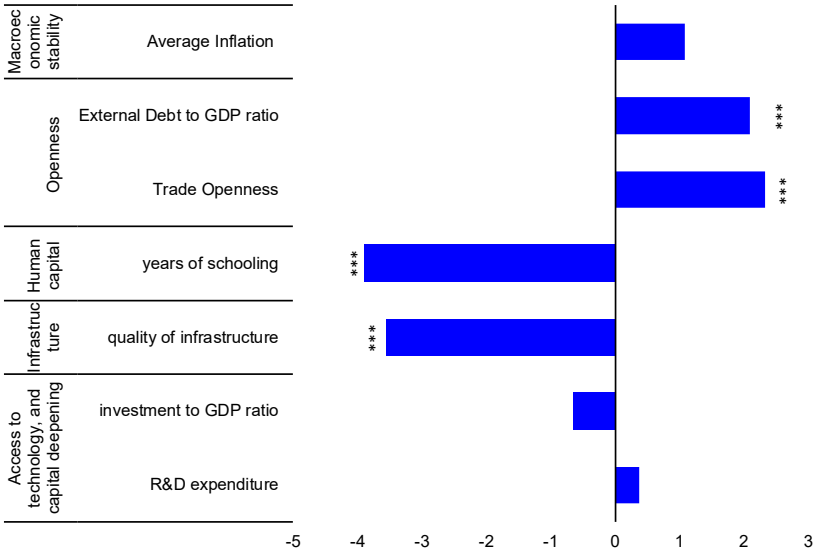
*(*Positive values mean the factor leads to higher complexity)



Notes:*** p<0.01, ** p<0.05, * p<0.1

Figure 15. Impact of Structural Indicators on Export Diversification Relative to 75 Percentile of the Cross-Country Distribution of Annual Changes in Export Diversification

*(*Negative values mean the factor leads to higher diversification)

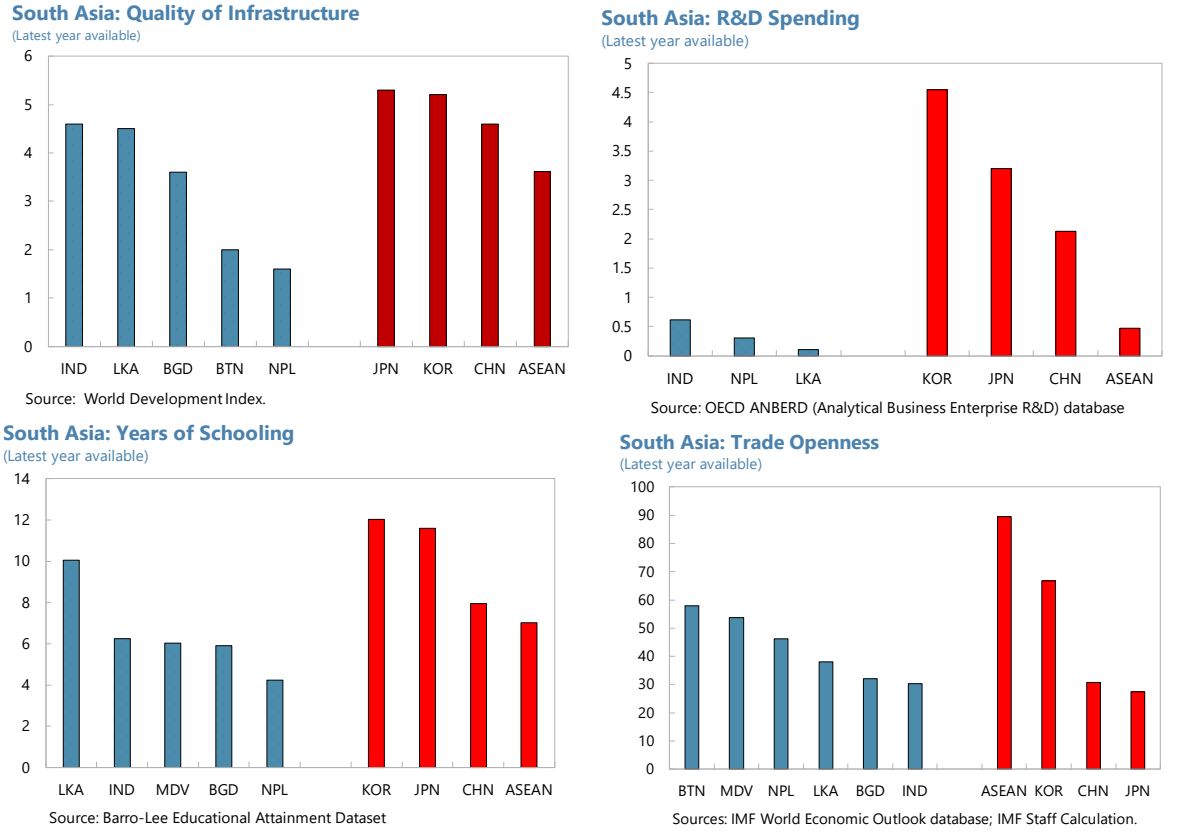


Notes:*** p<0.01, ** p<0.05, * p<0.1

What do these findings imply for South Asia? As previous studies have found, higher per capita income is broadly associated with greater export diversification and complexity before an economy reaches an advanced economy status. Along its journey to higher income status, South Asia needs to step up its reform efforts to improve the diversity and complexity of its exports. Compared to advanced economies such as South Korea and Japan, and other emerging economies such as China and ASEAN, South Asia lags behind in terms of the structural indicators associated with greater diversity and complexity (Figure 16). For example, average years of schooling and trade openness in India are roughly half of the levels in Korea, and spending on R&D was about 0.5 percent of GDP, compared to 4.5 percent of GDP in Korea. The region has room to further open to trade, invest in infrastructure and education, and promote R&D spending.

How would improvements in the underlying structural indicators translate to improvements in economic diversification and complexity? To help gauge the potential impact, Figure 17 shows illustrative scenarios of the potential impact should South Asian countries close 50 percent of the gap on economic fundamentals relative to the frontier. The frontier is defined as the average performance of the top three countries in terms of their economic complexity in 2017 (Japan, Korea, Switzerland) and export diversification in 2014 (Austria, Italy, Poland). The left chart shows the estimated quantitative effects, and the right chart shows the contribution from each of the underlying structural indicators.

Figure 16. South Asia: Selected Structural Indicators



Not surprisingly, the quality of infrastructure plays a key role for greater diversification, and improving R&D spending would contribute the most to greater economic complexity, while educational outcomes are instrumental to both dimensions. It is important to interpret the policy implications with caution: the larger contributions do not necessarily imply a sequence of the reforms – a country can start with the reforms that are expected to generate the largest impact, or with the reforms that are easier to implement. Increasing spending on infrastructure can lead to higher quality of infrastructure but improving the efficiency of spending and tackling the infrastructure bottlenecks are equally important. The potential positive effects stemmed from interactions among the various structural improvements are not captured here. Lastly, it is worth noting that these references are drawn based on the analysis from a broader sample of countries with South Asia included. While the regression coefficients are not South Asia specific per se, the quantified impacts are and so are policy implications.

Figure 17. Potential Gains from Improvements in Underlying Structural Indicators

More broadly, policies that encourage climbing up the quality ladder are instrumental in promoting diversification. As found in Cherif and Hasanov (2014), a focus on competing in international markets and an emphasis on technological upgrades and improving quality are crucial, among other policies. Though their study was based on a sample of oil exporters, the need to climb up the quality ladder equally applies to South Asian countries whose goods exports concentrate to a large degree on clothing and garments.

Encouraging vertical diversification can be complementary to the structural reforms discussed above. For example, India not only exports products such as cars parts, ships, and mobile phones, it also has developed domestic capabilities in downstream and upstream activities around these exports. Going forward, the emphasis could be on building linkages with the rest of the economy, technological transfer and upgrades, and expanding products along the current product space. Bangladesh has successfully developed the garments sector, and future development could involve creating networks of suppliers around the existing exporting industries and upgrading to more sophisticated products, following the example of Italy's high-end garments and fashion.

Overall, a more diversified economy in terms of exports is able to better withstand shocks and is associated with better economic outcomes. As it is hard to know in advance which sectors could be the winners, in this paper we do not recommend policies targeting specific sectors, but rather focus on creating the enabling environment where many sectors can flourish. During the diversification process, consideration should be given to developing sectors with higher value-added and encouraging the climb up the quality ladder.

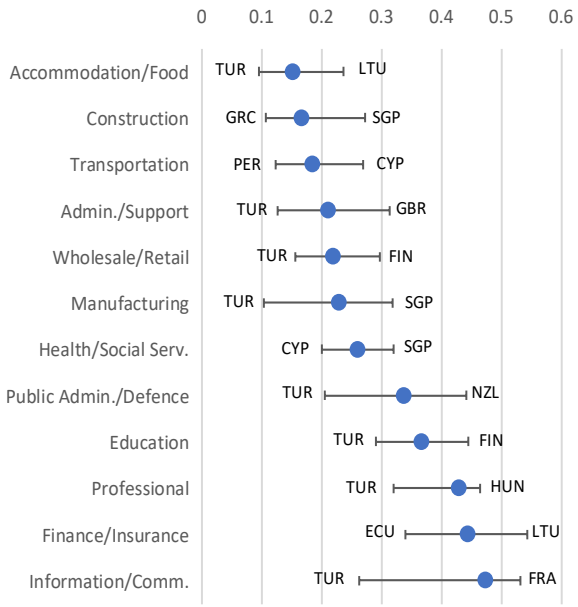
V. DIVERSIFICATION IN TIMES OF COVID-19

The challenges posed by the COVID-19 pandemic give an even greater impetus for countries to diversify their economies and export structures to become more resilient to shocks. At the same time, as the permanent impact on sectors becomes clearer, there is also the need to facilitate the reallocation of resources from less viable to more viable sectors.

One aspect of choosing which sectors are more viable is by looking at how easy it is to work in that sector remotely. To study this, we rely on the newly created database by Brussevich et al. (2020) that quantifies how feasible it is to work from home in different industries based on a sample of 35 advanced and emerging market economies. They find that it is harder to work remotely in sectors such as accommodation and food services, construction, and transportation (Figure 18). Sectors best suited for teleworking include ICT, finance, and other professional services that require less physical proximity and rely more on digital tools and technologies.

As it happens, South Asia's factor endowments and policy environment are well suited to ICT services trade, and the region saw its export basket successfully diversify into ICT over time (Figure 5). India in particular has been the poster child for services-led export diversification. In the early 1980s, the Indian government recognized that the large number of low-wage, high-skilled engineers, fluent in English, boded well for the country's potential in IT services (Saxenian, 2001). The emerging sector was proactively liberalized, with a new computer policy in 1984 and the creation of software technology parks in the early 1990s providing the ecosystem for attracting private investment. The global adoption of a new technology platform Unix created saving opportunities for big corporations in the United States and Europe to replace high-cost onshore IT service contracts with low-cost offshore ones in countries like India, Israel, and Ireland (Dossani, 2006). Now, ICT is the largest export sector in India, contributing over 9 percent to India's GDP, employing more than 4 million people, and making India one of the top 10 global service exporters, well known for its exports of business process outsourcing and support services for finance and medicine. Bangladesh, Nepal, and Sri Lanka also have emerging ICT sectors and should look to lessons from the successful India experience.

Figure 18. Tele-workability by Sector



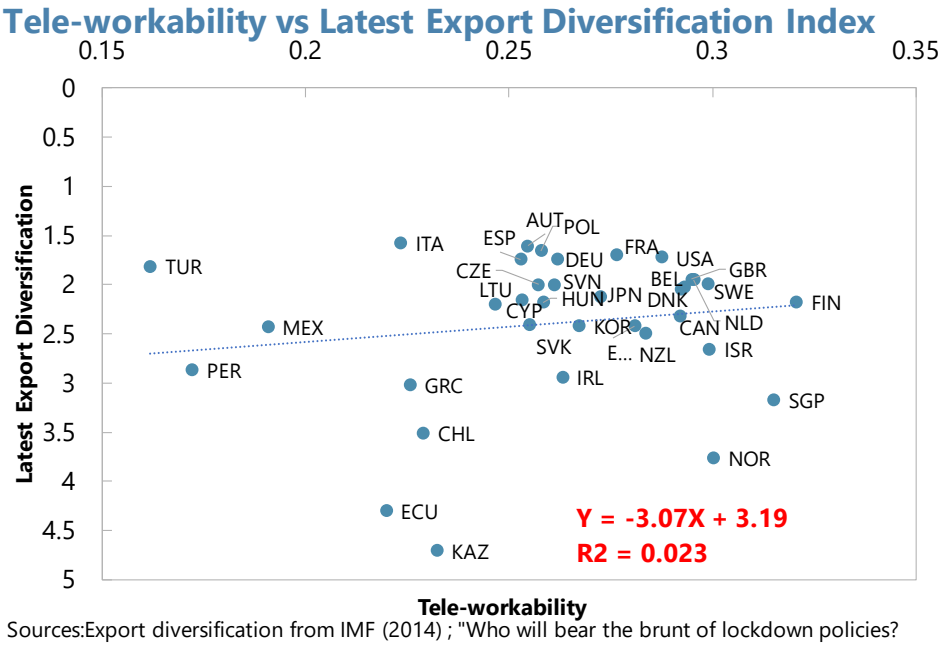
Source: Brussevich et. al (2020)
Note: Dots represent average tele-workability levels across all countries. End points represent countries with smallest and largest tele-workability levels in a given category.

The ability to provide services remotely is important not only when virus mutations prompt new quarantine requirements, but also more broadly, as we rethink the nature of work and potentially move to hybrid work models. The ability to provide services remotely will determine to what extent countries can benefit from the next wave of globalization, this time increasingly driven by services trade, both because of the technological shift toward tele-working as part of the "third unbundling" (Baldwin, 2016) and because trade in services could be less amenable to direct policy restrictions such as tariffs and quotas. Indeed, there seems to be a positive relationship between economic complexity and tele-workability (Figure 19). While the purpose of these two charts is not to claim one causes the other, the association between these indices indicates at least that they go hand in hand.

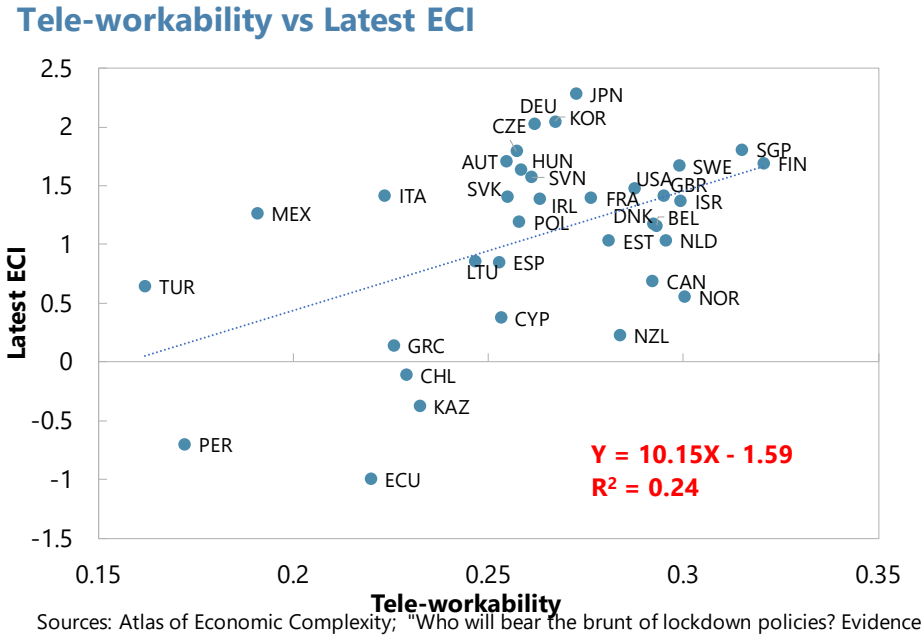
What factors could help improve tele-workability? The ability to work remotely seems to be related to fixed bandwidth subscription, years of schooling, and mobile phone subscriptions (Figure 20). As a result, adopting and investing in digital technologies and improving

education will be key to prepare the workforce for the challenges of the new economy. As it happens, these are also the factors that support growth and poverty reduction, enhance productivity, business opportunities, and greater diversification and complexity through better access to information and a wider range of goods and services at lower prices.

Figure 19. Diversification versus the Ease of Working Remotely

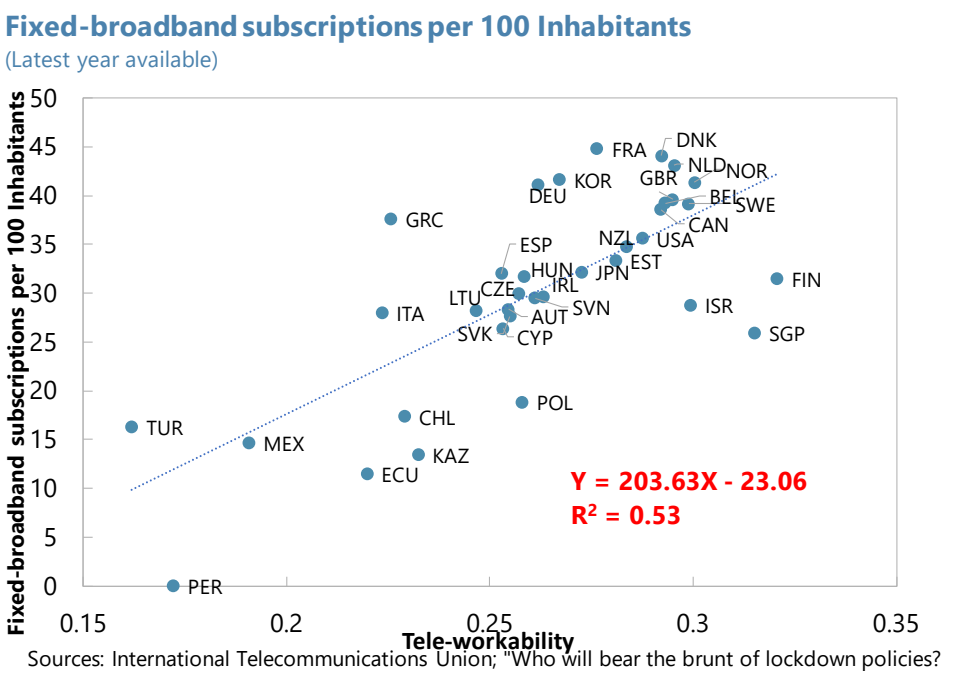


Sources:Export diversification from IMF (2014) ; "Who will bear the brunt of lockdown policies? Evidence from tele-workability measures across countries." (Brussevich, Dabla-Norris, Khalid, 2020)

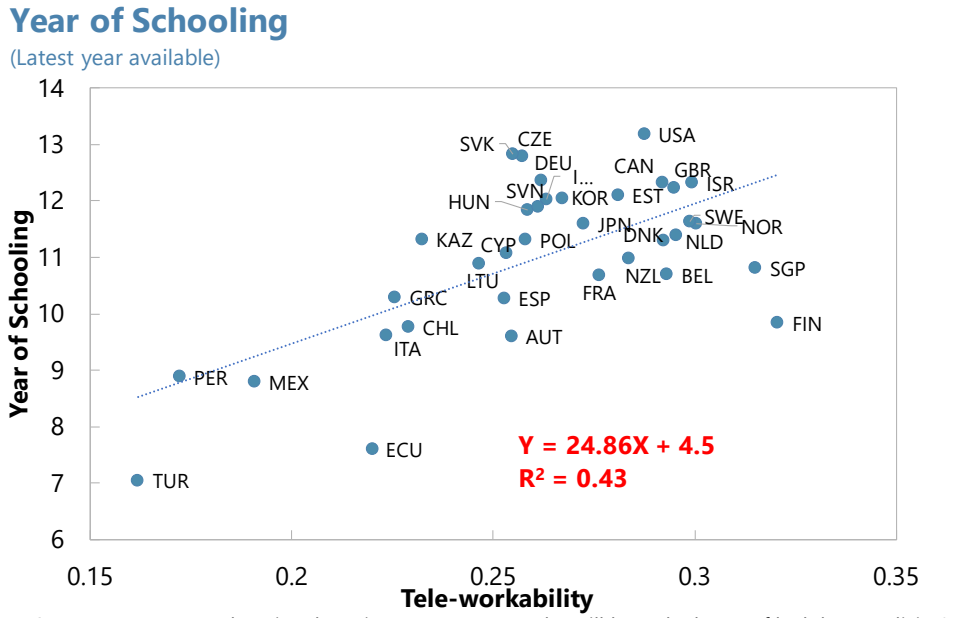


Sources: Atlas of Economic Complexity; "Who will bear the brunt of lockdown policies? Evidence from tele-workability measures across countries." (Brussevich, Dabla-Norris, Khalid, 2020)

Figure 20. Factors that Facilitate Tele-Workability

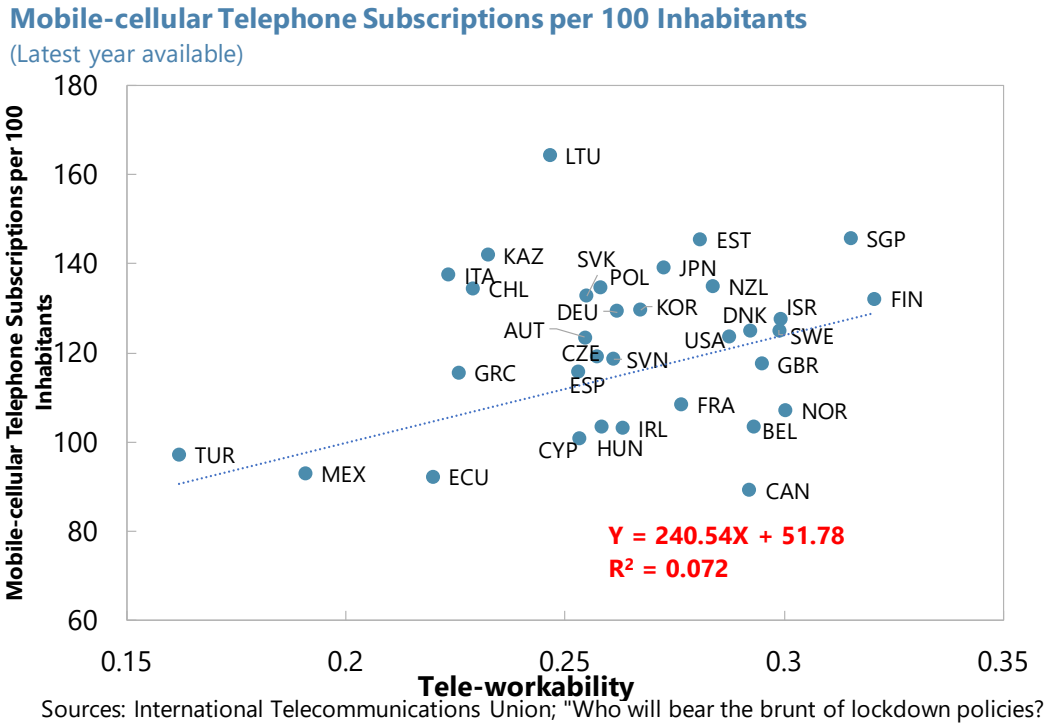


Sources: International Telecommunications Union; "Who will bear the brunt of lockdown policies? Evidence from tele-workability measures across countries." (Brussevich, Dabla-Norris, Khalid, 2020)



Sources: Barro-Lee Educational Attainment Dataset; "Who will bear the brunt of lockdown policies? Evidence from tele-workability measures across countries." (Brussevich, Dabla-Norris, Khalid, 2020)

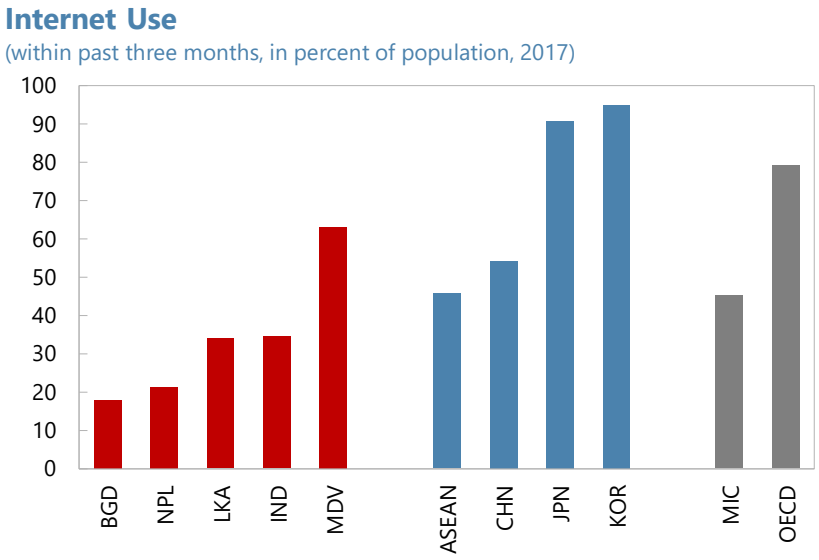
Figure 20. Factors that Facilitate Tele-Workability (Continued)



Sources: International Telecommunications Union; "Who will bear the brunt of lockdown policies? Evidence from tele-workability measures across countries." (Brussevich, Dabla-Norris, Khalid, 2020)

Going forward, investing in sectors such as ICT to strengthen the needed infrastructure for digital development that has been in high demand since the COVID-19 crisis would be needed. Although digitalization and financial technologies have grown in South Asia, investing in infrastructure will be key as a large share of the population still lacks internet access (Figure 21). Sectoral policies to further support the ICT sector could include in-house training and skill upgrades in new technologies – such as big data analytics, cloud computing, artificial intelligence, and machine learning – developing high value-added product software, engineering, and research and development services to move up the value chain and capture a larger share of the growing digital economy segment. These sectoral policies are complementary to the horizontal policies analysed in our empirical analysis.

Figure 21. Digitalization in South Asia: Room for Improvement



Source: World Bank World Development Indicators.

VI. Conclusions

Economic development, diversification, and complexity are mutually reinforcing processes. The process of creative destruction and dynamic reallocation of resources from less productive to more productive sectors boost growth, and more diversified economies tend to show greater resilience to shocks and exhibit lower volatility.

While South Asian countries have gone a long way diversifying their economies, there is substantial scope to do more. Some countries – such as India, Nepal, and Sri Lanka – can build on their existing production facilities; others where product space is clustered in specific industries – such as Bangladesh, Bhutan, and the Maldives – would need to undertake a more concerted push.

While it is hard to pick specific winner industries, South Asia can draw lessons from other countries on the enabling environment that can foster the process of greater diversification and complexity. South Asia needs to invest in infrastructure, education, and R&D, facilitate bank credit to productive companies, and increase openness to trade. Given the COVID-19 pandemic, adopting and investing in digital technologies as part of the infrastructure push and improving education are of even greater importance to facilitate the ability to work remotely and assist resource reallocation away from the less viable sectors.

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Annex 1. Data Sources and Definitions

Data Sources

Data sources for the dependent variables in this paper are Atlas of Economic Complexity database and IMF Export Diversification database. The primary data sources for independent variables are World Development Index, IMF World Economic Outlook database, and IMF Financial Development database, which cover the infrastructure, trade, macro stability and financial factors. The IMF Global Debt database provides details on private debt and public sector debt as percent of GDP. Other supplemental database on human capital and innovation indicators include Barro-Lee Educational Attainment Dataset and OECD ANBERD (Analytical Business Enterprise R&D) database.

Data Definitions

Physical capital per employee is defined as the ratio of capital stock at current PPPs in millions of 2011 USD) to the number of people engaged. Both indicators are from Penn World Table, version 9.1.

Trade openness measures the share of international trade in the economy. It is constructed as the sum of exports and imports of goods, both in percent of GDP in U.S. dollar terms. IMF World Economic Outlook database provides the detailed breakdown of balance of payments by country.

One of the robustness checks for the regressions in this paper examines the relationship between GDP per capita and diversification and complexity. GDP per capital is derived from GDP in U.S. dollars and population data from IMF World Economic Outlook database.

Oil dependency is measured by the ratio of oil export value to value of total exports of goods and services. Details on oil and total exports by country rely on IMF World Economic Outlook database.

The stylized fact on growth volatility presents the impact of export diversification and economic complexity on resilience to shocks. Growth volatility is the moving average of 5-year standard deviation of real GDP per capita by country. Data on real GDP per capita comes from World Development Indicators.

variable in the robust regressions represents the change of credit to GDP ratio, which measures the ratio of national debt to GDP of a country. Credit to GDP ratio comes from World Development Indicators.

Table A.1. Data Sources

Indicator	Source
Economic Complexity Index	Atlas of Economic Complexity
Export Diversification Index	Export diversification from IMF (2014)
Infrastructure	
Railway Density	World Development Index
Access to Electricity	World Development Index
Quality of Infrastructure	World Development Index
Regulatory Environment	
Ease of Doing Business	World Bank Doing Business Historical Data
External Conflict	Financial Development Database from IMF
Internal Conflict	Financial Development Database from IMF
Gini Index	World Development Index
Finance	
Financial Development Index	Financial Development Database from IMF
Financial Institutions Depth	Financial Development Database from IMF
Financial markets depth	Financial Development Database from IMF
Credit to GDP ratio	World Development Index
Human Capital	
Literacy Rate	World Development Index
Life Expectancy	World Development Index
Human Capital Index	World Development Index
Years of Schooling	Barro-Lee Educational Attainment Dataset
Total Labor Force Participation Rate	World Development Index
Trade Openness	
Total Export	IMF World Economic Outlook database
Total Oil Export	IMF World Economic Outlook database
Physical Capital	
Physical Capital per Employee	Penn World Table, Version 9.1
Investment to GDP ratio	IMF World Economic Outlook database
Macro Stability	
Average Inflation	IMF World Economic Outlook database
Private Debt as the Percent of GDP	IMF Global Debt Database
Public Sector Debt as the Percent of GDP	IMF Global Debt Database
External Debt	IMF World Economic Outlook database
Innovation	
Research and Development Spending as Percent of GDP	OECD ANBERD (Analytical Business Enterprise R&D) database
Foreign Direct Investment as Percent of GDP	IMF World Economic Outlook database
Other Factors	
Population	IMF World Economic Outlook database

Table A.2. Summary Statistics

Indicator	Obs	Mean	Std. Dev.	Min	Max
Economic Complexity Index	6,605	-0.06	0.96	-4.26	2.83
Export Diversification Index	6,402	3.43	1.42	0.00	6.42
Infrastructure					
Railway Density	3,478	1.70	2.73	0.00	16.55
Access to Electricity	3,865	78.02	31.42	0.01	100.00
Quality of Infrastructure	1,486	4.15	1.17	1.30	6.83
Regulatory Environment					
Ease of Doing Business	1,349	60.15	12.75	24.30	87.17
External Conflict	3,838	9.73	1.89	0	12
Internal Conflict	3,838	9.01	2.28	0	12
Gini Index	1,359	38.95	9.27	21	65.8
Finance					
Financial Development Index	5,551	0.28	0.21	0	1
Financial Institutions Depth	5,551	0.38	0.22	0	1
Financial markets depth	5,551	0.18	0.23	0	1
Credit to GDP ratio	5,891	39.74	39.23	0.19	309
Human Capital					
Literacy Rate	701	80.11	21.66	8.69	100
Life Expectancy	6,741	64.87	11.72	26.17	85
Human Capital Index	148	0.57	0.15	0.29	0.88
Years of Schooling	978	6.35	3.26	0.24	13
Total Labor Force Participation Rate	4,413	63	10	37	91
Trade Openness					
Oil in Exports	6,239	0.12	0.24	0	1.21
Trade Openness	7,011	49	46	0	810
Physical Capital					
Physical Capital per Employee	6,354	104,921	138,993	241	1,588,161
Investment to GDP ratio	5,869	24	12	-9	158
Macro Stability					
Average Inflation	6,607	25	333	-73	23,773
Private Debt as Percent of GDP	844	193	87	47	755
Public Sector Debt as Percent of GDP	309	57	40	10	346
External Debt as Percent of GDP	5,264	65	98	0	1,288
Innovation					
Research and Development Spending as Percent of GDP	1,782	0.96	0.95	0.01	4.58
Foreign Direct Investment as Percent of GDP	4,028	0.05	0.33	-0.45	10.20
Other Factors					
Population	7,011	31	123	0	1,410
GDP in US dollar	7,011	210	1,000	0.01	19,519
GDP in US dollar per capita	5,319	7,507	14,243	5.50	132,702

Annex 2. List of Countries and Time Samples Used in Regressions

Table A.1. Economic Complexity

	Country	Observations				Country	Observations		
		Number	Earliest	Latest			Number	Earliest	Latest
1	Albania	2	2007	2008	38	Lithuania	1	2010	2010
2	Algeria	5	2001	2005	39	Malaysia	9	1996	2010
3	Armenia	14	1997	2010	40	Mali	2	2007	2010
4	Belgium	8	2003	2010	41	Mexico	15	1996	2010
5	Bolivia	6	1998	2009	42	Mongolia	14	1997	2010
6	Brazil	11	2000	2010	43	Morocco	6	1998	2010
7	Bulgaria	15	1996	2010	44	Mozambique	4	2002	2010
8	Cambodia	1	2002	2002	45	Myanmar	4	1999	2002
9	Chile	4	2007	2010	46	Netherlands	10	2001	2010
10	China	14	1997	2010	47	Norway	12	1997	2010
11	Costa Rica	12	1996	2010	48	Pakistan	9	1997	2009
12	Croatia	12	1999	2010	49	Panama	11	2000	2010
13	Czech Republic	15	1996	2010	50	Paraguay	6	2001	2008
14	Ecuador	8	2001	2010	51	Peru	8	1997	2004
15	Egypt, Arab Rep.	9	1999	2010	52	Philippines	5	2002	2009
16	El Salvador	5	1998	2010	53	Poland	15	1996	2010
17	Estonia	7	2004	2010	54	Portugal	10	2001	2010
18	Finland	10	2001	2010	55	Saudi Arabia	8	2003	2010
19	Gabon	3	2007	2009	56	Senegal	2	2008	2010
20	Germany	10	2001	2010	57	Slovak Republic	5	2006	2010
21	Ghana	2	2007	2010	58	Slovenia	7	2004	2010
22	Greece	8	2003	2010	59	South Africa	10	1997	2010
23	Guatemala	6	2005	2010	60	Spain	10	2001	2010
24	Hong Kong, China	10	2001	2010	61	Sri Lanka	6	1996	2010
25	Hungary	15	1996	2010	62	Sudan	7	1999	2005
26	India	15	1996	2010	63	Tajikistan	10	2001	2010
27	Indonesia	3	2000	2009	64	Tanzania	2	2007	2010
28	Iran, Islamic Rep.	9	2001	2010	65	Thailand	13	1996	2009
29	Iraq	4	2007	2010	66	Tunisia	9	2002	2010
30	Ireland	9	2002	2010	67	Turkey	13	1998	2010
31	Israel	15	1996	2010	68	Uganda	9	2002	2010
32	Italy	9	2002	2010	69	Ukraine	14	1997	2010
33	Jordan	2	2002	2008	70	United States	5	2006	2010
34	Kazakhstan	14	1997	2010	71	Venezuela	6	2005	2010
35	Kenya	2	2007	2010	72	Vietnam	1	2002	2002
36	Korea, Rep.	15	1996	2010	73	Zambia	7	1995	2007
37	Latvia	1	2010	2010					

Table A.2. Export Diversification

	Country	Observations				Country	Observations		
		Number	Earliest	Latest			Number	Earliest	Latest
1	Albania	2	2007	2008	39	Latvia	4	2007	2010
2	Armenia	4	2007	2010	40	Lesotho	1	2009	2009
3	Belgium	4	2007	2010	41	Lithuania	4	2007	2010
4	Bolivia	1	2009	2009	42	Malaysia	3	2008	2010
5	Brazil	4	2007	2010	43	Mali	2	2007	2010
6	Bulgaria	4	2007	2010	44	Malta	4	2007	2010
7	Burundi	4	2007	2010	45	Mexico	4	2007	2010
8	Chile	4	2007	2010	46	Mongolia	4	2007	2010
9	China	4	2007	2010	47	Morocco	1	2010	2010
10	Colombia	4	2007	2010	48	Mozambique	2	2008	2010
11	Costa Rica	4	2007	2010	49	Namibia	1	2010	2010
12	Croatia	4	2007	2010	50	Nepal	3	2008	2010
13	Cyprus	4	2007	2010	51	Netherlands	4	2007	2010
14	Czech Republic	4	2007	2010	52	Norway	4	2007	2010
15	Ecuador	4	2007	2010	53	Pakistan	2	2007	2009
16	Egypt, Arab Rep.	4	2007	2010	54	Panama	4	2007	2010
17	El Salvador	4	2007	2010	55	Paraguay	1	2008	2008
18	Estonia	4	2007	2010	56	Philippines	2	2007	2009
19	Finland	4	2007	2010	57	Poland	4	2007	2010
20	Gambia, The	2	2008	2009	58	Portugal	4	2007	2010
21	Germany	4	2007	2010	59	Russian Federati	4	2007	2010
22	Ghana	1	2010	2010	60	Saudi Arabia	4	2007	2010
23	Greece	4	2007	2010	61	Senegal	2	2008	2010
24	Guatemala	4	2007	2010	62	Slovak Republic	4	2007	2010
25	Hong Kong, China	4	2007	2010	63	Slovenia	4	2007	2010
26	Hungary	4	2007	2010	64	South Africa	4	2007	2010
27	Iceland	3	2007	2009	65	Spain	4	2007	2010
28	India	4	2007	2010	66	Sri Lanka	2	2008	2010
29	Indonesia	1	2009	2009	67	Tajikistan	4	2007	2010
30	Iran, Islamic Rep.	1	2010	2010	68	Tanzania	2	2007	2010
31	Ireland	4	2007	2010	69	Thailand	3	2007	2009
32	Israel	4	2007	2010	70	Tunisia	4	2007	2010
33	Italy	4	2007	2010	71	Turkey	4	2007	2010
34	Jordan	1	2008	2008	72	Uganda	4	2007	2010
35	Kazakhstan	4	2007	2010	73	Ukraine	4	2007	2010
36	Kenya	2	2007	2010	74	United States	4	2007	2010
37	Korea, Rep.	4	2007	2010	75	Venezuela	4	2007	2010
38	Kuwait	4	2007	2010	76	Zambia	1	2007	2007

Annex 3. Summary Statistics of the Regression Sample

Table A.1. Economic Complexity

Variable		Mean	Std. Dev.	Min	Max	Observations		
ECI	overall	0.36	0.90	-2.86	2.38	N	=	595
	between		0.93	-2.41	2.19	n	=	73
	within		0.18	-0.32	0.96	T-bar	=	8
Railway density	overall	2.74	3.09	0.00	11.28	N	=	595
	between		2.91	0.00	11.13	n	=	73
	within		0.62	-4.72	4.95	T-bar	=	8
R&D expenditure	overall	0.84	0.86	0.01	4.43	N	=	595
	between		0.77	0.04	3.78	n	=	73
	within		0.17	-0.35	1.72	T-bar	=	8
Trade openness	overall	65.80	39.93	12.64	338.41	N	=	595
	between		37.22	20.37	274.93	n	=	73
	within		11.06	-12.62	129.28	T-bar	=	8
Average inflation	overall	8.59	44.26	-3.05	######	N	=	595
	between		10.89	-1.22	85.06	n	=	73
	within		42.12	-74.12	984.74	T-bar	=	8
log(Credit to GDP)	overall	0.42	0.26	0.00	1.12	N	=	595
	between		0.25	0.04	1.08	n	=	73
	within		0.08	-0.04	0.78	T-bar	=	8
log(External debt to GDP)	overall	0.52	0.38	0.00	2.44	N	=	595
	between		0.35	0.08	2.08	n	=	73
	within		0.13	-0.24	1.21	T-bar	=	8
Oil share in exports	overall	0.11	0.23	0.00	0.96	N	=	595
	between		0.25	0.00	0.95	n	=	73
	within		0.03	-0.28	0.22	T-bar	=	8
Years of schooling	overall	8.84	2.48	1.16	13.18	N	=	595
	between		2.75	1.54	13.05	n	=	73
	within		0.40	7.62	10.23	T-bar	=	8

Table A.2. Export Diversification

Variable		Mean	Std. Dev.	Min	Max	Observations		
ECI	overall	2.80	1.08	1.44	5.81	N	=	250
	between		1.07	1.49	5.74	n	=	76
	within		0.17	2.31	3.56	T-bar	=	3
Quality of infrastructure	overall	4.24	1.16	1.42	6.82	N	=	250
	between		1.11	1.73	6.69	n	=	76
	within		0.20	3.74	4.79	T-bar	=	3
R&D expenditure	overall	0.89	0.90	0.02	4.43	N	=	250
	between		0.86	0.02	4.21	n	=	76
	within		0.10	0.58	1.51	T-bar	=	3
Trade openness	overall	68.28	42.55	16.93	338.41	N	=	250
	between		40.27	19.15	310.08	n	=	76
	within		6.23	47.71	96.61	T-bar	=	3
Average inflation	overall	5.79	5.29	-1.68	31.44	N	=	250
	between		4.43	0.68	26.09	n	=	76
	within		2.83	-2.28	19.61	T-bar	=	3
Investment to GDP	overall	25.23	6.98	10.45	51.16	N	=	250
	between		6.92	11.64	51.16	n	=	76
	within		3.18	15.01	37.29	T-bar	=	3
log(External debt to GDP)	overall	0.60	0.51	0.05	2.49	N	=	250
	between		0.49	0.05	2.41	n	=	76
	within		0.08	-0.01	0.92	T-bar	=	3
Oil share in exports	overall	0.11	0.21	0.00	0.92	N	=	250
	between		0.20	0.00	0.86	n	=	76
	within		0.02	-0.02	0.19	T-bar	=	3
Years of schooling	overall	9.13	2.60	1.67	13.18	N	=	250
	between		2.74	1.80	13.09	n	=	76
	within		0.13	8.56	9.70	T-bar	=	3

Annex 4. Robustness Checks

Table A.1. Lagged Regressors – Economic Complexity

VARIABLES	(1) ECI	(2) ECI	(3) ECI	(4) ECI
Lagged railway density	0.0486***	0.0608***	0.0643***	0.0363***
	(0.00808)	(0.00769)	(0.00630)	(0.00725)
Lagged R&D expenditure	0.341***	0.311***	0.202***	0.188***
	(0.0301)	(0.0282)	(0.0242)	(0.0291)
Lagged trade openness	0.00148**	0.00233***	0.00374***	0.00197***
	(0.000613)	(0.000587)	(0.000487)	(0.000551)
Lagged average inflation	-0.00448*	-0.00736***	-0.00911***	-0.00372*
	(0.00242)	(0.00228)	(0.00187)	(0.00218)
Lagged log(Credit to GDP)	0.642***	0.352***	-0.264***	0.0547
	(0.103)	(0.103)	(0.0918)	(0.101)
Lagged log(External debt to GDP)	-0.153**	0.0422	0.0217	-0.382***
	(0.0630)	(0.0626)	(0.0492)	(0.0586)
Lagged oil share in exports	-1.175***	-1.122***	-1.360***	-1.572***
	(0.0932)	(0.0872)	(0.0737)	(0.0896)
Lagged years of schooling	0.103***	0.129***	0.0919***	0.0383***
	(0.0119)	(0.0114)	(0.00917)	(0.0116)
Lagged log(Population)		0.135***		
		(0.0159)		
Lagged log(GDP in US dollar)			0.246***	
			(0.0118)	
Lagged log(GDP in US dollar per capita)				0.342***
				(0.0238)
Constant	-0.881***	-1.498***	-1.587***	-0.282*
	(0.172)	(0.176)	(0.137)	(0.159)
Time FE	Yes	Yes	Yes	Yes
Observations	593	593	593	593
R-squared	0.724	0.756	0.835	0.779

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table A.2. Lagged Regressors – Export Diversification

VARIABLES	(1) Export diversification	(2) Export diversification	(3) Export diversification	(4) Export diversification
Lagged quality of infrastructure	-0.253***	-0.231***	-0.192***	-0.213***
	(0.0659)	(0.0603)	(0.0569)	(0.0591)
Lagged R&D expenditure	0.0276	0.114	0.206***	0.213***
	(0.0783)	(0.0726)	(0.0698)	(0.0717)
Lagged trade openness	0.00490***	0.00348***	0.00305**	0.00479***
	(0.00143)	(0.00132)	(0.00124)	(0.00125)
Lagged average inflation	0.0227*	0.0293***	0.0150	-0.0134
	(0.0117)	(0.0107)	(0.0101)	(0.0109)
Lagged investment to GDP	-0.0133*	-0.00677	-0.00974	-0.0214***
	(0.00744)	(0.00683)	(0.00637)	(0.00651)
Lagged log(External debt to GDP)	0.341***	0.0210	0.166	0.686***
	(0.121)	(0.122)	(0.107)	(0.115)
Lagged oil share in exports	3.188***	3.071***	3.652***	4.452***
	(0.252)	(0.231)	(0.225)	(0.272)
Lagged years of schooling	-0.117***	-0.126***	-0.0692***	-0.0157
	(0.0252)	(0.0231)	(0.0222)	(0.0273)
Lagged log(Population)		-0.221***		
		(0.0322)		
Lagged log(GDP in US dollar)			-0.242***	
			(0.0277)	
Lagged log(GDP in US dollar per capi				-0.453***
				(0.0693)
Constant	4.353***	5.014***	4.810***	3.972***
	(0.346)	(0.336)	(0.302)	(0.315)
Time FE	Yes	Yes	Yes	Yes
Observations	250	250	250	250
R-squared	0.551	0.620	0.664	0.658

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table A.3. Clustered Standard Errors – Economic Complexity

VARIABLES	(1) ECI	(2) ECI	(3) ECI	(4) ECI
Railway density	0.0333	0.0470*	0.0519**	0.0279
	(0.0318)	(0.0274)	(0.0204)	(0.0242)
R&D expenditure	0.366***	0.349***	0.229***	0.203*
	(0.117)	(0.0870)	(0.0565)	(0.106)
Trade openness	0.000953	0.00214*	0.00334**	0.00164
	(0.00124)	(0.00128)	(0.00167)	(0.00132)
Average inflation	2.75e-05	-0.000115	-4.11e-05	0.000270
	(0.000274)	(0.000327)	(0.000338)	(0.000234)
log(Credit to GDP)	0.678**	0.386	-0.218	0.0520
	(0.305)	(0.297)	(0.245)	(0.297)
log(External debt to GDP)	-0.113	0.0747	0.0413	-0.338**
	(0.132)	(0.135)	(0.108)	(0.140)
Oil share in exports	-1.040***	-1.044***	-1.369***	-1.518***
	(0.264)	(0.276)	(0.224)	(0.208)
Years of schooling	0.112***	0.135***	0.102***	0.0415
	(0.0334)	(0.0351)	(0.0286)	(0.0271)
log(Population)		0.147***		
		(0.0464)		
log(GDP in US dollar)			0.239***	
			(0.0409)	
log(GDP in US dollar per capita)				0.354***
				(0.0765)
Constant	-1.085***	-1.823***	-1.843***	-0.428*
	(0.215)	(0.306)	(0.194)	(0.250)
Time FE	Yes	Yes	Yes	Yes
Observations	595	595	595	595
R-squared	0.701	0.738	0.820	0.788

Clustered standard errors at the country level in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table A.4. Clustered Standard Errors – Export Diversification

VARIABLES	(1) Export diversification	(2) Export diversification	(3) Export diversification	(4) Export diversification
Quality of infrastructure	-0.240*	-0.225*	-0.169	-0.170
	(0.136)	(0.126)	(0.122)	(0.129)
R&D expenditure	0.00337	0.0932	0.184	0.110
	(0.160)	(0.131)	(0.131)	(0.163)
Trade openness	0.00437**	0.00303*	0.00248	0.00380*
	(0.00208)	(0.00179)	(0.00179)	(0.00197)
Average inflation	0.0263	0.0260*	0.0111	0.00762
	(0.0182)	(0.0134)	(0.0124)	(0.0192)
Investment to GDP	-0.00724	-0.00358	-0.00640	-0.0111
	(0.0130)	(0.0108)	(0.0103)	(0.0127)
log(External debt to GDP)	0.354	-0.0257	0.119	0.568**
	(0.252)	(0.279)	(0.253)	(0.261)
Oil share in exports	2.884***	2.875***	3.476***	3.638***
	(0.399)	(0.337)	(0.342)	(0.522)
Years of schooling	-0.125***	-0.134***	-0.0735*	-0.0486
	(0.0453)	(0.0427)	(0.0435)	(0.0555)
log(Population)		-0.240***		
		(0.0523)		
log(GDP in US dollar)			-0.257***	
			(0.0460)	
log(GDP in US dollar per capita)				-0.322**
				(0.141)
Constant	4.176***	5.009***	4.716***	3.737***
	(0.611)	(0.529)	(0.487)	(0.602)
Time FE	Yes	Yes	Yes	Yes
Observations	250	250	250	250
R-squared	0.536	0.629	0.662	0.568

Clustered standard errors at the country level in parentheses.
*** p<0.01, ** p<0.05, * p<0.1