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A Roadmap to Diversifying Pakistan's Exports: Operationalizing the Product Space

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Abstract

Pakistan has not been able to significantly increase exports or diversify its export base towards higher value-added products which has both contributed to its perpetual balance of payments problems and impeded growth. To address this, it is crucial to identify potential new exports that are not only relatively closer to the current export basket but also those products that have the potential to lead to higher value-added exports. This paper explores new categories of merchandise exports by incorporating the methodology developed by Hausmann and Klinger (2007), Hausmann et al. (2007), and Hidalgo et al. (2007). It operationalizes the concept of product space and identifies new products for Pakistan which are closer to prevailing production capabilities as well as new products that are of higher sophistication. Using the same methodology, this paper also analyzes the change in export basket of Pakistan from 2017 to 2021 and evaluates whether and to what extent the new categories recommended in 2017 have become part of 2021 export basket.

Introduction

Much has been written over the past decade concerning Pakistan's recurring balance-of-payments crisis. This discussion has covered a wide range of topics, from the cost of oil imports to boosting exports, from stabilization packages provided by the International Monetary Fund (IMF) to the China-Pakistan Economic Corridor (CPEC). While a comprehensive discussion of how to address the balance of payments problem must take into account most of these issues, this paper focuses on identifying potential export areas to revitalize the chronically underperforming export sector.

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This paper highlights three important features that characterize the Pakistani export sector, as a starting point. First, the Pakistani export sector has been heavily reliant on textile exports, particularly low value-added textile exports. As a first step, this makes sense since most developing countries start by exporting low value-added goods to leverage their comparative advantage. However, unlike many other countries Pakistan has consistently failed to diversify beyond a narrow range of low value-added exports.

Second, while there is much optimism about the impact of the recent round of devaluation on exports, economic theory suggests a more nuanced relationship in predicting the effect of devaluations on the balance-of-payments (exports and imports in particular). More specifically, although devaluations increase exports at the macroeconomic level, the actual impact depends on the price elasticity of exports. A decrease in price for Pakistan exports low value-added textile products may not lead to a proportional increase in exports, as much as policymakers would like, especially if demand is relatively inelastic. This underscores the need for Pakistan to move towards a comprehensive export strategy that focuses on producing and exporting higher value-added goods rather than relying solely on short-term macroeconomic policies like devaluations.

Finally, despite policy makers' frequents discussions of growth strategies, there has been a dearth of serious work done on developing a comprehensive industrial strategy to promote exports and economic growth. This neglect is partly due to a departure of international consensus from industrial strategies, yet cross-country evidence clearly shows that almost all industrially developed countries have relied on well-defined strategies. Additionally, Pakistani policymakers have previously lacked the capacity to formulate a detailed industrial strategy at the micro level.

This paper aims to address this gap by using well-developed techniques to analyze the product space and identify potential export products for Pakistan. The idea behind this is simple:, researchers have developed tools to measure the proximity of new products to a country's current production basket, despite the challenges of mapping a country's entire productive capabilities. This is done using the following method: For example, if five countries are producing and exporting the same bundle of goods as Pakistan, and all five are also producing and exporting another good that Pakistan is not, we can say that there is a relatively small 'distance' between this new good and the goods Pakistan exports—since these other countries possess similar capabilities to Pakistan. However, if a group of countries is exporting only a limited subset of Pakistan's exports while exporting other goods that Pakistan does not, then the distance to these new goods is relatively high—since these countries have different capabilities than Pakistan. This methodology allows us to determine goods that Pakistan could potentially produce and export based on the exports of other countries.

While we are able to identify potential export products for Pakistan this way, there is a risk of identifying relatively low value-added goods that other similar countries produce. While this may not be a problem at a macroeconomic level (since exports of a different set of low value-added goods still leads to higher and more diversified exports), it fails to address the issue of moving Pakistan toward higher value-added exports. In order to remedy this issue, we also consider established measures of product sophistication.

The notion is that product sophistication can be inferred from the countries that produce a product. High-income countries tend to produce more technologically advanced products while lower-income countries tend to produce less technologically advanced products. By examining the aggregate incomes of the countries that produce a good, one can rank that good according to its level of product sophistication. We apply this methodology to rank the products identified through distance analysis in terms of product sophistication.

Finally, we combine these factors and calculate the distance and product sophistication of potential exports. The policy implications are clear: If Pakistan aims to develop an export strategy focused on higher value-added goods that it can potentially produce, it should prioritize those goods that have lower 'distance' and exhibit a higher level of sophistication compared to the average sophistication level of goods in Pakistan's current export basket.

One question is whether Pakistan can actually produce the goods identified by the methodologies discussed above. If not, is the entire exercise merely academic? While we believe that our analysis above does provide important lessons, we extend our analysis by also calculating the distance and product sophistication of goods that Pakistan already exports, albeit in relatively small amounts (less than US$1 million or less than US$10 million). This provides us with a recommended list of products characterized by higher product sophistication that we know that Pakistan can produce (as it is already exporting them).

We begin by discussing some relevant literature, followed by a discussion of our methodology. Next, we present our results and simulations based on these results. Finally, we conclude with some preliminary findings.

Literature Review

Economic development necessitates undergoing structural transformation and accumulating productive capabilities that enable production and export of high-value-added and complex products. Therefore, export diversification has remained a central policy concern in developing economies. In this regard, the development path of a country as explained by Hausmann & Klinger (2007), Hidalgo et al. (2007), and Hidalgo & Hausmann (2009) is particularly relevant.

They emphasize that need for firms must continuously upgrade their skills and knowledge to employ more sophisticated product-specific factors required to produce and export high-value-added goods.

Hidalgo et al. (2007) introduced the concept of product space to explain this, which represents all products exported globally. Within this space, a country is likely to develop the capability to produce products which relate to its existing productive capabilities. For instance, a country that effectively exports silk cloth would possess the necessary human, physical and institutional capabilities to produce a related high-value-added product, such as silk shirts, rather than those needed for producing printed circuits. Therefore, the country would initially specialize in silk shirts, gradually accumulating the capabilities required to produce more complex products.

Several studies in the existing economic literature have employed the concept of product space and structural transformation to explain export diversification and its impact on economic development in various economies. Vitola & Davidsons (2008) used the product space model to identify potential exports that could replace Latvia's existing export basket, concluding that the economy could specialize in pharmaceuticals, medical, precision and optical instruments, as well as chemicals and chemical products. Similarly, Jankowska, Nagengast & Perea (2012) employed the product space methodology as proposed by Hidalgo et al. (2007) to analyze the structural transformation of the newly industrialized countries (NICs) in Asia, finding a gradual shift towards high-value-added industries such as iron, steel and electronics. Bojetic, Pejovic & Osorio-Roddarte (2013) also utilized the product space methodology to identify the potential exports for the export basket of Montenegro, including goods in the sectors of tourism, wine, food, and energy.

Likewise, Fortunato et al. (2015) demonstrated the potential export basket and the resulting sophistication gain in the exports of Ethiopia's less developed economy , finding that exporting more iron and steel products would lead to a more sophisticated export structure. Bayudan-Dacuycuay & Lim (2017) employed the product space methodology to compare export sophistication and export-led growth among selected ASEAN and developed Asian economies. They concluded that the ASEAN countries have a limited product scope and require a more substantial structural transformation to transition towards high-value-added exports within their current export baskets. Singh, Gupta, Sudan & Singh (2018) analyzed the product space model for India, revealing that industrial policy should prioritize textiles and clothing, selected agricultural products, food processing, electronics, and chemicals to increase and diversify Indian export structure.

UNCTAD (2018) examined the structural transformation dynamics of five Southern African economies: Mauritius, Mozambique, South Africa, the United

Republic of Tanzania and Zambia. The report explained that except for Mauritius and South Africa, the economies have a dominant primary sector and a limited production sector. The report recommended altering this by implementing efficient export diversification strategies based on the product space literature proposed by Hausmann & Klinger (2007). Bezerra & Pinheiro (2019) identified strategies for efficient economic diversification using the concept of product space for Paraguay. They measured the revealed comparative advantage (RCA) and extent of similarity of 738 Standard International Trade Classification (SITC) categories in Paraguay's production structure and recommended that policymakers specialize in the agricultural and chemicals sectors to attain a higher, more inclusive economic growth rate. Shah et al. (2021), investigated the potential in export diversification and opportunities for LNG exporting Asian countries, using the product space model to explore the connection between LNG and petrochemicals. The results indicated that Malaysia and Indonesia have untapped petrochemical production potential, while the UAE, Oman, and Myanmar have lower exploration potential. Moreover, Gloria et al. (2020) adapted the Hausmann-Hidalgo et al. (2009) product space approach to analyze the case of Italian provinces, examining the correlation between a province's export performance and the network connectedness and centrality of its exports. They created a new Product Space Position (PSP) index that shares many characteristics with Hausmann-Hidalgo et al. (2009) but is significantly more effective for managing provincial and regional data. The PSP index was found to outperform other indices, highlighting key concepts within the network-cognitive-distance-trade paradigm. A stronger presence in the export-network product area is associated with more favorable local economic outcomes.

Methodology

Calculating Product Distance

Any developing country aiming to upgrade its exports at a certain point in time must carefully select a particular set of products that are not only feasible to produce but also lead to a more sophisticated and high-value-added export structure. To explore such production and export possibilities for a particular country, this paper adopts a measure of productive capabilities proposed by Hausman & Klinger (2007), that operationalizes the concept of product space.

Product space represents the interconnectedness of products. Any two products are highly related if they require similar conventional factors of production (land, labor, capital) or similar levels of technology or institutions. According to Fortunato et al. (2015), such products are more likely to be produced together within the product space. Conversely, dissimilar products that require better technology or a different range of other factors of production are less likely to be produced together. For example, a country that produces and exports low-

value-added textiles, such as trousers, might find it more feasible to export formal suits or sportswear as sophisticated goods. These new products have higher proximity to the existing export basket and certainly require similar factors of production, human capital, technology and institutions. However, products such as machinery, printed circuits or electrical components require a completely different set of productive capabilities within the product space and are highly dissimilar products with respect to the current export basket. Hence, these products are less likely to be produced and exported.

Following Hausman & Klinger (2007), to generate this proximity-based measure, the methodology first identifies those products in an export basket for which revealed comparative advantage (RCA) is greater than one—or those products for which a particular country is an effective exporter. RCA (Balassa, 1986) states that a country *j* is an effective exporter of a product *k* if the export share of that product in that country is higher than the export share in the global market. RCA is calculated as:

$$RCA = \frac{\frac{X_{jk}}{\sum jk\, X_{jk}}}{\frac{\sum j\, X_{jk}}{\sum j \sum k\, X_{jk}}}$$

whereby X_{jk} is the export value in country *j* of product *k*. If RCA > 1, it is said that country *j* is an effective exporter of product *k* and if RCA < 1, then country *j* is not an effective exporter of product *k*. Proximity between product *k* and another product of interest, *h*, can be defined as:

$$\varphi_{kh} = min\{P(RCA_k > 1|RCA_h > 1), P(RCA_h > 1|RCA_k > 1)\},$$

where $P(RCA_k > 1|RCA_h > 1)$ is a conditional probability stating that a country exports product *k* with RCA > 1, given that it also exports product *h* with RCA > 1. For example, if 20 countries export product *k* with RCA > 1 and only 5 of them export product *h* with RCA > 1, then the proximity or probability of exporting *k* in relation to *h* is minimum of {20/5, 5/20} or 0.25.

It is important to take the minimum of the two conditional probabilities because the measure of $\varphi_{kh}$is not symmetric. Fortunato et al. (2015) explain that as the number of countries exporting product *k* decreases and approaches one, the probability that another country exports *h,* given that it also exports *k,* becomes a dummy variable, equal to 1 for every other good exported by that particular country and 0 otherwise. This shows the individuality of the country rather than the outcome of a proximity-based measure. Therefore, taking the minimum of the conditional probabilities is necessary to eliminate this problem, as the proximity value would be high only if a higher number of countries exporting product *k* also export product *h*.

The primary objective of using this methodology is to estimate the probability of transitioning to a new export product, *h*, from the current export basket. For this purpose, we adopt the aggregate measure proposed by Hausman & Klinger (2007) known as *distance*. Fortunato et al. (2015) define distance as the conditional probability of exporting a particular product of interest, *h*, given the current export basket, *b*. A country is more likely to produce and export product *h* if the required capabilities are closer to the current export basket, *b*, or the distance of *h* from *b* is low.

A country's possessed capabilities are reflected by the proximity between products it exports, *b*, and a product of interest, *h*, whereas lacking capabilities are inferred from the proximity between products that a country does not export and product *h*. Hence, distance is the sum of proximities between all products that a country *j* is not exporting, normalized by the sum of proximities between all products and product *h*. Distance would be low if a country exports majority of products closely related to product *h*, and high if it exports only a small proportion of products closely related to product *h*.

Distance is formally given by:

$$distance_{bh} = \frac{\sum_{k=1}^{N}(1 - M_{kh})\varphi_{kh}}{\sum_{k=1}^{N}\varphi_{kh}}$$

whereby {1, N} is the product space, $M_{kh} = 1$ if the country exports *k* with RCA > 1 and 0 otherwise. Distance would be equal to zero if country *j* exports all the products in the product space. Similarly, if country *j* instead produces none of the products in the product space, distance of moving towards *h* from current export basket, *b*, would be maximum and equal to one.

In this paper, *b* is defined as the current export basket of Pakistan for the year 2017. The product space represents all the product categories at the four-digit level in the SITC revision 4 for the same year. After estimating distance of all the products of interest, *h*, the potential products are categorized into 10 distance groups, whereby group 10 represents the one farthest from the current export basket, *b*, and has a high value of distance (closer to one).

Calculating Product Sophistication

In choosing the products of interest, *h*, it is beneficial to have a measure that reflects the export sophistication of the goods in the product space so that such products can be targeted in the new export basket. For this, we adopt the export sophistication index proposed by Hausmann et al. (2007). This index infers that a country with higher Gross Domestic Product (GDP) would have a more sophisticated export basket compared to a country with a lower GDP, likely due to higher technological content, availability of natural resources, or higher human

capital use in the exports of richer countries which make them more sophisticated, assuming no trade interventions. This product-level measure of sophistication of exported goods is known as PRODY and is calculated as the RCA-weighted GNI per capita of country *j* exporting product *k*.

$$PRODY_k = \sum j \frac{\frac{X_{kj}}{X_j}}{\sum j \left(\frac{X_{kj}}{X_j}\right)} Y_j$$

whereby X_{kj} is the value of exports of country *j* for product *k*, X_j is the aggregate value of exports of country *j* and Y_j is the GNI per capita of country *j*. If X constitutes a higher proportion of poor countries' exports compared to rich countries' exports, then PRODY would have a low value. Similarly, if X constitutes for a higher proportion of rich countries' exports compared to poor countries' exports, PRODY would have a high value. In other words, a rich country's export would lead to a higher PRODY value whereas a poor country's export would lead to a lower PRODY value.

This paper also estimates the average sophistication of the current export basket, *b* of country *j* at time *t*, following Fortunato et al. (2015). This distinguishes among those potential products, or that proportion of *h* in country *j*, for which PRODY is higher than the average sophistication. Formally, it is stated as:

$$AverageSophistication_{jt}^{b} = \frac{\sum k \left(PRODY_{kt} * ExpValue_{kjt}\right)}{\sum k \left(ExpValue_{kjt}\right)}$$

whereby $ExpValue_{kjt}$ is the export value at time *t* of product *k* in export basket *b* for country *j*. The products that are not yet exported from the product space would be eliminated and the measure would reflect average sophistication of the current export basket for a particular country.

Following Fotunato et al. (2015), we also take the product-level measure of $PRODY_{kt}$ and measure the country level export sophistication, EXPY of country j during year t. It is the export weighted sum of product-level sophistication of each exported good k and defined as follows:

$$EXPY_{jt} = \sum_k \frac{X_{kjt}}{X_{jt}} PRODY_k$$

We expect a higher EXPY for "high-income" countries and a low EXPY for "low-income" countries. The reason is that PRODY is measured using GNI per capita of a particular country, and if a country is richer with higher production capabilities,

then their export shares are multiplied by corresponding higher PRODY values, resulting in a higher EXPY. However, as pointed out by Fortunato et al. (2015), there is significant variation in this relationship. There could be low-income countries who manage to export a relatively more sophisticated export basket, or a high-income country with low export shares per category of all exports being multiplied by higher PRODY, diminishing the value of EXPY. Hence, a positive correlation may not occur, although it is theoretically anticipated. Lall et al. (2006) further suggested that there could be high-technology products with low sophistication and low-technology products with high sophistication. So, a country with low production capability or lower technological intensity may have a high EXPY, and vice-versa.

Identifying Products as Potential Exports

This paper analyzes 140 countries and product space represents 4-digit HS codes with 1223 product categories. Since Pakistan is the primary focus, distance groups were calculated exclusively for this country. Three categories were considered : (1) all unexported items in the product space, categorized into 10 distance groups with the 10th group representing products farthest from the current export basket; (2) all products with an export value less than US$1 million, categorized into 10 distance groups with the 10th group representing products farthest from the current export basket; and (3) all products in the product space with an export value less than US$10 million, categorized into 10 distance groups with the 10th group representing products farthest from the current export basket.

Potential exportable products or products whose exports can be further increased in the current export basket are identified by a PRODY higher than the average sophistication of the existing export basket, indicating that they are relatively high-value added, and are also feasible, meaning they are in closer distance groups.

A graphical representation of the product selection process is shown in Figure 1 (see Appendix).

The gray and white spaces represent product space while the white space shows the current export basket of a hypothetical country. The potential products, *h*, for this country that can increase export value would be those that are already being exported and have a PRODY higher than the average sophistication, such as epoxide resins. In the short term, natural abrasives could be an additional product in the current export basket as they possess a higher PRODY and similar distance to fungicides. Hence, natural abrasives are both feasible and more sophisticated than fungicides. Within products with higher distance groups—according to this country's productive capacity—pumps would be preferred over rail locomotives, as the latter may not be feasible due to higher productive capability requirements. However, rail locomotives could become a potential export product in the future once the average sophistication and PRODY levels improve over time.

Before discussing our results, it is important to acknowledge that while there has been much discussion about countries moving up the export sophistication ladder, much of this has focused on the balance-of-payments implications of exporting more sophisticated, higher value-added goods. However, there is also a fundamental relationship between producing (and exporting) more sophisticated goods, and an economy's level of development. As a country develops its human and physical capital (along with other factors that influence growth, such as institutions and technology), it naturally tends to start producing more sophisticated goods, which in turn contributes to further development. Therefore, the relationship between development and product sophistication is far more nuanced than a one-sided argument simply suggesting that producing and exporting more sophisticated goods leads to higher growth.

In the next section, we present our results.

Results

As discussed above, the analysis was conducted for three categories: (i) First, we analyzed the categories of potential exports based on the list of all goods which Pakistan currently does not export. (ii) Second, we analyzed the categories of potential exports based on the list of all goods which Pakistan does not export and those goods whose exports are less than US$1 million. (iii) Finally, we analyzed the categories of potential exports based on the list of goods which Pakistan does not export and those goods whose exports are less than US$10 million.

The purpose of examining these different categories was to identify new product categories for potential Pakistani exports and to pinpoint existing product categories in which Pakistan could potentially increase exports, both concentrating on products with higher-than-average sophistication level.

Results for New Pakistani Export Categories

In our initial analysis, we calculated the distance and sophistication of goods which Pakistan could potentially export, based on the exports of countries with similar export profiles.

In this case, we calculated the distance and sophistication of goods which Pakistan does not export but are exported by countries with similar export baskets as Pakistan. Figure 2 (see Appendix) illustrates the results.

In Figure 2, the red line represents the average sophistication level of Pakistan's exports in 2021. For comparison purposes, we have also plotted the average sophistication level of exports of other Asian countries including Malaysia, India and Vietnam, in Figure 3.

In Figure 2, products above red line represent goods whose sophistication level is higher than the average sophistication of Pakistan's 2021 export basket. From a policy perspective, based on this analysis, Pakistan should select products above the red line to potentially export. However, the product should not be too far above the red line, to be realistically produced and exported.

Figure 2 (see Appendix) also illustrates the distance of each product category from Pakistan's 2021 export basket of goods. Products that are closer to the origin represent goods which are potentially 'easier' for Pakistan to produce and export (in terms of production capabilities) while goods further away from the origin are 'more difficult' for Pakistan to produce and export (in terms of production capabilities). Turning again to a policy perspective, Pakistan should potentially focus on new products which lie closer to the origin since these goods have a greater chance of falling within its current production and export capabilities.

Table 1 in the Appendix details the list of goods sorted first by distance and then by level of sophistication. The argument here is that by first matching potential export goods with Pakistan's current capabilities (lower versus higher distance) and then sorting them by sophistication, one can identify potential export goods which can lead to higher-value-added exports.1

Results including Goods with Pakistani exports of US $1 million or less

We extend the first analysis to include products that not only lie outside Pakistan's 2021 export basket but also products that generate low export revenues or are characterized by low levels in the 2021 export basket. The rationale for this extension is that there may be products with high sophistication and relatively low distance (similar to what Pakistan can and is exporting) which are not exported in significant quantities. Since the country already produces and exports these goods, exporting these more sophisticated products could yield significant gains.

In this instance, we calculated the distance and sophistication of goods which Pakistan does not export but which are exported by countries with similar export baskets as Pakistan, and goods that Pakistan exports but are valued under US$1 million in Pakistan's 2021 export basket. Figure 4 (see Appendix) illustrates the results.

The orange line shows the average sophistication level of Pakistan's 2021 export basket—the products illustrated in blue are products valued at under US$1 million of exports in 2021, while the products illustrated in red are products which Pakistan did not export in that year.

1 We have also included the Leamer names and Lall product sophistication classifications for all of the products.

The first notable observation is that a substantial number of 'blue' products (or products that Pakistan exported in 2021) are closer to the origin. This aligns with our expectations as these goods are already produced and exported by Pakistan and are more closely aligned with the country's current production capabilities. However, we argue that all these products are not homogenous. Some goods closer to the current capabilities of the county exhibit a sophistication level higher than the average sophistication level of Pakistan's 2021 export basket, while a few others fall below the average sophistication level. In terms of potential, it would be prudent to prioritize expanding the exports of goods which a closer to the origin in terms of distance and also lie above the average sophistication level of Pakistan's overall export basket (above the orange line).

Next, for new exports, the same argument holds as in the previous section: it would be advantageous to prioritize those new potential exports which demonstrate higher-than-average sophistication levels (above the orange line) and are situated closer to the origin, in terms of distance.

Table 2 in the Appendix presents products exported by Pakistan in 2021 (in quantities less than US$1 million), sorted first by distance and then by product sophistication.2

Results including Goods with Pakistani exports of US$10 million or less

Finally, we extended our analysis to include potential exports and products exported by Pakistan in 2021 and exports valued at under US$10 million. The argument remains consistent: Any policy aimed at expanding Pakistan's exports should not only prioritize new exports but also more sophisticated goods that Pakistan exports in relatively small quantities.

In this case, we calculated the distance and sophistication of goods which Pakistan does not export but are exported by countries with similar export baskets as Pakistan, and goods which are exported but are valued under US$10 million in 2021. Figure 5 (see Appendix) illustrates the results.

In Figure 5, the orange line shows the average sophistication of Pakistan's 2021 export basket. Products in blue are those exported in quantities valued at under US$10 million while the products in red are those not exported in 2021.

From a policy perspective, 'blue' products with a higher-than-average sophistication level (lying above the orange line), and are closer to the origin in terms of distance, should be prioritized. The second priority should be the 'red'

2 Again, we have also included the Leamer product names and Lall product classifications for all of the goods.

products, which also exceed the average sophistication level and are relatively closer to the origin.

Comparison of Categories by Product Sophistication (PRODY) of Pakistani Goods Exported in 2017 and 2021

In 2019, we implemented a similar operationalization of product space analysis for Pakistan, using 2017 export data and recommended (i) Category 1: New product categories which could potentially be exported by Pakistan, (ii) Category 2: Products from the 2017 export basket with total export values of less than US$1 million, with a higher-than-average product sophistication (PRODY) and relatively lower distance, and (iii) Category 3: Products from the 2017 export basket with export values of less than US$10 million with higher-than-average product sophistication (PRODY) and relatively lower distance.

Below, we compare the export baskets of 2017 and 2021 to analyze whether Pakistan exporters began exporting goods in the categories (1-3) that we previously identified. If so, we also examine the increase in total export values under all three categories. Table 1 below, illustrates the results for each of the three categories. The data reveals that the 2021 export basket incorporated many of the recommended products.

Category 1 shows that by adding new products with a sophistication level above the average PRODY, Pakistan's export revenue increased from US$0 in 2017 to US$103 million in 2021.

In category 2, the export revenues of goods with smaller export values (less than US$1 million) increased from US$96 million in 2017 to US$427 million in 2021. Of this, approximately US$25 million of the US $96 million in 2017, were more sophisticated products while US$194 million of the US$427 million in 2021 were more sophisticated products. Focusing on those export categories where Pakistan was exporting smaller quantities (less than US $1 million), the country increased its exports of more sophisticated goods to over US$194 million. By combining the exports of new higher sophistication products from categories 1 and 2, we see that Pakistan exported approximately US$298 million worth of more sophisticated products in 2021 in those smaller categories (where it was exporting less than US$1 million) compared to only US$25 million in 2017.

Similarly, in category 3, the exports of goods with small to medium export values (of less than US$10 million) increased from US $818 million in 2017 to US$1,932 million in 2021. Of this, approximately US$233 million of the US$818 million in 2017 were more sophisticated products while in 2021, US$803 million of the US$1,932 million were more sophisticated products. Focusing on those export categories where Pakistan was exporting small to medium quantities (less than

US$10 million), the country increased its exports of more sophisticated goods to over US$803 million. By combining the exports of new higher sophistication products from categories 1 and 3, we see that Pakistan exported more than US$906 million worth of more sophisticated products in 2021 in those small to medium categories (where it was exporting less than US$10 million) compared to only US$233 million in 2017.

These results suggest that Pakistan has the capacity to produce and export higher-sophistication goods. Policymakers, especially those involved in trade agreements should consider this when formulating export, industrial and trade policies.

Table 1: Export Revenue Comparison by Product Sophistication (PRODY) between 2017 and 2021

	Export Value (US$1000)					
	Category 1 (actuals): New Products		Category 2 (actuals): All Products exported at value < US$1M		Category 3 (actuals): All Products exported at value < US$10 M	
	All Prod-ucts	Products above Average PRODY	All Products	Products above Average PRODY	All Products	Products above Average PRODY
Export Revenue in 2017	$0.00	$0.00	$96,508.15	$25,444.28	$818,709.53	$233,733.12
Export Revenue in 2021	$109,931.70	$103,291.40	$427,130.12	$194,967.92	$1,932,795.14	$803,055.46
Adding Category 1 products in 2021 Export Basket	$109,931.70	$103,291.40	$537,061.82	$298,259.32	$2,042,726.84	$906,346.86

Source: Authors' calculations based on UN Comtrade 2017 and 2021 export data of Pakistan.

Figures 6, 7 and 8 provide a more detailed breakdown of the changes in exports of Pakistan under each category. Figure 6 (see Appendix) shows recommended new products from 2017 which were exported in 2021. These mainly included exports of the following product categories:

- **Live animals,** whereby exports increased from US$0 to more than US$2.8 million;

- **Food and cereals,** for example cocoa exports increased by US$30.1 thousand, palm oil and its fractions, maize oil and its fractions recorded increases of US$0.42 million;
- **Precious metal ores,** particularly lead and lead alloys, unwrought, saw an increase in exports of US$22.7 million;
- **Chemicals** such as epoxide resins, fungicides, disinfectants, particularly styrene polymers, recorded increases of US$1.075 million;
- **Manufactured and machinery items** such as bars and rods, tubes and pipe fittings, electronic valves, vehicles specially designed for traveling in snow, and baby carriages;
- **Other items** such as gold witnessed an increase in exports by US$0.38 million.

Similarly, Figures 7 and 8 illustrate the expanded product space for new products and low-value exports (valued under US$1 million and US$10 million respectively), in 2017, that Pakistan's 2021 export basket was able to successfully capture.

Apart from the new products in Category 1, the products whose exports increased in Categories 2 and 3 were mostly concentrated in the following sectors and sub-sectors:

- **Food** including meat and edible meat (exports increased from US$50 thousand to US$2.6 million), sausages, fish, mollusks and aquatic invertebrates (exports increased from US$0.15 million to US$85.12 million), birds' eggs, in shell, fresh, preserved/cooked which recorded an increase in exports from US$8 million to US$14 million, macaroni, spaghetti & similar products (pasta) where exports increased from US$9.9 million to US$20.2 million, cereals, fruits (fresh and processed) such as tomatoes which reported increase from US$0.7 million to US$9.03 million, soya beans, seeds, maize oil, fat and oil and its fractions;
- **Tobacco** exports increased from US$0.4 million to US$11.5 million;
- **Textiles** including synthetic fibers (reported an increase from US$0.78 million to US$9.4 million), leather exports increased from US$0.027 million to US$17 million, wool, carpets, knitted garments, yarn reported an increase in exports from US$0.98 million to US$18.1 million, woven fabrics exports increased from US$0.6 million to US$10 million;
- **Metals & ores** such as copper ore reported an increase in exports from US$0.3 million to US$11.5 million, copper bars whose exports increased from US$1.2 million to US$28.8 million, iron ore agglomerates where exports increased from US$0.021 million to US$15.5 million, flat-rolled products of iron or non-

alloy steel where exports increased from US$0.6 million to US$13.3 million), aluminum, copper ores;

- **Chemicals** such as other acyclic alcohols reported increase in exports from US$0.00017 million to US$6.6 million, polyvinyl chloride whereby exports increased from US$0.78 million to US$27 million, catalysts and catalytic preparations, n.e.s. where exports increased from US$0.6 million to US$11.7 million. Others include hydrocarbons, polycarboxylic acids, carbonates, paints, soaps, polycarbonates;
- **Manufactured and machinery items** such as manufactures of woods (particularly densified wood and particle board reported increase from US$0.074 million to US$2.2 million), paper, tyres, manufactures of mineral materials, glass such as float glass and surface ground or polished glass showed an increase in exports from US$5.8 million to US$15.2 million, household articles, sewing machines, machine tools, other electric power machinery where exports increased from US$0.38 million to US$1.4 million, gas generators, wheeled tractors such as road tractors for semi-trailers where exports increased from US$1.7 million to US$6 million, airplanes & other aircraft mechanically-propelled (other than helicopters) of an unladen weight exceeding 15,000 kg, where exports increased from US$1.1 million to US$39.7 million), surgical goods, basketware, wickerwork and other articles of plaiting materials, n.e.s where exports increased from US$0.9 million to US$3.9 million, compasses, measuring, controlling and scientific instruments, n.e.s. which recorded an increase in exports from US$0.4 million to US$1.105 million) sports goods, and other items such as **gold**.

Simulations

In the previous sections, we discussed how to identify goods which align with the productive capabilities of the country and exhibit a higher-than-average sophistication level. Our aim was to present a template which policymakers can use to identify new export categories and pinpoint currently exported goods with the greatest potential for growth.

A crucial question regarding the real-world impact of the aforementioned analysis is the potential impact of expanding exports, as discussed. What would be the effect on overall exports if Pakistan began exporting a subset of the new goods identified based on the 'distance' measure (or, in other words, started exporting goods closest to its current productive capabilities)? Additionally, what would be the impact on exports if Pakistan focused on expanding those exports which currently constitute only a small portion of the current export basket and are also close in terms of 'distance'?

Table 2 below shows some of these projects. Simulation 1 projects the impact on merchandise exports if Pakistan began exporting the new products closest to its current export basket (or those goods in distance categories 1-6). In this simulation, we assumed that the potential value of exports for each new product is equal to the average value of exports for each product Pakistan currently exports. We see that expanding into these new categories could increase Pakistan's merchandise exports by more than 13.8 percent (from US $28.7 billion to US $32.8 billion).

Simulation 2 projects the impact on merchandise exports if Pakistan began exporting the new products closest to its current export basket (or those goods in distance categories 1-6) and also doubled the exports of products closest to its current export basket and are valued at under US$1 million (or, in other words, doubled the exports of goods in distance groups 1-6 with a value of less than US$1 million). As before, we assumed that the potential value of exports for each new product is equal to the average value of exports for each product Pakistan currently exports. We see that expanding into these new categories and increasing the export of goods—which the country has the capability of producing could increase Pakistan's merchandise exports by almost 14.2 percent (from US$28.7 billion to US$32.9 billion).

Finally, Simulation 3 replicates the scenario of Simulation 2 but doubles the exports of all goods with export values under US $10 million. In this case, Pakistan's merchandise exports would increase by approximately 17.3 percent (from US$28.7 billion to US$33.8 billion).

Although these simulations are simplified approximations, they show the potential impact of expanding the country's export base towards more sophisticated products.

Table 2: Potential Growth in Pakistan's Merchandise Exports based on Simulations

Pakistan's Merchandise Exports in 2021 (USD Billion)	28.795
Simulation 1: Potential Merchandise Exports after Adding Not Yet Exported Products in Distance groups 1 – 6 ($ Billion)	32.770
Simulation 2: Potential Merchandise Exports after Adding Not Yet Exported Products and Doubling all Products with Export Value of Less than USD 1 M in Distance groups 1 to 6 ($ Billion)	32.885
Simulation 3: Potential Merchandise Exports after Adding Not Yet Exported Products in Distance groups 1 to 6 and Doubling all Products with Export Value of Less than US$10 M in Distance groups 1 to 6 (US$ Billion)	33.788

Source: Authors' Calculations

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