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**The Effective Rate of Protection in
an Input-Output Framework**

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Input-Output Framework**

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ABSTRACT

This research work quantifies the changes in effective protection rates in Pakistan during the last decade, 2011-20, using various inputs and outputs. Based on its results, it supports a more flexible trade policy in Pakistan. Furthermore, it identifies the sectors with strong and weak long-run productive capacities and highlights the role of trade barriers in these industries. A key concern is the decreasing productive capacity of the textile and leather sectors, where the textile industry has the largest share in total exports from Pakistan. Hence, there is a dire need to invest more in research and development activities in such industries. Finally, the country needs to increase its range of export items and export destinations with more favourable terms of trade.

JEL Classification: C67, D57, F6, L5, R15

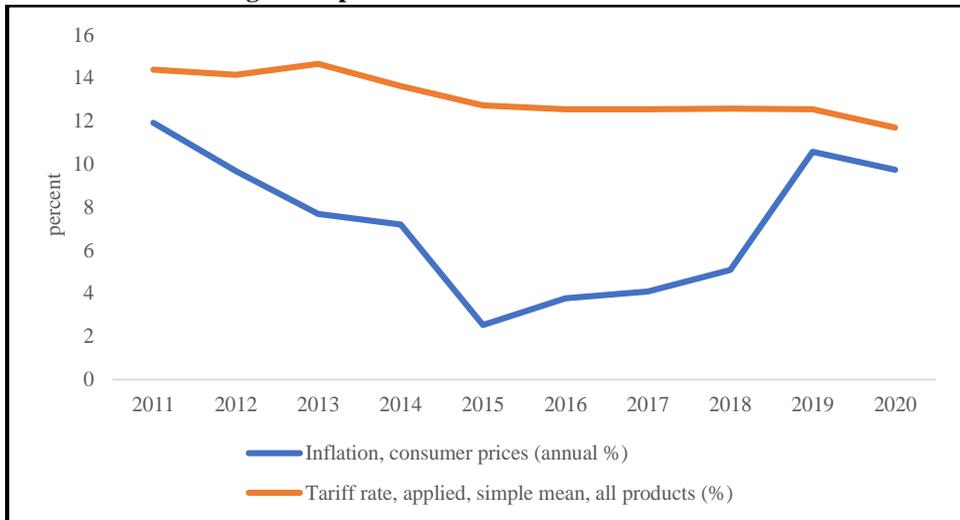
Keywords: Effective Rate of Protection, Input-Output Table, Industry, Trade, Pakistan

1. INTRODUCTION

Free trade is a fundamental principle that allows businesses to sell their products internationally without being hindered by tariffs or other barriers to entry. However, import duties in Pakistan are used to generate income rather than as a trade policy tool. Since these tariffs can be implemented easier than direct taxes, the tax department relies heavily on import tariffs. The Ministry of Commerce & Textile (2019) states that the share of import tariffs in the total tax revenues is around 48 percent in Pakistan in contrast with export-driven countries such as China (3.9 percent), Indonesia (2.6 percent), India (12.8 percent), Malaysia (1.6 percent), South Korea (3.2 percent), Turkey (2.4 percent) and Thailand (3.9 percent).

High protection rates create an export bias by increasing domestic prices of sectoral value added relative to world prices (Shapiro, 2021). Producers gain mainly because their profit margins increase, however, at the expense of higher production costs and reduced export competitiveness in the international market. On the other hand, it adversely affects the real incomes of end users of expensive domestic products because high import tariffs translate into more inflation; Figure 1 shows a clear pattern between import tariffs and the inflation rate in Pakistan. The end consumers face welfare losses because of the purchase of expensive household goods and limited access to cheaper imports.

Fig. 1. Import tariffs and inflation in Pakistan



Source: WDI.

Acknowledgements: This research work is greatly motivated by Dr. Nadeem ul Haque, Vice Chancellor, PIDE.

The last decade indicates a slightly flexible trade policy in Pakistan. The applied simple mean tariff on all products in Pakistan decreased from 14.4 percent in 2011 to 11.7 percent in 2020, which is an 18 percent reduction in a decade (WDI).¹ This effort is consistent with the country's National Tariff Policy (NTP), which emphasises the gradual elimination of tariffs on imported raw materials and intermediate products to provide small and medium enterprises (SMEs) economic access to primary raw materials. However, the simple mean tariff rates are ineffective in deriving a sound economic policy; sector-specific import tariffs can be more effective.

Traditionally, governments levied a Nominal Protection Rate (NRP) on imported products. A higher NRP adversely affects the real income of final consumers, whereas producers gain positively since their profit margins rise, however, at the expense of the higher cost of production. This cost rises due to higher nominal tariff rates on different inputs, and the NRP cannot address this issue. Therefore, the Effective Rates of Protection (ERP) become more relevant. The ERP measures the level of protection granted to domestic producers against competing import commodities. This tool is widely employed by governments and various international organisations, including the World Bank (WB), the World Trade Organisation (WTO), and the Organisation for Economic Co-operation and Development (OECD). Governments employ this tool to regulate the level of protection for key domestic industries, whereas international organisations use this tool in trade negotiations (Elbehri and McDougal, 1998).

Previously, Ul Haque and Siddiqui (2007) have worked on the ERP in Pakistan and emphasised the impact of the ERP on different industrial features, including labour intensity, revealing comparative and export orientation. However, the present study has a policy focus on other aspects, such as the role of flexible trade policy with major trading partners, how long-run productive capacity affects trade potential, and highlighting new export-oriented sectors.

Hence, this study quantifies the changes in ERP in Pakistan during the last decade. To achieve its research objectives, it uses consistent Input-Output Tables (IOTs) developed by the Asian Development Bank (ADB, 2022). Besides, it employs the Global Trade Analysis Project (GTAP) research centre's most recent multi-regional input-output tables for empirical analysis. The author of this study is the sole contributor of the Pakistan input-output tables to the GTAP research centre, Purdue University, USA.²

The rest of the study is as follows: methodology and data are provided in the next Section 2, whereas Section 3 discusses Pakistan's trade with its major trading partners. Section 4 elaborates on the model results, and Section 5 concludes this study and introduces a discussion.

2. METHODOLOGY AND DATA

The ERP is an indicator of import tariff and examines a country's trade policy by examining its import substitution strategy. ERPs are observed to be higher in developing countries than in developed countries because the former countries try to protect the infant domestic industries from the stiff global competition (Caliendo *et al.* 2021). Tariff barriers on final products are raised while maintaining a competitive supply of foreign inputs through lower import tariffs on intermediate inputs. However, these tariffs increase production costs, increasing a country's overall price level.

¹ <https://data.worldbank.org/indicator/TM.TAX.MRCH.SM.AR.ZS?locations=PK>

² https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=5957

Conventionally, ERP is measured within a partial equilibrium framework; however, this approach is not that effective because it ignores other sectors of the economy (Elbehri and McDougal, 1998). Melzer (1980) provides an alternative method based on an input-output framework, which provides a complete and consistent framework of the overall economy such that:

$$ERP_j = \frac{t_j - (\sum_i t_i \alpha_{ij})}{1 - \sum_i \alpha_{ij}} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (1)$$

where,

$[1 - \sum_i \alpha_{ij}] > 0$, α_{ij} represents technical coefficients in an input-output based Leontief model (Zeshan, 2019; Zeshan and Nasir, 2019), such that:

$$x = (I - A)^{-1} f \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (2)$$

where,

x , f , I , and A represent a column vector of the total gross output of an industry, a vector for final demand, an identity matrix, and a square matrix of input coefficients, respectively, where $A = [\alpha_{ij}]$. Finally, t_j represents the nominal rate of protection such that $t_j = \text{total tariff revenues}_j / \text{total Imports}$.

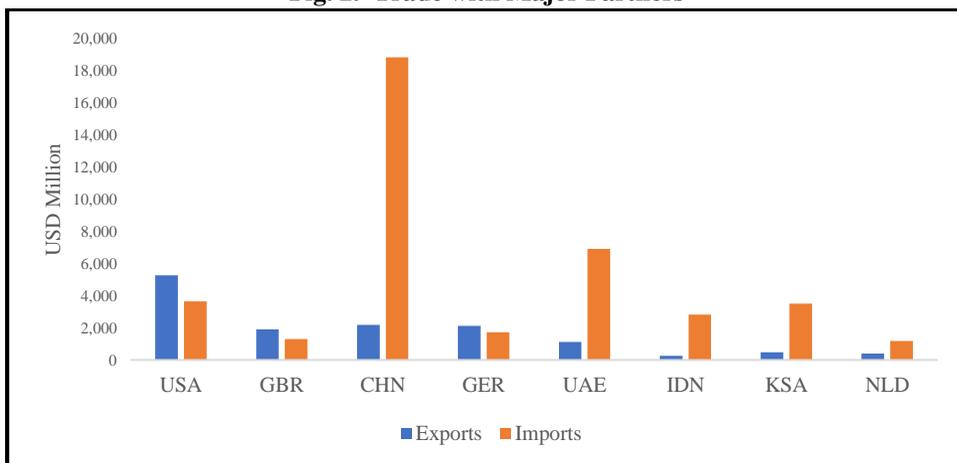
Tariff rates significantly impact the domestic price level of intermediate and final products, imported or domestic. Due to higher import tariffs, domestic producers increase the price of commodities such that the local price is equal to the tariff duty plus the international price. Hence, the domestic sector 'j' directly benefits from the import tariffs added to the products it produces; however, it bears an extra cost of high intermediate inputs, domestic and imported.

To achieve its research objectives, this study uses Pakistan's input-output tables (IOTs) developed by the Asian Development Bank (ADB, 2022) for 2011 and 2020. For the disaggregation of agriculture, it uses the multi-regional input-output tables from the Global Trade Analysis Project (GTAP) Research Centre, USA (Aguiar et al. 2022, Aguiar et al. 2019). Although the ADB IOTs are consistent during the analysis period, many essential agricultural sub-sectors are aggregated in these tables.

This procedure provides us with the required sectoral disaggregation of the agriculture sector. The data on import tariffs are collected from various Federal Board of Revenue's (FBR) yearbooks.

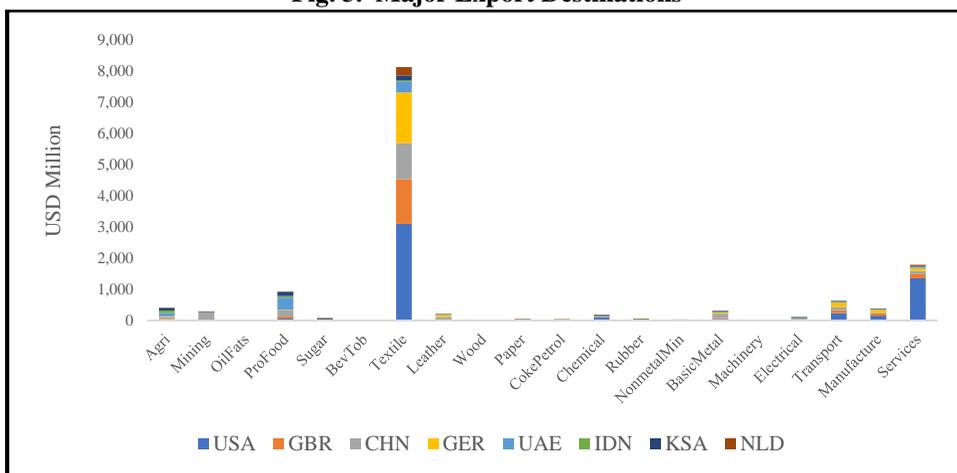
3. MAJOR TRADING PARTNERS

Pakistan has a limited number of major trading partners, including the United States (USA), Great Britain (GBR), China (CHN), Germany (GER), United Arab Emirates (UAE), Indonesia (IDN), Kingdom of Saudi Arabia (KSA), and the Netherlands (NLD). Pakistan has a trade surplus with three major trading partners, the USA, UK and GER, whereas it bears a trade deficit with all other major trading partners (Fig. 2.). Overall, total exports from Pakistan are around USD 29.4 billion, whereas its total imports are nearly 69.2 billion. The biggest export markets are the USA, China, and Germany, constituting 18, 7.4 and 7.2 percent shares in Pakistan's total exports. On the other hand, China, USA and KSA are the most significant import markets for Pakistan, and the shares of imports in total imports from these countries are around 27, 10 and 5 percent, respectively.

Fig. 2. Trade with Major Partners

Source: Own calculations from the GTAP database version 11.

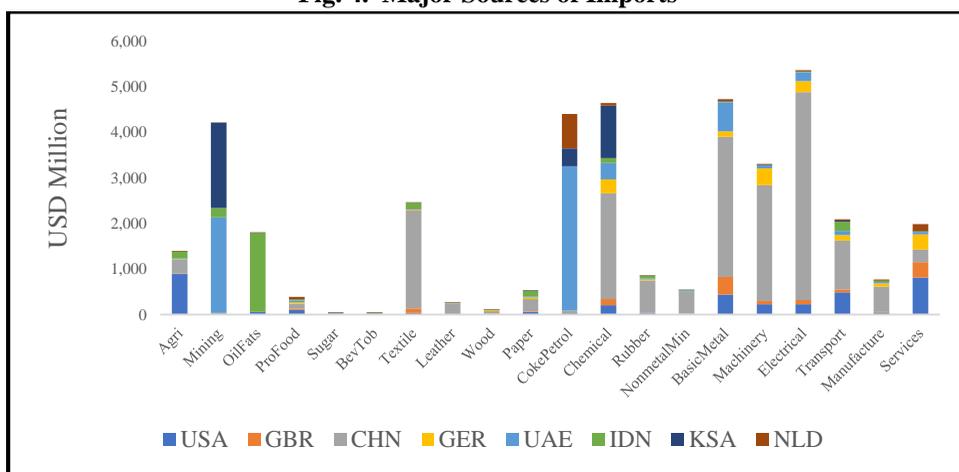
The manufacturing sector in Pakistan earns most of the foreign exchange from exports (85 percent of total export revenues) compared to the agriculture and services sectors (4 and 11 percent of total export revenues, Fig. 3.). Overall, the export earnings from agriculture, manufacturing and services sectors are around 1.1 billion, 25 billion and 3.2 billion, respectively. Within the manufacturing sector, textile is the leading exporting industry of Pakistan. It has a 51 percent share in total exports, and the country earns around 15 billion from its textile exports. The main export destinations are USA, GER, GBR and CHN. Pakistan exports around 21, 11, 9 and 8 percent of its total exports, respectively, and earns around 3.1, 1.6, 1.4 and 1.1 billion, respectively. The second major exporting industry is processed food which constitutes around 10 percent share of the total exports of Pakistan. Major export destinations for processed food are UAE and CHN, where Pakistan earns export revenue of around 392 and 200 million, respectively.

Fig. 3. Major Export Destinations

Source: Own calculations from the GTAP database version 11.

Compared to the exports of Pakistan, imports in Pakistan are distributed over a wide range of products (Fig. 4.). Overall, chemicals, mining, basic metals, electrical equipment, and petroleum products are the main imports of Pakistan, whereas the primary sources of imports are CHN, UAE, KSA, and USA. The shares of imports in total imports from these countries are around 27, 10 percent and 5 percent, respectively. Pakistan's total imports from China are around 19 billion, where key imports are electrical equipment, basic metals, machinery, chemicals and textile products. The value of total imports from UAE is around 7 billion; key imports are petroleum and mining products.

Fig. 4. Major Sources of Imports



Source: Own calculations from the GTAP database version 11.

4. MODEL RESULTS

A sector can have a positive or negative ERP value (rate). A positive rate indicates that it enjoys a higher rate of protection on its output compared to the inputs it uses in the production process. On the other hand, a negative rate shows that a sector has a lower protection on its output compared to the protection on the inputs it uses in the production process. In an ideal world, the ERP should be zero, indicating no protection on the final output or the inputs used in its production.

Overall, the average ERP suffered a reduction from 53 percent to 21 percent in Pakistan during the last decade, 2011-20 (see Table A in Appendix). It fell from 3.6 percent to 1.2 percent in the agriculture sector, from 99.8 percent to 39.7 percent in the manufacturing sector, and from -2.8 to -0.7 percent in the services sector. It indicates that the manufacturing sector is the most protected, whereas the services sector is the least protected sector in Pakistan. The services sector does not enjoy any protection on its output, but it pays for the expensive inputs from various domestically protected industries.³

³ Results in this study are consistent with Ul Haque and Siddiqui (2007) such that manufacturing sector is the most protected sector whereas the agriculture and the services sectors are the least protected. Within the manufacturing sector, cooking/vegetable oil is the most protected industry whereas vegetables and fruit industry is the most protected industry in agriculture sector. Finally, all the industries in the services sector bear the high protection rates on their inputs but do not enjoy any protection on their outputs.

A decomposed analysis of agriculture shows that vegetables, fruits, fish and oilseeds industries are well protected. The vegetables and fruit industry has the highest level of protection at around 12 percent. In contrast, the others, such as cereals, livestock and forestry, do not enjoy any protection from the government. On the other hand, the ERP is slightly negative in all other unprotected industries in 2011; it was zero in 2020.

A breakdown of the manufacturing sector shows that the cooking oil, sugar, leather, and machinery sectors mainly benefit from a higher level of protection during the analysis period. The ERP in these sectors was around 747 percent, 292 percent, 337 percent and 150 percent in 2011. It reduced to around 236, 76, 171 and 112 percent in 2020, respectively. On the other hand, the transport equipment sector is the least protected, where the ERP changed from -13 percent in 2011 to -5 percent in 2020.

A decomposed analysis of the services sector shows that the government does not protect this sector. As a result, the nominal rate of protection is zero in all of its sub-sectors, whereas the effective rate of protection is negative in most of its sub-sectors. Hence, the cost of doing business has increased significantly in the services sector, and the air transport industry suffers the most.

Table 1 presents a matrix of positive trade balances of different industries in Pakistan with its major trading partners. This analysis will help derive favourable flexible/free trade agreements with major trading partners. Since the ERPs are very small in agriculture and mostly negative in the services sector (see Table A in Appendix), all the sub-sectors in these industries are aggregated as the agriculture and services sector in Table 1. Since the ERP is relatively higher in the manufacturing sectors compared to the agriculture and services sectors, Table 1 gives more space to different sub-sectors in the manufacturing industry.

Table 1

Matrix of Free Trade Agreements (Trade Balance, USD Million)

Trade Surplus	USA	GBR	CHN	GER	UAE	IDN	KSA	NLD	Total
Agriculture	-863	21	-243	10	81	-65	76	-8	188
Mining	40	2	206	1	-2,097	-203	-1,869	4	253
Cooking oil	-55	0	-1	0	-4	-1,729	-4	0	
Processed food	-26	23	86	-3	359	17	131	-41	615
Sugar	25	2	-5	-2	-13	0	25	0	53
Beverage and tobacco	-6	1	-4	-5	-16	1	2	-1	4
Textiles	3,066	1,340	-1,001	1,609	320	-85	160	265	6,761
Leather	15	18	-167	61	12	8	2	8	124
Wood	-15	-1	-61	-27	0	0	1	0	1
Pulp and paper	-50	-13	-267	-34	-20	-91	-11	-5	
Refined petroleum	-24	-1	-22	-4	-3,175	0	-388	-758	
Chemical	-107	-135	-2,313	-293	-319	-100	-1,146	-38	
Rubber	-15	-6	-684	-21	-13	-60	-8	-1	
Nonmetallic minerals	-1	6	-481	-10	-25	-3	3	0	9
Basic/fabricated metals	-379	-377	-2,918	-83	-595	-8	-9	-36	
Machinery	-223	-70	-2,545	-361	-65	-11	3	-20	3
Electrical equipment	-189	-81	-4,565	-233	-160	-16	2	-25	2
Transport	-248	33	-963	20	-65	-188	-14	-15	53
Manufacturing and recycling	126	47	-536	29	-6	-30	4	-16	206
Services	549	-206	-176	-240	-8	-3	1	-111	550

Source: Own calculations.

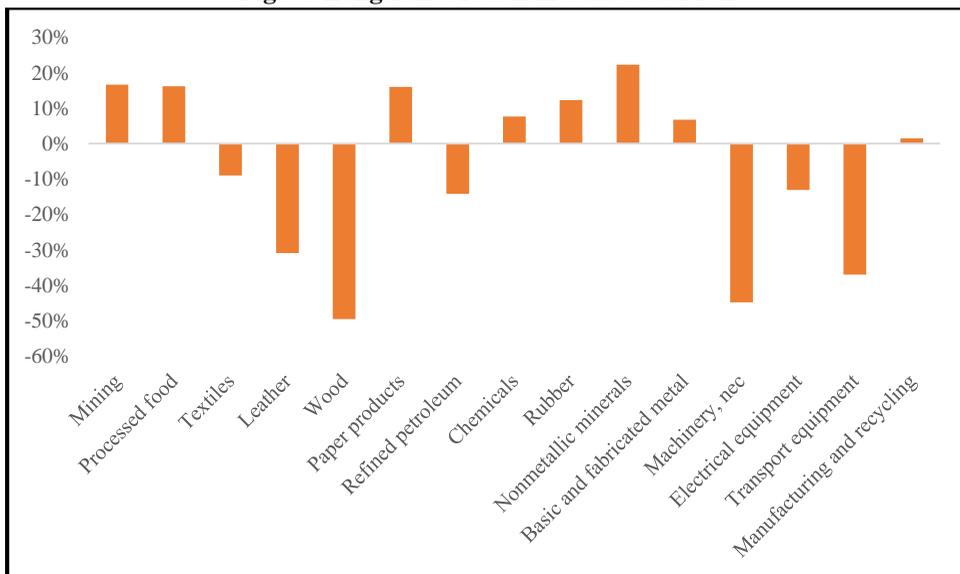
Skewed exports from Pakistan do not allow it to maintain a trade surplus from a wide range of export products. The textile industry in the manufacturing sector has the highest share (77 percent) in total trade surplus, which is around 6.8 billion, where the major trading partners are USA, GBR, GER, UAE, KSA, and NLD. This sector is already quite competitive since the ERP in this sector fell from 40 percent in 2011 to 10 percent in 2020.

Other notable exports from Pakistan is processed food and manufacturing and recycling products. The total trade surplus from these two sectors is around 821 million. The main export destinations for processed food are GBR, CHN, UAE, IDN, and KSA. In contrast, the main export destinations for manufacturing and recycling products are the USA, GBR, GER, and KSA. Over the last decade, the ERP in the processed food sector reduced from 44 percent to 11 percent, whereas it reduced from 31 percent to 11 percent in the manufacturing and recycling sectors. The key lesson from the above results is that a lower ERP in an exporting industry has the potential to earn a trade surplus in this sector.

To explore the export potential of an industry, it is essential to examine its long-run productive capacity. For this purpose, the present study looks into the changes in the value-addition of a sector over the last decade, 2011-20. It reduces the most in the textile sector by around 732 million, whereas it increases the most in the case of processed food by around 1.1 billion during the analysis period (

Fig. 5.). Both sectors had similar ERPs in 2011 and 2020 and have experienced similar reductions in their ERPs over the last decade. However, a higher contribution to the total value-addition by the processed food industry indicates that it can gain more trade surplus compared to the textile sector in the long run.

Fig. 5. Long-run Growth in Value-addition



Source: Own calculations.

The paper products industry has had a 16 percent growth rate in its value-addition during the last decade and contributes around 201 million to the total value-addition. However, this industry is highly protected by import tariffs. Although the ERP has reduced from 77 percent to 19 percent during the last decade in this industry, it is still quite high. A minor reduction in this industry's import tariff can significantly add to the trade surplus. Similarly, lower import tariffs in rubber and basic and fabricated metal sectors are expected to earn more foreign exchange for Pakistan since these industries report around 12 percent and 7 percent growth rates in their respective value-addition over the last decade.

5. CONCLUSION AND DISCUSSION

This research work quantifies the changes in the ERP in Pakistan during the last decade (2011-20) using various input-output tables. It employs various indicators to explore a sound trade policy stance for Pakistan. For instance, it uses the trade surplus approach, where Pakistan earns trade surplus from its major trading partners and the long-run productive capacity approach, highlighting the potential exporting sector. These tools help identify how to increase the share of Pakistan's trade in the global market, earn more foreign exchange, purchase cheaper intermediate inputs, and expand its export base over new export industries and destinations.

The results show that the manufacturing sector in Pakistan earns the highest foreign exchange from exports compared to the agriculture and services sectors. More specifically, the textile sector is the key export industry in Pakistan, its share in total exports is around 51 percent. Pakistan earns around 15 billion in foreign exchange from its textile exports; the main export destinations are USA, GER, GBR and CHN, where Pakistan exports around 21 percent, 11 percent, 9 percent and 8 percent of its total textile exports, and earns foreign exchange of around 3.1, 1.6, 1.4 and 1.1 billion, respectively.

Overall, the average ERP has reduced in Pakistan over the last decade, 2011-20. It reduced from 3.6 percent to 1.2 percent in the agriculture sector, 99.8 percent to 39.7 percent in the manufacturing sector, and -2.8 percent to -0.7 percent in the services sector. The manufacturing sector is the most protected industry, whereas the services sector is the least protected industry in Pakistan. The services sector does not enjoy any protection on its output.

To examine the export potential of an industry, the present study uses the long-run productive capacity approach. It reduced the most in the textile sector but increased the most in the processed food industry. The paper products and rubber sectors also show promising long-term productive capacities, but they are highly protected. Reducing import tariffs in these industries can significantly add to the trade surplus.

Summing up, the import tariff rates are very low in the agriculture and services sectors. In contrast, the manufacturing industry is highly protected, which is Pakistan's primary foreign exchange source. The country needs to adapt to more flexible trade agreements with its trading partners where it can enjoy more trade surplus. Pakistan imports an extensive range of products, but its exports are based on a minimal range of products. Hence, the country needs to figure out new potential export sectors. Another important concern is the decreasing productive capacities of the textile, leather, and transport equipment sectors, where the textile industry has the largest share in the total exports from Pakistan. Hence, there is a need to invest more in research and development

activities in these sectors. This research claims that reducing the trade barriers in the sectors with higher long-run productive capacities can lead towards a better trade policy.

APPENDIX

A. Sector-specific Nominal and Effective Rates of Protection in Pakistan

S. No.	Sector	Imports (USD M)		Share (%)		NRP (%)		ERP (%)	
		2011	2020	2011	2020	2011	2020	2011	2020
Agriculture:									
1	Cereals	459	653	2 %	2 %	0 %	0 %	-1 %	0 %
2	Vegetable & fruit	245	348	1 %	1 %	10 %	4 %	12 %	5 %
3	Oil seeds	71	100	0 %	0 %	4 %	1 %	4 %	1 %
4	Livestock	648	921	3 %	3 %	0 %	0 %	-1 %	0 %
5	Forest	39	55	0 %	0 %	0 %	0 %	-1 %	0 %
6	Fish	35	49	0 %	0 %	6 %	2 %	8 %	2 %
Manufacturing:									
7	Mining	57	74	0 %	0 %	2 %	1 %	2 %	1 %
8	Cooking oil	10	14	0 %	0 %	199 %	66 %	747 %	236 %
9	Processed food	870	1,259	4 %	5 %	14 %	4 %	44 %	11 %
10	Sugar	16	23	0 %	0 %	79 %	22 %	292 %	76 %
11	Beverages & tobacco	55	80	0 %	0 %	19 %	4 %	66 %	13 %
12	Textiles	998	1,170	5 %	4 %	15 %	4 %	40 %	10 %
13	Leather	43	36	0 %	0 %	123 %	62 %	337 %	171 %
14	Wood	34	20	0 %	0 %	45 %	51 %	68 %	96 %
15	Paper products	185	260	1 %	1 %	47 %	12 %	77 %	19 %
16	Coke, refined petroleum	1,390	1,157	6 %	4 %	18 %	10 %	34 %	15 %
17	Chemicals	1,169	1,558	5 %	6 %	8 %	3 %	10 %	4 %
18	Rubber	241	341	1 %	1 %	53 %	16 %	115 %	30 %
19	Nonmetallic minerals	429	604	2 %	2 %	0 %	0 %	-4 %	-1 %
20	Basic metals	453	538	2 %	2 %	31 %	15 %	54 %	23 %
21	Machinery, nec	171	112	1 %	0 %	74 %	58 %	150 %	112 %
22	Electrical	386	389	2 %	1 %	33 %	17 %	48 %	23 %
23	Transport equipment	1,403	1,011	7 %	4 %	1 %	0 %	-13 %	-5 %
24	Manufacturing, nec	483	524	2 %	2 %	25 %	11 %	31 %	11 %
25	Motor vehicles	559	738	3 %	3 %	58 %	21 %	95 %	33 %
26	Railways	2,548	3,362	12 %	13 %	0 %	0 %	-5 %	-1 %
27	Water transport	9	20	0 %	0 %	11 %	1 %	14 %	0 %
28	Air transport	174	294	1 %	1 %	0 %	0 %	-9 %	-3 %
Services:									
29	Electricity	3,554	4,181	17 %	16 %	0 %	0 %	-7 %	-2 %
30	Construction	1,000	1,564	5 %	6 %	0 %	0 %	-7 %	-2 %
31	Trade	1,381	1,542	6 %	6 %	0 %	0 %	-2 %	-1 %
32	Hotels	359	422	2 %	2 %	0 %	0 %	-9 %	-2 %
33	Supporting transport	39	46	0 %	0 %	0 %	0 %	-1 %	0 %
34	Post-Tele	138	164	1 %	1 %	0 %	0 %	-2 %	-1 %
35	Financial	112	120	1 %	0 %	0 %	0 %	0 %	0 %
36	Real estate	22	30	0 %	0 %	0 %	0 %	0 %	0 %
37	Renting activities	103	222	0 %	1 %	0 %	0 %	0 %	0 %
38	Public administration	1,252	2,223	6 %	8 %	0 %	0 %	-4 %	-1 %
39	Education	48	86	0 %	0 %	0 %	0 %	-1 %	0 %
40	Health	201	383	1 %	1 %	0 %	0 %	-2 %	-1 %

41 Personal services 66 140 0 % 1 % 0 % 0 % -1 % 0 %
 Source: Own calculations.

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