PIDE
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ENERGY REFORMS FOR EXPORT ORIENTED UNITS IN PAKISTAN

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PIDE ENERGY CELL

RESEARCH TEAM

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EXECUTIVE SUMMARY

Changes in energy prices are generally likely to have implications for the competitiveness of economies. Besides, a more profound concern is the disparity in the availability and price of energy might erode the productive efficiency in industrial units of some regions, eventually leading to deindustrialization.

The Circular Debt Management Plan 2023 aims to reduce the country's growing circular debt by discontinuing the electricity tariff support for zero-rated industry, which led to no announcement of an industrial support package in Budget FY2024. The annual rebasing of nearly Rs 4.96/kWh for FY2024 and Rs 7.91/kWh for FY2023 under the IMF standby arrangement will increase the base tariff for different consumer categories, except for protected consumers, from Rs 3/KWh to Rs 7.50/KWh, leading to more than a doubling of the tariff for Bulk Power Consumer (B3 and B4).

This study explores the efficiency of tariffs and their effect on investment, employment, and revenue for various manufacturing sectors. The study also evaluates the potential impact of removing government electricity tariff support and maintaining varying gas prices on the textile and clothing industry.

First, the study examines data from 335 firms divided into two groups_ exporting and non-exporting. These groups were further subdivided into seven major manufacturing groups: textile, petroleum, chemical, food, cement, electronic and other manufacturing. The analysis finds that the rise in energy tariffs negatively impacts firms' employment, investment, and sales revenue regardless of their export orientation. Although, this impact is more substantial for export-oriented firms in Punjab.

Second, the study projected the impact of gas/RLNG-based and NEPRA-determined energy tariffs (that is, greater than regionally competitive tariffs) on 47 export-oriented textile units. It finds that increasing energy costs would result in layoffs, decreased investment and export revenue, and significant profit margin contraction, leading to early deindustrialization in Punjab. However, the change in industrial electricity tariffs will not significantly affect textile EOUs in Sindh, as they already benefit from a competitive electricity tariff through local gas-based captive power plants.

To countercheck, the study also explores linkages between energy (electricity) tariff changes and external competitiveness of export-oriented units at the macro level and finds a robust negative association between export growth and energy tariff increase. A 1 percent increase in electricity tariffs decreases textile exports by 0.5 percent and other manufactured exports by 0.4 percent.

While analyzing the tariff, the study finds that the recent rise in electricity prices is a cross-subsidy from the industry to other sectors. This practice has no legal, economic, or technical justification.

The study suggests that the tariff mechanism in Pakistan needs to be reconsidered to lower electricity prices. The recommended approach is establishing a tariff system based on the service cost for all consumer categories, without cross-subsidies. The most effective method would be to adopt a flat linear tariff but vary it based on the service cost for each consumer category or geographical area.

Furthermore, allowing open access to all market participants on a non-discriminatory basis can reduce energy costs and improve supply for the industrial consumers in the country.

The gas price difference between EOUs in Punjab and Sindh is causing issues for Punjab's industrial units. The limited availability of gas also affects the competitiveness of Punjab's EOUs. After analyzing the tariffs, it was found that providing cheaper gas to Sindh is not economically efficient due to the depletion of indigenous gas resources.

It is necessary to reconsider the policies for pricing and allocating natural gas in Pakistan. The sector should be deregulated, and the pricing structure should be liberalized, allowing all consumers to compete for market share. A market-based pricing system would also reduce the gas price differential between industries in Punjab and Sindh. The power industry should be prioritized in getting a share of indigenous gas to reduce overall electricity generation costs.

1. PREFACE

Pakistan has around US$4 billion in foreign reserves (as of July 05, 2023), enough to finance less than one month of imports. As of March 2023, Pakistan has a total debt and liabilities amounting to US$ 125.7 billion, with almost 77% of it (US$ 96.3 billion) owed directly by the government to different multilateral and bilateral creditors, which puts pressure on repayment. Within three years, Pakistan must repay over US$ 77 billion (Malik, 2023). Even if the principal payments are deferred through negotiations, payments on account of debt servicing will remain. Leaving aside domestic debt, the markup on foreign debt in FY2023 stands at Rs 511 billion. Beyond that, the Pakistani rupee has dropped to a historically low value by almost Rs 100 in a year.

In the last few months, imports have not come in, disrupting supply chains and forcing industries to stop production. Industries are laying off workers amid over 37% inflation (May 2023). Exports in FY2023 have declined by 15% compared to exports in FY2022.

The most critical issue facing Pakistan and became the central point in Pakistan-IMF discussions is the staggering US$15 billion energy sector circular debt_ US$ 9.6 billion in the power sector, and the remaining in the gas sector[1]. As per the Circular Debt Management Plan 2023, the electricity tariff support package for the zero-rated industry is discontinued to reduce mounting circular debt in the country.[2] This, along with an annual rebasing of Rs 7.91 for FY2023, increased the tariff for Bulk Power Consumer (B3 and B4) from Rs 19.99/kWh to Rs 39/ kWh in off-peak hours and Rs 45.10/ kWh in peak hours.

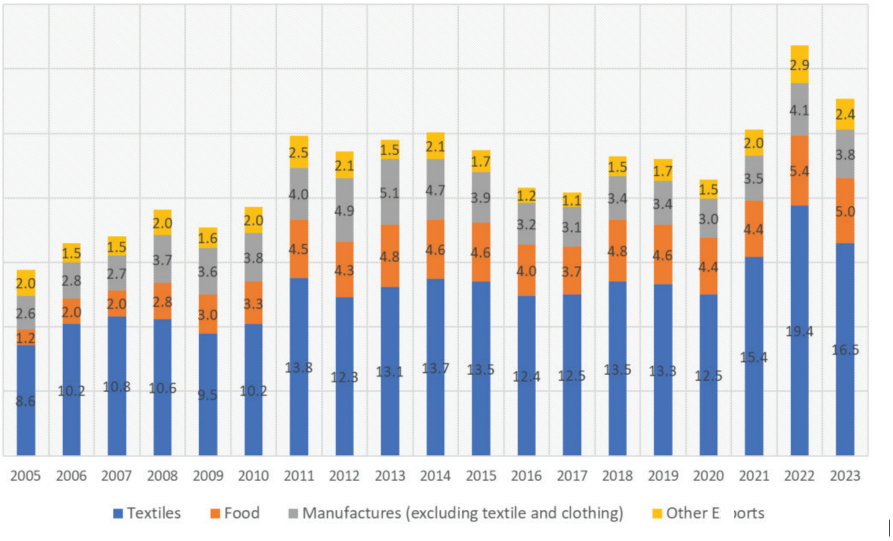
Including taxes, electricity prices surged by 78% over a year, from Rs 28/kWh in June 2022 to approximately Rs 50/kWh in July 2023 due to frequent upward adjustments in the form of quarterly and fuel price adjustments in electricity rates. Now, another rebasing of tariff is approved by NEPRA under the IMF deal[3]. NEPRA has increased Rs 4.96 /kWh in the base tariff for FY2024[4]. This massive jump in the absence of any tariff support package is feared to erode the industry's competitiveness and export gains in the last two years.

Limited foreign exchange reserves and rising debt burden are serious concerns for Pakistan's economy. The falling export competitiveness due to a rise in energy prices and, in turn, its revenue, along with declining remittances and the rising energy import burden, will put further pressure on our already tumbling foreign exchange reserves. The IMF package and support from friendly countries will undoubtedly bring in the foreign exchange needed to strengthen reserves. But this is not going to be sustainable. Sustainable GDP growth depends on the strength of the overall economy, along with a stable macroeconomic environment. Export growth and deeper structural reforms, including in the energy sector, are necessary.

Changes in energy prices are generally likely to have implications for the competitiveness of economies. The fear is that the energy price policies impede the capacity of the domestic industry to compete in export markets, predominantly for energy-intensive sectors. Beyond that, a more profound concern is the disparity in the availability and price of energy might erode the productive efficiency in industrial units of some regions, eventually leading to deindustrialization.

In Pakistan, the contribution of Large-scale Manufacturing (LSM) to total manufacturing is 74% in real terms. For a long time, textiles and clothing have played an important role in the economic development of Pakistan. The textile sector is the largest industrial sector of Pakistan from an investment, employment, and export point of view. Textiles are about one-fourth of industrial value-added products. It employs 40 % of the total labor force. Textiles contributed almost 9% to GDP and 61% to exports in FY2022.

Figure 1. Pakistan's Exports by Commodity (Billion US$)



Source: SBP and FBS

PIDE (2021) on Regionally Competitive Energy Tariffs and Textile Sector's Competitiveness finds energy costs as the leading component in the conversion cost. High energy costs and energy unavailability became the reason behind the closure of about 100 units between 2014 and 2018. Textile exports remained almost stagnant in this period (Figure 1).

Textile exports increased by 55% after the COVID crisis in 2020, while other manufactured and food-related exports increased by 25% and 23%, respectively, during the same period (as shown in Figure 1). However, due to import bans and uncertainties related to electricity tariffs causing disruptions in the supply chain, textile exports have decreased by about 15% in FY2023. The impact is relatively less in other exporting sectors (around 8% in food and other manufacturing).

Gas is the second primary source of energy in industrial units. The recent developments in gas prices in Pakistan for the export-oriented units (EOUs) have driven an extreme wedge between prices in Sindh and Punjab.

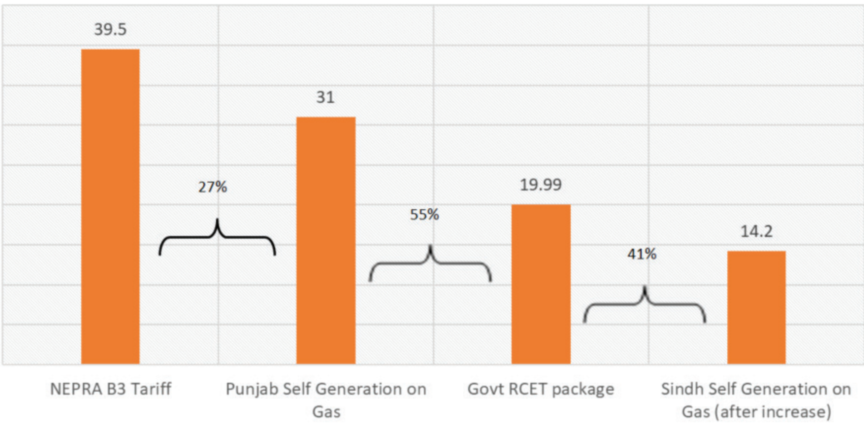
Table 1. Industrial Gas Price Differential

	Punjab		Sindh	
Gas Price	Rs 2430/MMBtu	US$ 9/MMBtu	Rs 852/MMBtu	US$ 3.11/MMBtu
Electricity through Gas based Captive Power Plants	Rs 31/kWh	US cents 11.5/kWh	Rs 11/kWh	US cents 4/kWh
Availability of Gas	25% on average; used in Sept., Oct., & Nov. 2021*. No availability for new projects or expansions.		100%; however, pressure drop in certain areas and at times curtails operation	

Source: OGRA & APTMA *Details in Appendix Table A

As a part of its agreement with the IMF, the government announced an increase in gas tariff for Captive Power Plants (CPPs) in export industries from Rs 852/MMΓtu to Rs 1100/MMBtu (US$ 4.015/ MMBtu)[5]. Despite this increase, the gas price disparity between the textile units in the two provinces will remain.

Figure 2. Cost of Electricity (Rs/kWh) (February 2023)



Source: NEPRA, OGRA, and APTMA

These developments have sparked fears of losing domestic and international competitiveness due to pre-mature deindustrialization among Punjab's EOUs (mainly textile). Meanwhile, investment outflows from Punjab to Sindh are also feared. In other words, the industrial units in Punjab will lose their export market share and consumers in domestic markets. The increase in energy tariff for the industry will create risks to economic activity in Punjab, especially for sub-sectors directly exposed to price rises. In other words, stagnation or decline in output in the export-oriented units in Punjab.

This study aims to examine the impact of energy tariffs on export-focused industries. The main research question is whether an increase in energy prices hinders or does not affect the growth of exports generated primarily by the industrial sector. To answer the question, both macro and firm-level data are analyzed. The study investigates this question empirically by undertaking a three-part analysis.

- The macro-level analysis - to explore the role of energy tariffs (or indirectly providing tariff subsidies) on the competitiveness of export-oriented units.

- Firm-level investigation of the impact of energy costs (tariffs) on investment, employment, and total revenues in a group of industrial units, irrespective of whether they are exporting or non-exporting firms (textile, food, petroleum, cement, electronics, chemical, and other manufacturing sectors). The objective is to see the difference between the two groups, as the government's special tariff support was provided only to zero-rated industries.

- The third aim of the study is to project the impact of eliminating government electricity tariff support and maintaining varying gas prices across provinces on employment rates, investments, output, and potential exports in a selected sample of textile and clothing units in Punjab and Sindh.

The study also analyzes the efficiency of Pakistan's energy tariff structure, mainly for the industry.

Here is the breakdown of the study plan: The first section is an introduction that includes the conceptual framework. Section 2 has a brief profile of Pakistan's manufacturing sector with a particular focus on Pakistan's textile sector. Section 3 examines the energy tariff structure in Pakistan, while Section 4 evaluates the effect of the increase in energy tariffs on industrial performance. Finally, Section 5 provides a conclusion to the discussion.

2. PAKISTAN INDUSTRY AND EXPORTS

The composition of Pakistan's exports has changed significantly over the years, with a steep fall in the shares of primary and semi-manufactured exports and an equally sharp increase in the percentage of manufactured exports. In FY1972, the shares of primary, semi-manufactured, and manufactured goods in total exports were 45%, 27%, and 28%, respectively. While in FY2022, these shares were 16%, 7%, and 77 % for primary, semi-manufactured, and manufactured exports, respectively.

Undoubtedly, the pattern of trade has changed substantially in response to trade reform measures - Pakistan has moved from primary products to finished manufactured goods. But unfortunately, overall export performance has not remained promising. The share of goods and services exports in the GDP in FY2022 was 10.5%. The share of Pakistan in world exports was 0.13% in FY2022.

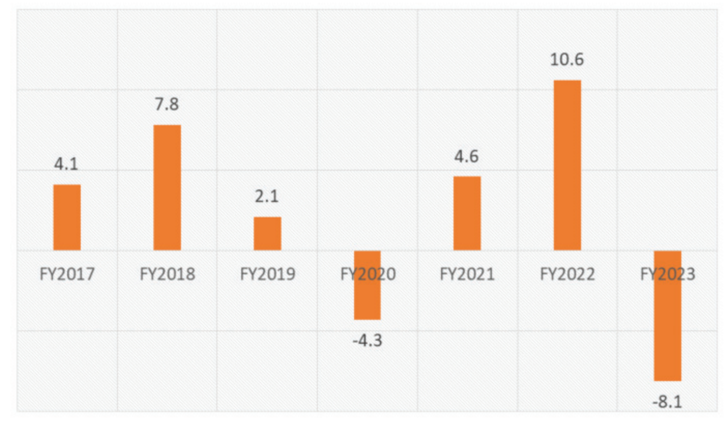
Manufacturing contributes 12 % to Pakistan's GDP. During July-March FY2023, LSM growth was -8.1%, down from 10.6% last year. Negative growth was driven by food (-1.62), tobacco (-0.57), textile (-3.16), garments (2.94), petroleum (-0.68), cement (-0.85), pharmaceuticals (-1.30), and automobiles (-1.85).

Table 2. Pakistan's Manufacturing sector

Manufacturing VA Growth (FY2022)	10%
Share of Manufacturing in GDP (FY2022)	13.2%
Major Manufacturing Activities with Weights (FY2022)	Textiles & Wearing Apparel (24.24) Food & Beverages (14.53) Petroleum Products (6.7) Chemicals (6.5)
Share of Manufacturing in Total Exports (FY2022)	77%

Source: Pakistan economic Survey 2022-23 and WDI

Figure 3. Large Scale Manufacturing Growth % (July to March)



Source: Pakistan Economic Survey 2022-23

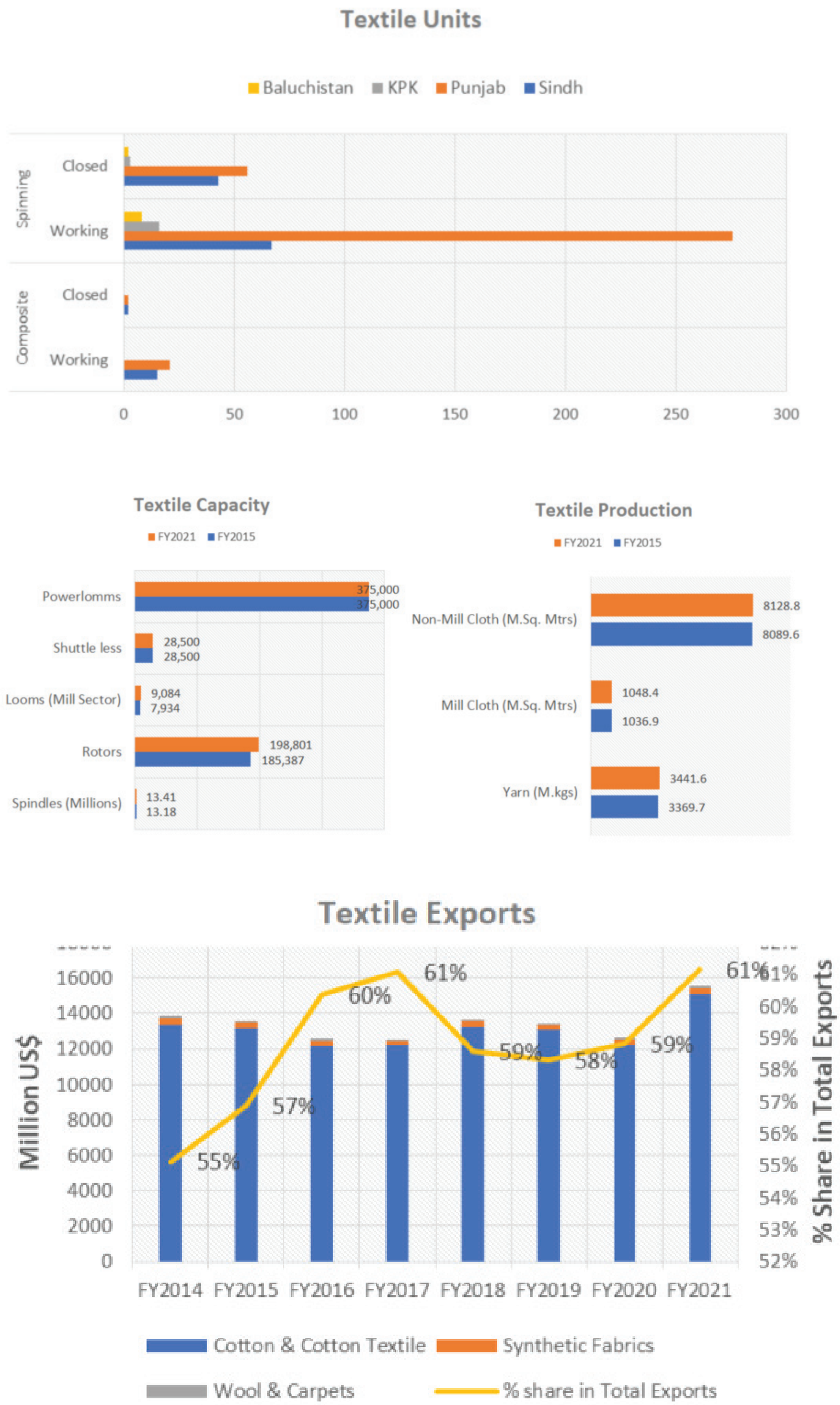
The textile industry is the leading source of export earnings for Pakistan. Its share in total merchandise exports of Pakistan was 61% in FY2022 (Figure 1). Pakistan has a supply base for almost all manmade and natural yarns and fabrics. This abundance of raw materials is an advantage for Pakistan because of its impact on cost and operational lead time (BOI, 2022).

The textile industry is Pakistan's largest large-scale manufacturing sector, weighing 18.2% in the Quantum Index of manufacturing. At the same time, apparel manufacturing is at number 5, weighing 6.1%. Textile and clothing are energy-consuming industries. Excluding apparel manufacturing, about 34% of energy is consumed in spinning, 23% in weaving, 38% in chemical processing, and 5% in miscellaneous purposes.[6]

A rise in electricity tariffs for the industry is expected to increase manufacturing costs and create a liquidity (investment) crisis because of the decreased profitability. Besides, making exports uncompetitive will eventually lead to the sector's contraction with negative implications for employment. In other words, pre-mature de-industrialization because of the increase in energy costs.

As of June 2021, the Pakistan textile industry comprises 517 textile units (40 composite units and 477 spinning units). A hundred and eight units are lying idle (Figure 4). Punjab has a large textile base with 297 mill units working. Of the 108 closed units, 58 (56 spinning and two composites) are in Punjab.

Figure 4. Pakistan Textile Industry

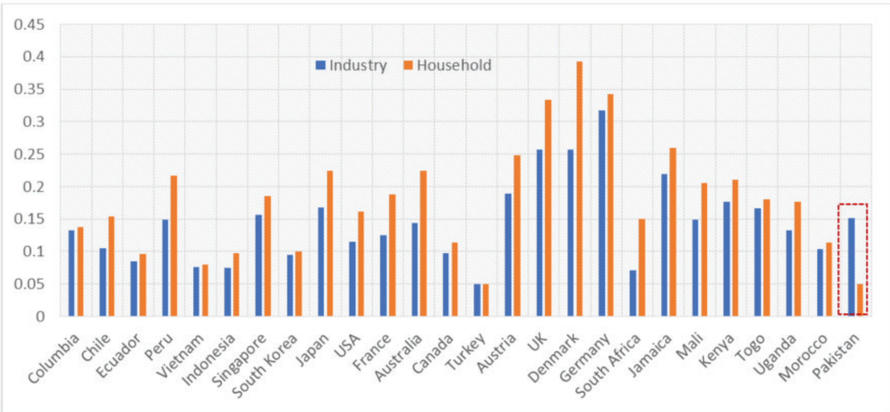


Source: Textile Commissioner's Organization Annual Report 2020-21

3. INDUSTRIAL ENERGY TARIFFS

Global evidence suggests that industrial tariffs are lower than residential consumers in countries with a priority towards industrial growth.[7] Not only the developed countries, e.g., in the United States, EU countries, Japan, and South Korea, several of the low- and middle-income countries have prioritized their industrial growth. The industrial and commercial tariffs in these countries are lower than residential tariffs, for instance, Argentina, Peru, Indonesia, Vietnam, Columbia, South Africa, Morocco, and Kenya. Even some African countries like Mali, Rwanda, and Togo, with low income per capita, prefer productive business activities more by charging a lower tariff than household electricity tariff (Figure 5). It is beyond doubt that price variation across sectors creates horizontal injustice to the productive sectors of the economy.

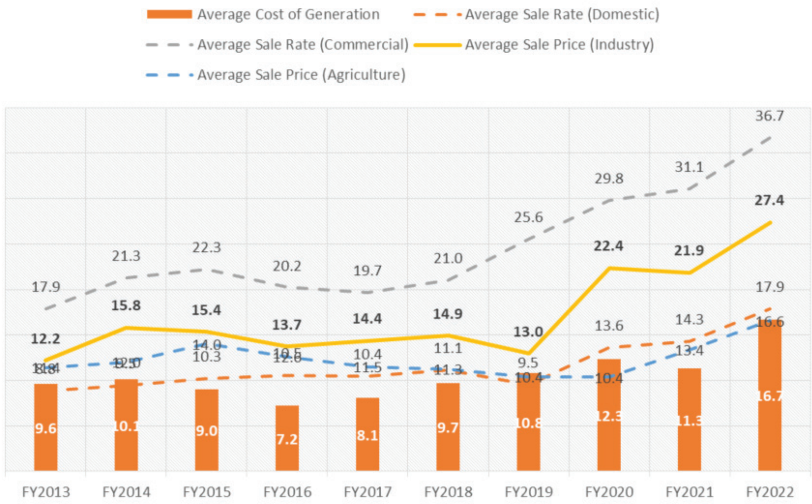
Figure 5. Electricity Tariff Across Countries



Source: https://www.globalpetrol prices.com/electricity prices

In Pakistan, a weak link between price and demand and substantive cross-subsidization has skewed consumption toward less-productive domestic consumers over the years. Domestic consumption of electricity in FY2022 was more than 45%. In comparison, industry consumes 25%. High electricity tariffs and a shortage of reliable electricity for the industry over the years forced them to have their Captive Power Plants (CPPs). In other words, the productive sectors that require a continuous supply of electricity either must restrict their production or rely on other sources when electricity service is considered a 'right' for some consumer categories (Burgess et al. 2020).

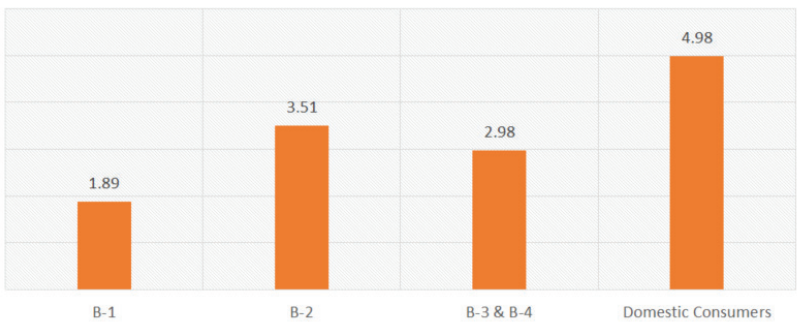
Figure 6. Cross-subsidy Across Sectors



Source: NEPRA *Average Cost of Generation does not include Transmission Charges

The tariff structure in Pakistan allows for cross-subsidy from industrial and commercial consumers to domestic and agricultural consumers (Figure 6). Due to the high tariffs (without RCET) and unreliable supplies, industrial consumers in Punjab, mainly small-scale industrial units, have grown by hardly 2% from 2016 to 2022. In comparison, domestic consumers grew by more than 5% (Figure 7).

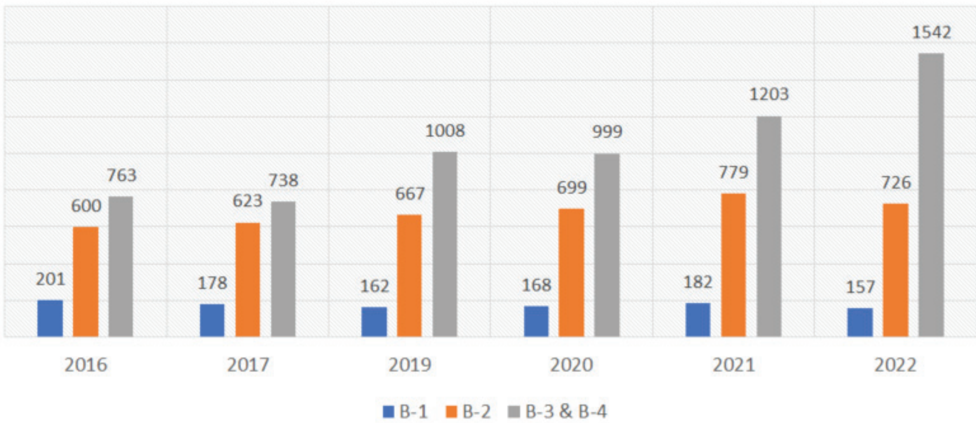
Figure 7. % Growth in Electricity Consumers in Punjab (2016-2022)



Source: PEPCO and NEPRA State of Industry Report 2021-22

In fact, in Punjab, small industries have contracted by -3.47% from 2016 to 2022. In comparison, the increase in the consumption of large-scale manufacturing (B3 and B4) (Figure 8) was due to the non-availability and high costs of RLNG. During the same period, a special budgetary package for zero-rated industry and the rebate of incremental consumption from November 2020 and the earlier special rate of US$ 7.5/ kWh from January 2019 were provided.

Figure 8. Electricity Consumption in Punjab (MWh)



Source: PEPCO

The service cost to the industry was around Rs. 13.01/kWh for the year 2020 in Pakistan. However, the average unit price charged to industrial units (all) was around Rs. 22.4/kWh (Figure 6) during FY2020. A significant cross-subsidy from industrial and commercial consumers to agricultural and domestic consumers (below 300 units) increased the inefficient use among the agricultural and domestic consumers.

Table 3. Average Tariff in FY2020

Power Purchase Price (including Transmission Charges)	Rs 13.01/kWh
Power Purchase Price Adjusted for T&D Losses	Rs 15.04
Distribution Margin	Rs 1.88
PYA Adjustments	---
Average Tariff- FY 2019-20	Rs 16.91
Source: NEPRA	

Source: NEPRA

Over the years, limited progress has been made in reducing cross-subsidies. Manufacturing exports rely heavily on electricity consumption.[8] The high cost of electricity reduced the competitiveness of these exports, thereby impacting the country's trade deficit and balance of payment. Large cross-subsidies (especially in favor of domestic and agriculture consumers) and heavy tax incidence are contributing to grid[8] defection by large consumers (industry, commercial and high-end consumers) (cited from Malik and Urooj, 2022).

The energy tariffs are high due to governance issues, operational, financial, and commercial inefficiencies, inapt policies, distortions in applicable tariff schemes, irrational cross-subsidies, and sub-optimal energy mix (Malik, 2020). The policymakers try to cover all these inefficiencies through subsidies or by charging a higher tariff to industry, commercial and high-end residential consumers (cross-subsidies).

3.1. Expected Cross-subsidy in Industrial Tariff without Industrial Support Package

The difference between the average cost of supply and the unit price of supply represents a level of subsidy. For this reason, the average supply cost is a critical component in estimating subsidies or any other benefits. The cost of supply is the generation cost, including transmission charges.

Table 4. Tariff Calculation

	FY2023	**FY2024**
Units Received	127,973 (GWh)	124860 (GWh)
Units Sold	113,002 (GWh)	110165 (GWh)
Transmission & Distribution (T&D) Losses	11.7%	11.77%
Energy Cost (Rs Million)	1,152,357	840462
Capacity Cost (Rs Million)	1,250,959	1874334
Unit of System Charges	114,606	151363
Dist. Business Cost	---	
Power Purchase Price (PPP) (Rs Million)	2,517,922	2866159
Average Tariff based on Cost of Service (Rs/kWh)	**19.68**	**22.95**
Average Tariff based on Cost of Service (T&D Losses Adjusted) (Rs/kWh)	**22.28**	**26.02**
Distribution Margin (Rs Million)	246,032	341403
Prior Year Adjust. (Rs Million)	40,566	73599
Total Revenue Requirements	2,804,520	3281162
Average Tariff Based on Revenue Requirements (Rs/ kWh)	**21.91**	**26.28**
Average Tariff Based on Revenue Requirements (Rs/ kWh) (T & D Losses Adjusted)	**24.82**	**29.78**
Industrial tariff (B3 & B4) Peak (Rs/kWh)	**45.10**	**36.4***
Industrial tariff (B3 & B4) Off-Peak (Rs/kWh)	**39.00**	**30.8***
Cross-subsidy in Peak hrs. (Rs/kWh) (T&D Losses Unadjusted)	**23.19**	**-----**
Cross-subsidy in Peak hrs. (Rs/kWh) (T&D Losses Adjusted)	**20.82**	**-----**
Cross-subsidy in Off-Peak hrs. (Rs/kWh) (T&D Losses Unadjusted)	**17.09**	**-----**
Cross-subsidy in Off-Peak hrs. (Rs/kWh) (T&D Losses Adjusted)	**14.18**	**-----**

Source: NEPRA and APTMA *Without quarterly and fuel price adjustments

Anecdotal evidence suggests that the tariff recovery rate for the industry is high. In FY2022, the average recovery of the billed amount was more than 97% from the industry in Punjab, a breach of less than 3% from NEPRA targets. All the industrial units have been installed with smart electricity meters for the last 15 years or so. This has substantially reduced the chances of theft. Retail electricity prices are usually high for residential and commercial consumers because it costs more to distribute electricity to them. Industrial consumers use more electricity and can receive it at higher voltages, so supplying electricity to these customers is more efficient and less expensive (economies of scale). The retail price of electricity to industrial customers is generally close to the wholesale price of electricity.

In the present formula, the electricity costs across the entire value chain are lumped together (averaged) to determine the total revenue required by the utility, which is then used to set an average price. The individual retail tariff derived from the averaged costs bears no semblance to the actual costs incurred by the utility to deliver a service to separate customer groupings. This is discriminatory for consumers, e.g., industry, by making them pay for charges they do not contribute to.

- The actual service cost to the industry is even lower than the average of Rs 19.68/kWh (Table 2).

- The industrial consumers are subsidizing by more than Rs 25/ kWh in peak hours. This will increase even further after another re-basing of Rs 6.9/KWh under the IMF Standby Arrangement. The base tariff will increase from Rs 24.8/ KWh to Rs 31.7/KWh.

- Yet, even after allowing for the revenue requirements of the distribution sector as per NEPRA Tariff Standards and Procedures Rules, 1998, and adjusting for T & D losses, the cross-subsidy from industry to other sectors in peak hours is more than Rs 20 /kWh, which is not justifiable by any law.

As Clause 31 of the NEPRA Act specified, cross-tariff subsidies should have been avoided. But it did not happen.

- Sub-clause 2(f) is about eliminating exploitation and minimizing economic distortions. This enormous cross-subsidy from industry to other sectors is not only exploitation but creating economic distortions in the electric power industry.

That is, by encouraging the inefficient use of expensive energy resources. Evidence suggests it is increasing the inefficient use in subsidized sectors with more commercial and operational losses. In other words, more financial losses[9] (Malik, 2020 and 2023).

- Sub-clause 3(h) states that tariffs should, to the extent feasible, reflect the total service cost to consumer categories with similar service requirements. This is also not happening. Likewise, sub-clause 3(e) is about marginal cost pricing.

- In contradiction to sub-clause 2(e)[10], from an overall economic perspective, this enormous cross-subsidy leads to the contraction in industrial output, exports, foreign exchange reserves, and general economic activities (details in the next section).

All these clauses are rightly contained in the original NEPRA Act but have yet to be implemented. The cross-subsidy from industry in the tariff structure clearly violates existing law, with no legal and technical justification.

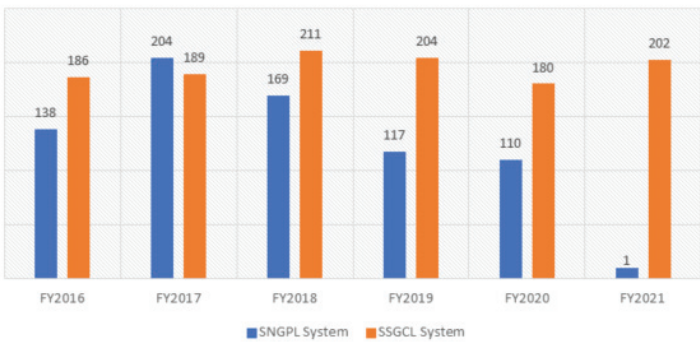
Cross-subsidies are a part of the state's socioeconomic or political obligations. These must not burden or exploit industries or any other consumer category. The government's social obligations can be met through social protection schemes, which are already in place (Cheema et al., 2022).

3.2. Gas/ RLNG for Industry

The second energy source for the EOUs to run their operation effectively is gas/RLNG. However, in Punjab, the supply of gas and RLNG to industry is also severely constrained (Table 1, Figure 9). Natural gas, apart from CPPs, is used as fuel for boilers, which generate steam for the production process, dry & steam dyeing, and thermo sole dyeing. The gas shortage[11] in Punjab has led to a rise in production costs for the industry. In December 2021, textile units in Punjab were forced to close for 15 days due to gas shortages resulting in a loss of US$ 250 million worth of exports, equal to 20% of the sector's annual revenue (Mustafa, 2022).

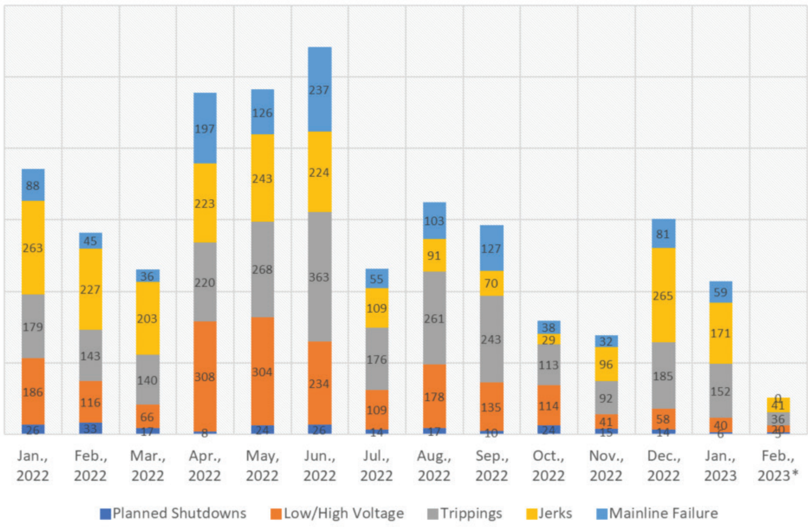
Due to the non-availability of gas Punjab's industries rely on unreliable grid electricity supplies (Figure 10). A shutdown of up to 5 days has resulted in a capacity contraction of 25%[12]. PIDE (2021) reports that unannounced shutdowns or power fluctuations, in addition to production loss[13], damage computerized gadgets attached to the latest machinery[14]. For other uses, in the absence of gas, the industry has had to rely on alternative fuels, diesel or furnace oil, which are more expensive. Fuel switching can be even more detrimental to the productivity and competitiveness of the textile industry in Pakistan (Isaad & Reynolds, 2022).

Figure 9. Gas Consumption in Captive Power Plants (MMCFD)



Source: OGRA State of Petroleum industry (Various Years)

Figure 10. Electricity (Grid) Interruptions (Nos.)



Source: APTMA; *Data is only for the first 12 days

Considering the depleting gas reserves and rising RLNG prices due to the Ukraine crisis,[15] the gas supply will not increase soon. Furthermore, given the limited foreign exchange reserves, LNG procurement has become difficult for Pakistan. Ultimately, due to limited RLNG imports and an ineffective gas allocation policy, there is a limited supply of gas to the industries in Punjab. Plus, the price differential in gas between Punjab and Sindh has rendered the EOUs in Punjab uncompetitive and possibly the leading cause of the shutdown of EOUs in Punjab (Figure 4) in the past and could be in future.

As an alternative to grid electricity, higher gas prices for CPPs in Punjab have increased the marginal cost of production for the industries. The resulting energy price differential relative to their trading partners within country (in Sindh) or within region will lead them to produce fewer energy-intensive exports in future and relocate the energy-intensive production to areas with low-energy prices. This premature de-industrialization in the province apart from its detrimental effect on exports, will increase unemployment in the province.

The geopolitical context is putting extra pressure on international gas prices,[16] which could aggravate the already significant impact of the energy bill on textile industry in Punjab. As per OGRA notification on February 15, 2023, the industry's gas pricing varies from Rs1100-1650 per MMBTU (US$4 to US$7.5 per MMBTU). On the other hand, the RLNG price for the transmission and distribution networks for SNGPL is US$13.7/MMBTU (Rs3753/MMBTU) (OGRA notification as on February 13, 2023).

Export-based Industries in Punjab are getting RLNG at US$9/MMBTU. Although lower than the notified SNGPL RLNG price, it is more than double the gas price for export-based industries in Sindh (US$4.1/MMBTU).

The disparity in energy prices has brought Punjab-based textile firms at a cost disadvantage. The EOUs get taxed on their turnover, not profit. Therefore, all the excess profits from energy cost savings will benefit Sindh-based industrialists. Sui Southern Gas Company Ltd supplies about 350 MMCFD to the industry and CPPs, including export and non-export (OGRA State of the Regulated Petroleum Industry Report 2020-21). With the price difference of US$5 per

MMBTU between EOUs based in Sindh and Punjab, the cost advantage to the industry in the South is at least US $ 575m per year[17].

Currently, 1,211 captive power units on both Sui Northern Gas and Sui Southern Gas networks with the capacity to consume about 415 MMCFD of gas. Out of this, 610 are EOUs[18]. The efficiency for CPPs in Sindh is around 30%[19]. As these are getting gas at a lower rate (Table 1), they are not incentivized to improve their plant efficiency and move towards combined cycle or co-gen facilities.

Although the constitution allows the producer province the right to first use gas, the difference between RLNG price and locally produced gas price is immense. Local gas resources are decreasing rapidly. Current reserves will last a maximum of 15 years if demand is capped at present-day consumption levels (Malik & Ahmad, 2022). Under this scenario, this colossal price disparity is not viable. There is a need to reconsider the gas allocation and pricing policy. The government, in February 2022, introduced the WACOG bill. Nevertheless, stay was granted by the court after a month.[20]

The gas sector circular debt has crossed Rs1.6 trillion. Gas companies are trapped in this debt due to the provision of subsidized gas to many sectors (Malik & Ahmad, 2022). Substantial government involvement across the LNG supply chain, the distorted subsidy structure and political preference for local gas distribution has made the actual recovery of LNG costs difficult.[21]

The government introduced the WACOG bill because of the country's increasing dependency on imported RLNG. Its implementation would have allowed the government to initiate gas pricing reforms in the gas pricing structure reforms.

4. ENERGY TARIFFS, EXPORTS, AND INDUSTRIAL PERFORMANCE

4.1. Energy Costs and Firm-level Performance

In this section, we study the impact of the rise in energy costs on employment, investment, and revenues of 353 industrial units in Pakistan. The data covers the period from 2015 to 2022 and includes both exporting (209) and non-exporting firms (126) divided into the following categories: textile & clothing (119), food & beverages (47), chemical (42), electronics (6), cement (16) and other manufacturing units including automobiles (40). The data analyzed is collected from the annual reports of listed manufacturing companies. For the third objective of the study, the sample period remains the same but includes 46 textile (exporting) units, with 37 located in Punjab and 9 in Sindh.

Box 1. Impact of energy price shocks on firms' competitiveness

There are four primary response measures that firms can adopt:

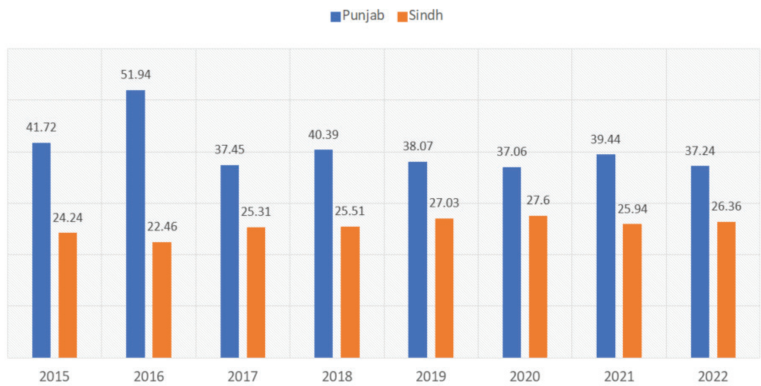
- When profit margins are high, firms can temporarily absorb additional production costs from fuel price increases.
- Companies may switch to alternative energy sources, requiring new technology and access.
- Firms can reduce energy consumption while maintaining production levels by updating technology - energy efficiency.
- Firms can pass on the price shock to end-users depending on the price elasticity of demand.

The export sector in developing countries cannot pass on cost increases to foreign consumers because they are price takers or face competition from firms unaffected by price shocks. The export sector would be vulnerable to energy price shocks, mainly when it is dominated by small and medium enterprises (SMEs) with little margin buffers to cope with shocks, which could lead to bankruptcy or exit from the market.

Source: Rentschler et al. (2017) and Kpodar, et al. (2019)

Our analysis is primarily focused on the EOUs in Punjab and Sindh. After controlling raw material costs, energy costs had the maximum share in conversion costs. This ratio was higher for Punjab firms in the sample period than those in Sindh (Figure 11). It is due to the gas price disparity between the two provinces.

Figure 11. % Share of Energy in Conversion Costs



Energy costs in terms of sales revenue in textile units in Punjab are much higher than the textile units in Sindh (Figure 12). This is also reflected in the difference in net profit margins (average) between firms in Punjab and Sindh. Non availability and high gas costs for Punjab firms has severely affected their net profit margins.

Figure 12. Energy Costs % of Total Revenue

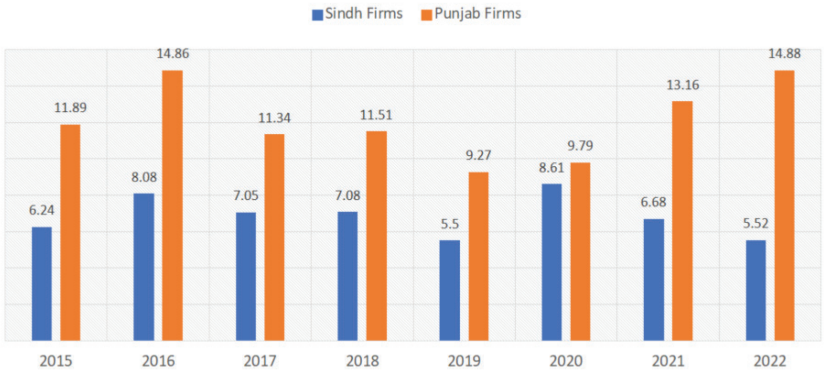
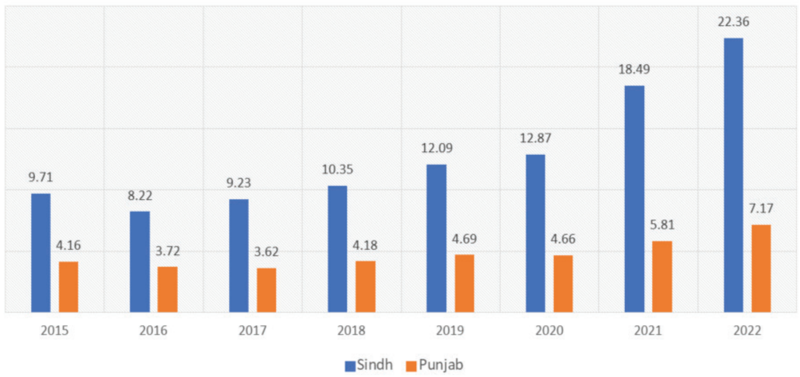


Table 5. Average Net Profit Margin (%)

	2016	2017	2018	2019	2020	2021
Punjab	-0.97	0.97	0.85	0.65	-0.94	6.19
Sindh	3.68	3.27	5.37	8.34	2.51	8.95

This also translates into lower exports growth in Punjab. The average growth in exports sales in our sample firms in Punjab from 2015 to 2022 was 7% as compared to 11% growth in exports from Sindh firms (Figure 13).

Figure 13. Average Exports Revenue (PKR Billion)



4.2. Impact of Energy Costs on Exporting vs Non-Exporting Firms

To estimate the impact of energy price differential on outcome variables (i.e., output, investment, employment, and export), the following model is used:

$$q(\varphi) = \varphi l^{\alpha} k^{\beta} Pow^{\omega} \left[\int_0^1 x_H(j)^{\frac{\gamma-1}{\gamma}} dj + z \int_0^N x_F(j)^{\frac{\gamma-1}{\gamma}} dj \right]^{\frac{\theta\gamma}{\gamma-1}} \quad \ldots (1)$$

Where; φ measures the labor productivity of the textile unit, l is the amount of labor employed, k is the amount of capital employed, Pow is the amount of energy employed, x_H (j) is a particular variety j of the domestic raw material x_H,x_F is the variety j of imported raw material, z {0,1} implies either the textile unit employs domestic raw material or imported raw material. Detailed model in Appendix C1.

We used the cost minimization approach to estimate the impact, modified slightly from the PIDE (2021) methodology to suit our study's needs. Through the cost minimization approach, we will obtain the elasticities of investment, employment, and total sales revenue[22] induced by the energy tariff differentials by applying panel data econometric tools and techniques. Detailed model specification and Fixed-Effect Generalized Least Square (GLS) estimation results are reported in Tables 6 to 8. Detailed results are reported in Appendix C2.

We estimated growth rates for total revenue, exports, investment, and employment from the collected data. So, by using elasticities and growth rates, we computed the Solow Residual for all firms, which would be induced by tariff increase. Such analysis would demonstrate the impacts of tariff differential on the exporting firms' productivity compared to non-exporting firms.

Table 6. Impact of Energy Costs

Estimated Elasticities						
	All Firms	Export	Non-Export	Textile		
				All Firms	Export	Non-Export
Employment[1]	-135.65*	-149.75*	-164.81*	-229.5**	-241.4**	-247.6
Investment	-0.33**	-0.39**	-0.31**	-0.30	-0.50*	-0.27
Total Sales Revenue	-0.51**	-0.86***	-0.40*	-0.13***	-0.57*	-0.05

Source: Author's estimation
Note: Standard Errors in Parenthesis, *** p<0.01, ** p<0.05, * p<0.1
[1]semi-elasticity

Table 7. Impact of Energy Costs

Estimated Elasticities									
	Food			Chemical			Cement		
	All Firms	Export	Non-Export	All Firms	Export	Non-Export	All Firms	Export	Non-Export
Employment[1]	-93.5**	-132.8**	-78.7**	-88.6*	-216.0**	-56.1	-1417	-1513	-1229
Investment	-0.06***	-0.23*	-0.11	-0.22***	-0.30	-0.15	-0.24	-0.27	-0.59
Total Sales Revenue	-0.02**	-0.32*	0.14	-0.48**	-0.78***	-0.38**	-1.23**	-1.39**	-0.80*

Source: Author's estimation
Note: Standard Errors in Parenthesis, *** p<0.01, ** p<0.05, * p<0.1
[1]semi-elasticity

Table 8. Impact of Energy Costs

Estimated Elasticities									
	Petroleum			Electronic			Other Manufacturing		
	All Firms	Export	Non-Export	All Firms	Export	Non-Export	All Firms	Export	Non-Export
Employment[1]	-152.8	-231.7	-140.5	-276	321.8	-136.8	-43.3*	-298.5*	-17.1*
Investment	0.41*	-0.63**	-0.41*	-0.76	-1.10	-0.79	0.09***	-0.02***	-0.11***
Total Sales Revenue	-0.68**	-1.09***	-0.38***	-3.94**	-4.94**	-4.03***	-0.76**	-0.77**	-0.76*

Source: Author's estimation
Note: Standard Errors in Parenthesis, *** p<0.01, ** p<0.05, * p<0.1
[1]semi-elasticity,

The results reported above confirm the negative impact of any change in energy costs influenced by tariff rise on firms' employment, investment, and total sales. The results are equally strong for non-exporting firms.

With a 1% increase in energy tariffs, investment will decline by 0.33% in all firms, and total sales revenue will go down by 0.51% for all firms (exporting and non-exporting). Further, the results suggest that a firm will be forced to lay off its workers. The number varies across various economic groups. Based on the significance of the results, the maximum labor unemployed will be in the textile sector. With a 10% increase in energy costs (tariffs), a textile firm (on average) will lay 24 employees.

The study further investigates the difference of any change in energy costs (tariff differential across regions, that is, Punjab and Sindh. The results are reported in Table 9 (detailed results are reported in Appendix C3. The impact of any energy price change on employment, investment, and total revenue is the same (declining) in firms (exporting and non-exporting), both in Punjab and Sindh. But, For exporting firms, particularly in Punjab, the impact of a 1% increase on employment, investment, and total revenues is more robust and significant compared to firms in Sindh. The firms in Punjab will be hurt more by the increase in electricity tariffs. As discussed in the previous section, the reason could be the gas price differential between the two provinces.

Table 9. Impact of Energy Costs

Estimated Elasticities						
	Punjab			Sindh		
	All Firms	Export.	Non-Export.	All Firms	Export.	Non-Export.
Employment	-0.104**	-0.166**	-0.087	-0.086	-0.150*	-0.896
Investment	-0.426*	-0.486*	-0.407*	-0.268	-0.295	-0.260
Total Sales Revenue	-0.649**	-0.687**	-0.613**	-0.477*	-0.567**	-0.267

Source: Author's estimation
Note: Standard Errors in Parenthesis, *** p<0.01, ** p<0.05, * p<0.1

4.3. Impact of Energy Price Increase in Textile Export-Oriented Units

Next, through the cost minimization approach (as used in Section 4.2), we estimated the elasticities of investment, employment, domestic sales revenue, and export revenue induced by the energy tariff differentials by applying panel data econometric tools and techniques for only textile exporting firms in Punjab and Sindh. Detailed estimation results using Generalized Least Square (GLS) are in Appendix C4. We have projected the impact of new energy prices from estimated elasticities, as reported in Table 10.

We estimated growth rates for domestic revenue, exports, investment, and employment from the collected data for 46 textile firms. Using elasticities and growth rates, we computed the Solow Residual for the textile firms, which would be induced by tariff differential. Such analysis would demonstrate the impacts of tariff differential on the productivity of the textile firms of Punjab as compared to Sindh.

Table 10. Estimated Elasticities and Projections

	Estimated Elasticities		Projections			
			Punjab Self Generation on Gas/RLNG (Rs31/kWh)		NEPRA B3 Tariff (Rs39/kWh) (FY2023)	
			55.07% increase Impact		97.59% Increase Impact	
	Punjab	Sindh	Punjab	Sindh	Punjab	Sindh
Investment	-0.18*	-0.04***	**-9.9%**	-2.1%	**-17.57%**	-3.71%
Employment[1]	-312***	-70**	**-172 (No.)**	-38 (No.)	**-304 (No.)**	-68 (No.)
Exports	-0.23***	-0.16***	**-12.65%**	-8.8%	**-22.45%**	-15.6%
Net Profit (Without taxation)[1]	-27113.4**	709*	**-14.9 (PKR Billion)**	----	**-26.5 (PKR Billion)**	----
Domestic Sales Revenue	-0.09***	-0.04	**4.95%**	-2.2%	**8.78%**	3.9%

Source: Author's estimation
Note:[1]semi-elasticity; *** p<0.01, ** p<0.05, * p<0.1

Pakistan's energy price system (in general) and industries (in particular) have distortions. This system has been facing numerous challenges for years, affecting industrialization. The results in Table 5 illustrate the impact of energy price change on investment, employment, export share, domestic share, and net profitability growth in Punjab textile units.

Export is a growth driver and a factor facilitating interdependent relationships among the world's countries. Exports growth is an effective instrument to promote the inflow of foreign exchange. Higher export earnings working through increasing foreign exchange earnings enhance the capacity to import more raw materials and capital goods, which helps expand productive capacity. Increasing production encourages industrial and technological progression, creating new employment opportunities and expanding commercial volume.

In Pakistan, textile is the primary source of export earnings. Any disruption is an indication of disrupting the entire growth process. Textile exports can stimulate the industry's growth by increasing demand for textile products, promoting investment in the sector, and creating opportunities for value addition. The result of the study reveals:

- With a 1 percent increase in tariff, exports revenue will decline by 0.23%. With a 55% increase (RLNG-based tariff) and 97.6% in energy tariffs (with cross-subsidies), an export share will drop by 12.65% and 22.45% in Punjab firms.

Pakistan's energy price hikes may bring distortions and inefficiencies in the export market, where exports have been facing constraints due to exchange rate movements and inadequate regulatory frameworks for the export sector for the last many years (SBP, 2017). We need uninterrupted export growth to cushion our declining foreign exchange reserves. Nevertheless, with an increase in energy tariffs, it will not be possible. Furthermore, the impact on Punjab will be critically more severe as Industries in Sindh are already getting electricity at a rate lower than RCET.

Investment in the textile industry is of paramount importance for Pakistan, as it is the country's largest manufacturing sector, accounting for a significant share of its GDP and exports. As the results in Table 5 suggest, an increase in energy tariffs under the Circular Debt Management Plan will have a more adverse impact on EOUs in Punjab as the alternative source of energy RLNG for CPPs is also expensive for them as compared to Industries in Sindh EOUs.

- With a 1 percent increase in price, the investment will decline by 0.18%. With the NEPRA tariff (FY2023) (i.e., 97.59% increase, the investment will decline by 17.6%. While with RLNG at US$9/MMBTU, there will be a decline in 9.9 % investment in Punjab textile units. However, due to limited availability of RLNG to Punjab, firms will have to rely on expensive grid electricity.

The results are consistent with IGC findings about the relation to Pakistan's energy system, which is faced with low coordination, lack of government capacity, and difficulty in regulating and pricing (IGC, 2023).[23]

The textile industry is one of the country's largest employers, employing millions of people directly and indirectly.

- With a 1% increase in price, a firm will lay off three employees (on average) in Punjab textile units. With a 55% increase in energy tariffs, each firm in Punjab will lay off 172 employees. With a 97.59% increase, each firm will lay off 304 employees. The total number of unemployed with a 97.59% increase in energy tariff will be 90,431 in 297 working textile units (organized sector) in Punjab[24] in a year. On average, the closure of about 38 units in Punjab in a year.[25]

TCO(2021) reports on a highly fragmented cottage/small-scale textile sector in addition to the organized large-scale textile industry. According to the Census of Manufacturing Industries (2015-16), 5967 textile units in Punjab employ (on average) 1943 persons. The same survey reports 1713 wearing apparel units in Punjab employing (on average) 1553 persons. Based on these figures:

- With a 97.59% increase in electricity tariff, about 1.8 million will be unemployed in Punjab textile units. On average, the closure of 934 textile units in a year. Likewise, with this tariff increase, about 0.52 million will be unemployed in wearing apparel units of Punjab; on average, there will be a closure of 335 apparel units in the province. In other words, an increase in electricity tariff for the industrial units will be a move towards pre-mature deindustrialization in the province.

As per unofficial figures, there are currently 11,820 working textile units in Punjab, excluding the cotton ginning industries.[26] According to the Labor Force Survey 2020-21, about 4.12 million are employed in the textile sector (formal and informal) in Punjab. Going by these figures, the magnitude of unemployed with a 97.59% increase in electricity tariff will be even more than the above figures.

The estimation further reveals:

- A 1 percent increase in energy costs will decrease net profit (without taxation) by PKR 0.28 billion (keeping other factors constant). With RLNG-based energy costs in the next year, net profit for a firm (on average) will decline by PKR 14.9 billion. With 100% reliance on grid electricity, net profit (on average for a firm) will decrease by PKR 26.5 billion.

With such a huge loss, the smaller firms will be unable to sustain themselves and shut down their operations.

- A 1 percent increase in tariff will contract domestic sales revenue by 0.09%. If the firm uses RLNG-based electricity, the domestic sales revenue will decrease by 4.95%; with grid-based electricity, its domestic sales will contract by 8.78%.

- In other words, a 1 percent increase in tariff will contract total industrial revenues (output) by 0.32%. It means that including cross-subsidy (97.6% in energy tariffs) will decrease firms' output by more than 31%. Even using RLNG-based electricity, the output in Punjab firms will decline by more than 17%.

The estimations further suggest that the firm's revenue from exports and domestic sales significantly depends on the firm's new investments in innovative products, machinery, etc. With the increase in energy tariffs, firms in Punjab will cut down their investments, thus affecting their competitiveness in world and domestic markets.

In brief, energy constraints/costs will considerably reduce investment, employment, export competitiveness, profits, and the businesses' productivity. Thus, limiting fiscal space and raising debt to undermine growth prospects in the country.

A similar exercise for Sindh firms suggests relatively little impact. Their energy costs are already low compared to energy costs in textile units in Punjab.

4.4. Impact of Energy Tariffs on Manufacturing Exports

We compile annual data (2002-2022) to investigate empirical linkages between energy (electricity) tariff changes and the external competitiveness of export-oriented units. The sample size and period of study have been guided by data availability. It includes the period (2018 onwards) when a special package for zero-rated industries was provided. The data sources include State Bank of Pakistan reports, World Development Indicators, Federal Bureau of Statistics, and NTDC statistics.

The baseline model below explains export growth by changing electricity prices, controlling for a set of variables traditionally thought to matter for the country's export competitiveness. The specification of the model is as follows:

$$Ln(Export)t = \alpha + \beta \, Ln(Electricity\ Tariff)t + \Sigma \, \delta k \, Ln(Xk)t + \mu t \qquad \text{..... (2)}$$

Where Ln(Export)t is the logarithm of export (textile, other manufacturing, and total in US$) of Pakistan in year t; Ln(Electricity Tariff)t denotes the logarithm of domestic electricity prices (US cents/ kWh) in year t (the main variable of interest); and Ln(Xi) is the logarithm of a set of i control variables including the real effective exchange rate, the relative price of exports, world GDP as an indicator of external demand, import tariffs as trade restrictions, and time dummy (2016 and onwards =1, otherwise zero), and μt is the residual term.

As underlined in the previous sections, our primary focus is to investigate how energy tariffs (and potential tariff subsidies) impact external competitiveness, which can be measured through export growth. This indicator has the advantage of being simple and meaningful. The coefficient will be negative and significant if electricity tariffs rise and hurt competitiveness. On the other hand, if the coefficient is not significant or positive, it supports the idea that energy prices do not harm competitiveness (or even enhance it).

We used fully modified OLS regression to determine how industrial electricity tariffs affect the performance of textile exports, other manufacturing exports (excluding textiles), and total exports. An interaction term between the industrial electricity tariff and time dummy is utilized to measure the effect of the industrial support package (from 2018 onwards) on export performance. The relevant results are reported in Table 11.

Table 11. Estimated Impact at the Macro Level

	Log Textile Export	Log Other Manufacturing	Log Overall Export
Log Energy Tariff	-0.503*** (0.122)	-0.371** (0.185)	-0.244* (0.129)
Interaction of Energy Tariff and Time Dummy (2018-2022 = 1, Otherwise 0	0.767*** (0.150)	0.533** (0.227)	0.355** (0.158)

Source: Author's estimation
Note: Standard Errors in Parenthesis, *** p<0.01, ** p<0.05, * p<0.1

The results confirm a robust negative association between export growth and energy tariff increase. When an industry significantly depends on energy resources for its economic activities, its price increase hinders its export competitiveness. A 1 percent increase in electricity tariffs decreases exports by 0.5 percent for textile EOUs and 0.4 percent for other manufacturing EOUs. However, when this tariff interacted with the time dummy (representing the time when the industrial support package was introduced), it became positive and significant for all categories. It means when a competitive tariff (that is, a tariff without a cross-subsidy) was provided, it helped enhance export growth.

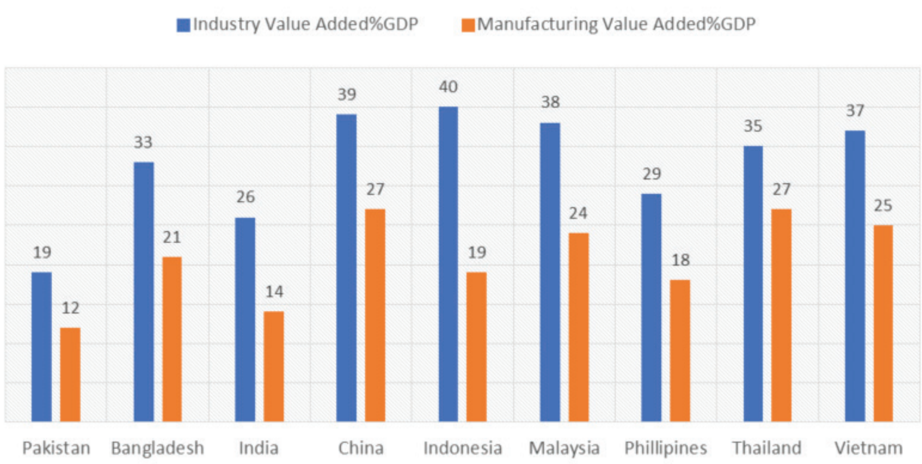
All the control variables are as expected signs. World demand is a significant indicator of export demand growth. The real effective exchange rate and relative export price are only significant for textile exports. On the contrary, import tariff restrictions do not play a significant role in the case of textile exports. Detailed results are reported in Appendix C5.

4.5. Energy for Industrial Growth

The conclusion from previous sub-sections is that competitive tariffs are essential for increasing output, employment, and investment in all firms regardless of export orientation and can be achieved through reforms in tariff structure. Otherwise, the rising tariff trend will hurt the overall industrial growth in Pakistan, particularly in Punjab. Moreover, the data analysis indicates that a rise in energy tariffs will substantially impact the expansion of exports. Specifically, the textile sector located in Punjab will experience notable repercussions, leading to premature deindustrialization.

Industry is crucial for economic development. It has been the main contributor to development for most advanced countries. Premature deindustrialization occurs when countries move away from the industrial sector at relatively lower income levels (PBC, 2017). In Pakistan, the share of industries and manufacturing (in particular) in GDP is lower than most of its regional competitors (Figure 14). There has been a reversal of industrialization over the years. This process will accelerate as energy costs rise, especially in Punjab, further eroding export potential.

Figure 14. % Share of Industry in GDP



Source: World Development Indicators

When energy tariffs increase, it can negatively affect industries by raising their production costs. This can result in decreased competitiveness domestically and internationally, leading to reduced demand for products, lower profits, and less output and employment opportunities. In some cases, industries may choose to relocate to regions or countries with lower energy prices (as happened in 2008 when prominent industrialists shifted industry from Pakistan to Bangladesh), leading to a loss of revenue, limited employment opportunities, and increased poverty. This could also have a broader impact on the economy of Punjab, reducing its contribution to the national GDP, which is currently at 54% .[27]

The higher energy prices will impact companies in two steps. The most immediate impact, as the result of this study suggests, will be through an increase in production costs with a rise in energy tariffs. Whereas the firms (e.g., large ones) that survive will pass on the cost impact to customers of their products. As a result, customers, too, are confronted with higher costs, decreasing their purchasing power. They will either switch to cheaper (competitive products) from other producers (markets) or reduce their spending, which, in turn, will have a decreasing impact on overall GDP.

As mentioned in Box 1, the export sector cannot pass on cost increases to foreign consumers because they are price takers or face competition from firms unaffected by price changes, mainly when it is dominated by small and medium enterprises (SMEs) with little margin buffers to cope with shocks, which could lead to bankruptcy or exit from the market.

The SME sector is considered the backbone of Pakistan's economy. According to the Small & Medium Enterprise Development Authority (SMEDA), there are more than 5 million SMEs in Pakistan. The energy price hikes will impact the competitiveness of SMEs as they may need more financial capacity to absorb the increased costs. This will lead to a reduction in the number of SMEs and the concentration of economic power in the hands of large affording companies. Additionally, it may also lead to supply chain disruptions.

Pakistan's share of global exports is only 0.13%, indicating that its exports are not competitive globally. Unfortunately, this has been the case for decades. To address the decrease in foreign exchange reserves, the textile and clothing industry is currently the most viable option in the short term. It is imperative to maintain manageable business costs across the manufacturing sector to remain globally competitive (especially for EOUs) and encourage a focus on exporting for the remaining firms.

Finally, to enhance industrial activity in Punjab, there is an urgent need to manage reliable and consistent energy supplies at a competitive rate. The NEPRA estimates that cumulative load shedding during the last year in Punjab was about 41 million minutes (PGS, 2023).

5. CONCLUSION AND WAY FORWARD

Pakistan is passing through a deep structural crisis. Pakistan's economy is in bad shape. In this scenario, any increase in energy prices for industry will lead to layoffs and industrial shutdowns. Accordingly, reducing revenues from industry and industrial exports, declining foreign exchange reserves, enlarging trade and capital account deficit, increasing the need for more foreign loans, and pushing the economy further into the debt trap.

Pakistan's exports rose until June 2022, but a 15% decline in exports was observed in FY2023 compared to FY2022: a decline of US$4.1 billion[28]. One of the main reasons cited in various sources is energy shortage. Some of the export orders have also been cancelled (in the last couple of months) owing to the high cost of energy in manufacturing and the shortage of imported raw materials. It is adversely affecting the already low foreign exchange reserves. Many factories are forced to close down or scale down their operation.

Our findings can be summarized as follows. First, electricity price increases tend to lead to a non-negligible decline in export growth. This impact is stronger for the energy intensive textile sector at the macro level. The firm level analysis in the study suggests that unreliable and expensive energy supplies will lead to a decline in overall firm revenues, investments and ultimately laying off workers in both exporting and non-exporting firms. This impact will be stronger for the labor-intensive textile sector[29]. Particularly in Punjab (where most of the textile units are positioned, any increase in energy tariffs will force them to shut down their operations partially or completely.

For grid electricity, the study finds:

- No legal, economic, or technical justification for such an enormous cross-subsidy from industry to other sectors.

- The tariff allowed to EOUs in the recent past was not a subsidy to the industry but a tariff without cross-subsidy. The financial burden on the government by removing this cross-subsidy will not be much if estimated in terms of its impact on exports growth.

In FY2022, the government support to the EOUs was equivalent to about 2.9% of textile exports[30].

Pakistan is among the top thirty countries worldwide with comparatively high electricity tariff rates. Due to long-term agreements with guaranteed capacity payments to thermal generation companies, switching to cheaper indigenous energy sources is impossible in the short to medium term. Therefore, the complex tariff mechanism must be revised to reduce electricity prices in Pakistan to promote industrial growth. Tariffs should be based on the actual cost of services to all consumer categories including manufacturing units (exporting and non-exporting) (Malik & Urooj, 2022; Cheema et al., 2022).

For achieving socio-political objectives, the government has other alternatives. No need for providing relief at the cost of compromising industrial/ export competitiveness.

- The best way is to move to a flat linear tariff without cross-subsidies and consumer differentiation. It will not only minimize ineffi¬ciencies but will have a positive impact on sector revenues.

- NEPRA needs to revisit its tariff calculation policy as per the NEPRA Act. It is desired not only for fairness but also for the overall improvement in the power sector. The power sector can only improve if the actual service cost is charged to every consumer category.

- Above all, to recover capacity payments (Rs 1.95 trillion for FY2024), sales need to be increased by charging a cost-based tariff to the industry. Making the grid electricity attractive to productive sectors will also help in reducing circular debt burden.

- Allow open access to all market participants on a non-discriminatory basis. The 'wheeling of electricity' for the bulk power consumers (industry) must come into play. It must be supported by viable requisite policies and plans at the governmental level (Cheema et al., 2022). The facility will reduce energy costs and improve supply for the small BPC population in the country.

According to the tariff analysis (at the province level) in the study, export-oriented units in Sindh already receive competitive tariffs through local gas-based CPPs, so moving away from zero-rated tariffs will not make a difference for them. However, providing cheaper local gas to Sindh is not economically efficient. Local gas resources are depleting quickly; there is a need to reevaluate gas pricing and allocating policies.

- Gas allocation to sectors should be from a growth perspective and not based on political decisions. Economically, it would be more appropriate to prioritize the power sector in the allocation of local gas, to minimize the overall cost of electricity generation.

- Pakistan should de-regulate and liberalize the natural gas sector and its pricing structure.

- Let all consumers compete for market share in RLNG and the remaining gas (local). A market-based pricing system will also curtail the disparity in gas price use between industries in Punjab and Sindh.

- Through unbundling of the downstream gas sector, an open access policy, and removal of tariff restrictions, new entrants in the retail sector will be free to sell gas in any area at the market determined price.

Globally due to changing gas market dynamics, gas markets in several countries have moved towards WACOG or price pooling formulas. It is the best short-term solution against declining local gas resources in Pakistan. But require political will and national level consensus. Besides, WACOG does not mean a uniform tariff across provinces, the end consumer tariff will still be different due to difference in transportation charges. Instead of the right of first use, there are other ways to compensate the province where the gas is produced. The payment of royalties or some other mechanism for sharing economic benefits from natural resources, that is, natural gas, can be used.

Lastly, any tariff increase will likely affect the energy-intensive sectors more. The firms must adopt new and more efficient technologies to reduce energy intensity[31]. Higher energy prices can reduce competitiveness if firms absorb the rise in energy costs without balancing it with innovation (Calì et al., 2021).

Pakistani firms must invest in alternate energy sources[32] that are more sustainable and affordable in the long run. The increased use of green (renewable) energy combined with energy efficiency and conservation would reduce net energy production costs.

Pakistan adopted a private sector-oriented approach somewhat earlier than other economies in the region but has yet to be able to expand its exports compared to other economies in the region due to inconsistency in policies (Malik et al., 2017). There is an urgent need to assist private entrepreneurs, who are dynamic and open to innovation, by providing a favorable business environment with good governance, appropriate institutional and financial support mechanisms, an adequate legal and support framework, and physical infrastructure, including supplying energy uninterrupted and at a reasonable cost.

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Endnotes

1. Circular debt has crossed Rs2.6 trillion by the end of May 2023, registering an increase of Rs394 billion from July 2022 to May 2023, according to a report by the Ministry of Energy

2. No package announced in Federal Budget FY2024.

3. The IMF staff and the Pakistani authorities have reached a staff-level agreement on a nine-month Stand-by Arrangement (SBA) for about US$3 billion (as of June 29, 2023).

4. https://www.thenews.com.pk/print/1087866-nepra-works-out-rs6-9-unit-hike-in-base-power-tariff

5. Source: SRO Notification for Publication in the Gazette of Pakistan, February 15, 2023.

6. https://www.fibre2fashion.com/industry-article/3377/energy-conservation-in-textile-industries-savings

7. Cited from Malik and Urooj, 2022)

8. Estimated correlation between textile exports and electricity consumption is 0.96.

9. Circular debt was at Rs 2.646 trillion by the end of May 2023.

10. This sub-clause states the Federal Government's economic and social policy objectives.

11 Export Oriented Units (EOUs) in Sindh have an uninterrupted gas supply. While for Punjab EOUs, supply is limited.

12. Source: APTMA

13. A breakdown of one-minute stops work in spinning units for 20 to 25 minutes, a production loss of 10 to 15%.

14. These gadgets are imported, which takes time and more cost.

15. LNG has become five to ten times more expensive than domestic gas (Isaad & Reynolds, 2022).

16. LNG prices are anticipated to remain high for the next two to three years, mainly due to the global economic recovery from the COVID-19 pandemic and Ukraine war (Isaad & Reynolds, 2022).

17. https://www.dawn.com/news/1737220

18. https://www.spglobal.com/commodityinsights/en/market-insights latest-news/electric-power/012821-pakistan-aims-to-divert-gas-from-captive-power-plants-to-residential-consumers

19. Source: APTMA

20. On Thursday, February 17, 2022, the Senate of Pakistan approved the Weighted Average Cost of Gas (WACOG) Bill. Under the WACOG bill, all gas sources, including Re-gasified Liquefied Natural Gas (RLNG) and local gas, will be pooled, and a weighted average cost will be taken for gas purchase.

21. Pakistan featured in the top 10 countries providing the most subsidies to the natural gas sector in 2019, with a level close to the one observed in the gas-exporting countries. The subsidy amount was around US$ 1,750 million in real terms compared to US$ 873 million in India and US$ 824 million in Bangladesh.

22. As in this section, we focus on exporting and non-exporting firms, therefore using total sales revenue instead of domestic and export revenue separately.

23. https://www.theigc.org/blogs/how-reforming-energy-systems-can-tackle-climate-risks-evidence-pakistan

24. Reported in TCO Annual Report 2021.

25. Average number of employees in sample textile firms in Punjab are 2400.

26. https://profit.pakistantoday.com.pk/2022/09/25/the-state-of-punjabs-industries/

27. Source: PGS (2023)

28. Source: Pakistan Bureau of Statistics

29. There could be a sample bias, as majority firms in the sample are textile.

30. Budgetary support for Gas/RLNG and power prices in FY2022 was Rs 107 billion. The textile exportearnings in FY2022 were Rs 3649 billion (Ejaz, 2022).

31. Based on the energy audit of 38 textile units, UNIDO(2019) estimates 7% energy saving potential in textile spinning sector, and energy saving potential of 140MJ/y and 21MJ/y in the weaving and processing sectors.

32. Enormous solar PV potential in Punjab.

Appendix A. Industrial Gas Consumption

Gas Consumption Quota Allowed	Supply of Gas on	Effective Period
100%	Contractual Load	01.10.2018 – 14.12.2021
0%	Average gas consumption of three months Sep-Nov, 2021	15.12.2021 – 29.12.2021
38%	As Above	30.12.2021 – 29.01.2022
47%	As Above	30.01.2022 – 14.02.2022
75%	As Above	15.02.2022 – 28.02.2022
100%	As Above	01.03.2022 – 30.03.2022
50%	As Above	31.03.2022 – 29.04.2022
25%	As Above	30.04.2022 – 06.05.2022
50%	As Above	07.05.2022 – 31.05.2022
0%	As Above	01.06.2022 – 07.06.2022
50%	As Above	08.06.2022 – 20.06.2022
100%	As Above	21.06.2022 – 25.06.2022
50%	As Above	26.06.2022 – 30.06.2022
0%	As Above	01.07.2022 – 08.07.2022
75%	As Above	28.10.2022 – 30.10.2022
100%	As Above	31.10.2022 – 09.11.2022
50%	As Above	10.11.2022 – 13.12.2022
100%	Contractual Load	14.12.2022 – 26.12.2022
50%	Average gas consumption of three months Sep-Nov, 2021	27.12.2022 – 23.01.2023
0%	As Above	24.01.2023 – 30.01.2023
25%	As Above	31.01.2023 – 01.02.2023
50%	As Above	02.02.2023 – 05.02.2023
100%	As Above	13.02.2023 -14.02.2023
100%	Contractual Load	15.02.2023 – To date

Source: APTMA

Appendix B. Average Revenue Growth

Figure B1. Average Revenue in Punjab Textile Firms (PKR Billion)

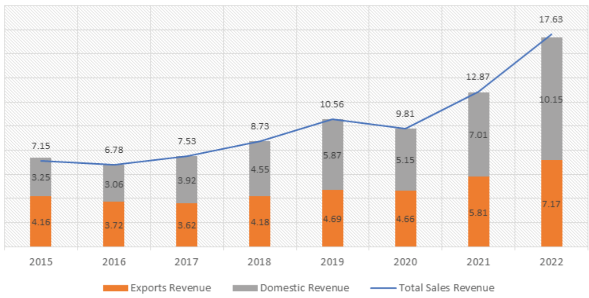
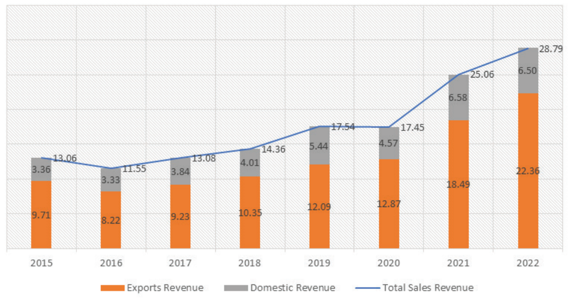


Figure B2. Average Revenue in Sindh Textile Firms (PKR Billion)



Appendix C1. Underlying Economic Model

To measure the impact of energy tariffs on employment and investment, we consider the following production function:

$$q(\varphi) = \varphi l^{\alpha} k^{\beta} Pow^{\omega} \left[\int_0^1 x_H(j)^{\frac{\gamma-1}{\gamma}} dj + z \int_0^N x_F(j)^{\frac{\gamma-1}{\gamma}} dj \right]^{\frac{\theta\gamma}{\gamma-1}}$$

The associated cost function is:

$$C = wl + rk + \mu Pow + p\left(\int_0^1 x_H(j)dj + z\int_0^N t_F \tau_F(x_F(j))dj \right)$$

The conditional demands for capital (investment) and labor are derived from cost minimization, which are:

$$k = \left(\frac{q}{\varphi}\right)\left(\frac{w}{\alpha}\right)^{\alpha}\left(\frac{r}{\beta}\right)^{\beta-1}\left(\frac{\mu}{\omega}\right)^{\omega}\left(\frac{P}{\theta}\right)^{\theta} \qquad ...1$$

$$l = \left(\frac{q}{\varphi}\right)\left(\frac{w}{\alpha}\right)^{(\alpha-1)}\left(\frac{r}{\beta}\right)^{\beta}\left(\frac{\mu}{\omega}\right)^{\omega}\left(\frac{P}{\theta}\right)^{\theta} \qquad ...2$$

By applying duality, the production function will be.

$$q = \varphi l^{\alpha} k^{\beta} Pow^{\omega} [x_H + zNt_F\tau_F x_F]^{\theta} [1 + zN(t_F\tau_F)^{1-\gamma}]^{\frac{\upsilon}{(\gamma-1)}} \qquad \text{...3}$$

Or

$$q = f(\varphi, l, k, \mu, p)$$

Appendix C2. Detailed Estimation Results_ All Firms Exporting and Non-Exporting, Economic Classification

Dependent Variable: Log Revenue	**Full Sample**		**Textile Sector**		**Other Sectors**	
	(1)	(2)	(3)	(4)	(5)	(6)
	Overall	Export Status	Overall	Export Status	Overall	Export Status
Log raw material	-0.0194	0.0384	-0.324	-0.248	0.192	0.234
	(0.231)	(0.217)	(0.335)	(0.327)	(0.258)	(0.243)
Log energy cost share	-0.514**		-0.133***		-0.831***	
	(0.219)		(0.030)		(0.230)	
Non-Exporting: log energy cost share		-0.399*		-0.0448		-0.703***
		(0.207)		(0.287)		(0.229)
Exporting: log energy cost share		-0.857***		-0.570*		-1.087***
		(0.212)		(0.304)		(0.235)
Log total capital employed	-0.0293	-0.0468	0.0607	0.00559	-0.123	-0.115
	(0.0648)	(0.0612)	(0.0847)	(0.0873)	(0.0912)	(0.0863)
Log the number of workers	0.262***	0.238***	0.234**	0.210**	0.257**	0.239**
	(0.0866)	(0.0830)	(0.109)	(0.103)	(0.120)	(0.117)
Firm age 21 to 30 years	-0.493	-0.593	-0.0993	-0.249	-0.600	-0.681
	(0.441)	(0.432)	(0.186)	(0.216)	(0.582)	(0.571)
Firm age 31 to 40 years	-0.291	-0.440	0.0823	-0.121	-0.361	-0.485
	(0.442)	(0.436)	(0.208)	(0.238)	(0.578)	(0.570)
Firm age 41 to 50 years	-0.192	-0.387	0.217	-0.0615	-0.296	-0.448
	(0.454)	(0.446)	(0.321)	(0.315)	(0.587)	(0.581)
Firm age above 50 years	0.0576	-0.178	0.540	0.238	-0.197	-0.400
	(0.478)	(0.471)	(0.404)	(0.397)	(0.600)	(0.597)
Constant	9.474***	8.877***	8.044***	7.895***	10.40***	9.640***
	(0.769)	(0.686)	(1.099)	(1.044)	(1.080)	(0.929)
Observations	2,332	2,332	823	823	1,509	1,509
Number of firms	335	335	119	119	216	216
Note: Hausman test suggest Fixed Effect Model						

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

Dependent Variable: Log investment (capital employed)	Full Sample		Textile Sector		Other Sectors	
	(1)	(2)	(3)	(4)	(5)	(6)
	Overall	Export Status	Overall	Overall	Export Status	Other
Log sale	-0.0292	-0.0374	0.00890	-0.0176	-0.0706	-0.0675
	(0.0302)	(0.0301)	(0.0373)	(0.0418)	(0.0462)	(0.0452)
Log raw material cost share	-0.955***	-0.944***	-1.305***	-1.258***	-0.649***	-0.652***
	(0.136)	(0.132)	(0.156)	(0.172)	(0.131)	(0.132)
Log wage/salary cost share	0.280	0.282	0.595**	0.602**	0.0472	0.0450
	(0.179)	(0.177)	(0.288)	(0.277)	(0.202)	(0.206)
Log energy cost share	-0.326**		-0.299		-0.418**	
	(0.143)		(0.252)		(0.173)	
Non-Exporting: log energy cost		-0.310**		-0.266		-0.427**
		(0.136)		(0.233)		(0.166)
Exporting: log energy cost		-0.392**		-0.499*		-0.392*
		(0.172)		(0.293)		(0.213)
Firm age 21 to 30 years	0.123	0.102	-0.101	-0.167	0.190	0.198
	(0.124)	(0.118)	(0.144)	(0.136)	(0.162)	(0.157)
Firm age 31 to 40 years	0.152	0.123	-0.0482	-0.134	0.178	0.190
	(0.131)	(0.126)	(0.157)	(0.154)	(0.173)	(0.166)
Firm age 41 to 50 years	0.148	0.112	0.0325	-0.0838	0.138	0.152
	(0.136)	(0.132)	(0.174)	(0.174)	(0.173)	(0.168)
Firm age above 50 years	0.160	0.119	0.0438	-0.0745	0.117	0.136
	(0.148)	(0.146)	(0.198)	(0.201)	(0.181)	(0.174)
Constant	6.716***	6.655***	6.233***	6.212***	7.194***	7.232***
	(0.381)	(0.381)	(0.643)	(0.631)	(0.436)	(0.458)
Observations	2,337	2,337	828	828	1,509	1,509
Number of firms	335	335	119	119	216	216
Note: Hausman test suggest Fixed Effect Model						

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

Dependent Variable: Number of Employed	Full Sample		Textile Sector		Other Sectors	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Overall	Export Status	Overall	Export Status	Overall	Export Status
Log sale	127.1***	100.4***	222.1***	132.7***	71.11***	65.97***
	(26.39)	(22.85)	(54.04)	(39.46)	(17.31)	(17.82)
Log raw material cost share	-296.2**	-272.3**	-753.2**	-641.0*	-23.73	-20.63
	(142.3)	(135.8)	(356.5)	(334.5)	(71.39)	(68.59)
Log energy cost share	-135.65*		-229.5**		-121.2*	
	(20.18)		(118.9)		(72.35)	
Non-Exporting: log energy cost		-164.81*		-247.6		-109.1
		(35.9)		(210.3)		(76.44)
Exporting: log energy cost		-149.75*		-241.39**		-140.3**
		(27.17)		(102.9)		(68.75)
Log total capital employed	-57.06*	-62.06**	-89.30	-112.5*	-43.54*	-43.35**
	(31.34)	(29.22)	(80.75)	(67.99)	(22.63)	(21.92)
Firm age 21 to 30 years	-85.16	-136.8**	-330.3**	-382.3***	-31.13	-46.19
	(59.48)	(55.33)	(139.9)	(136.6)	(34.93)	(38.06)
Firm age 31 to 40 years	-106.6	-160.5**	-389.5**	-418.4***	-50.81	-69.09
	(70.84)	(68.41)	(157.3)	(152.2)	(48.93)	(53.89)
Firm age 41 to 50 years	-109.7	-168.1**	-267.7	-285.7	-41.65	-61.84
	(82.09)	(81.16)	(195.2)	(182.5)	(57.91)	(65.49)
Firm age above 50 years	-151.4	-211.5*	-422.4*	-381.0	20.29	-5.959
	(115.8)	(115.6)	(252.7)	(237.6)	(90.15)	(99.44)
Constant	-2,044***	-1,729***	-3,849***	-2,572**	-968.5***	-931.6***
	(590.9)	(544.8)	(1,339)	(1,126)	(344.2)	(340.6)
Observations	2,332	2,332	823	823	1,509	1,509
Number of firms	335	335	119	119	216	216
Note: Hausman test suggest Fixed Effect Model						

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

Dependent Variable: Number Employed	**Food**	**Cement**	**Chemical**	**Petroleum**	**Electronic**	**Other Manufacturing**
	(1)	(2)	(3)	(4)	(5)	(6)
Log sale	56.94	152.5	172.3*	186.0***	-46.66	-1.660
	(35.65)	(90.69)	(99.19)	(53.97)	(50.81)	(50.02)
Log energy cost	-93.52**	-1,417	-88.60*	-152.8	-276.2	-43.25*
	(40.54)	(2,238)	(45.10)	(192.7)	(307.1)	(22.69)
Log raw material	86.07	370.3	15.51	-91.03	380.7	-321.2
	(86.53)	(1,515)	(96.50)	(184.1)	(417.0)	(276.1)
Log total capital employed	5.870	-510.6	-36.36	-43.29	56.01	-146.5
	(21.68)	(385.5)	(33.12)	(41.75)	(67.89)	(146.5)
21 to 30 years old firm	-173.4*		-74.70	0.0351		-101.2
	(93.20)		(77.49)	(33.04)		(67.28)
31 to 40 years old firm	-199.4**	155.8	-99.93	-322.1***		-101.7
	(75.68)	(388.6)	(115.2)	(46.91)		(96.26)
41 to 50 years old firm	-180.4***	-67.18	-105.5			29.79
	(53.23)	(461.4)	(136.3)			(181.2)
Above 50 years old firm			-417.8***			
			(146.3)			
Constant	-213.2	-3,184	-1,839	-1,367	1,226	84.47
	(459.5)	(3,628)	(1,279)	(837.9)	(794.9)	(1,148)
Observations	329	112	294	68	42	280
Number of firms	47	16	42	10	6	40
Note: Hausman test suggest Fixed Effect Model						

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

Dependent Variable: Number Employed	**Food**	**Cement**	**Chemical**	**Petroleum**	**Electronic**	**Other Manufacturing**
	(1)	(2)	(3)	(4)	(5)	(6)
Log sale	53.38**	132.2**	116.7	222.6**	21.82	3.780
	(24.72)	(59.07)	(93.82)	(75.81)	(24.12)	(51.86)
Log raw material cost	105.0*	503.8	3.415	-80.95	141.5	-211.3**
	(56.04)	(1,642)	(75.52)	(175.0)	(169.2)	(130.1)
Non-exporting: log energy cost	-78.70**	-1,229	-56.13	-140.5	-136.8	-17.10*
	(34.12)	(1,962)	(85.36)	(179.8)	(152.6)	(10.0)
Exporting log energy cost	-132.8**	-1,513	-216.0**	-231.7	321.8	-298.5*
	(66.07)	(2,331)	(109.0)	(209.1)	(380.7)	(152.6)
Log total capital employed	13.26	-419.6	-49.34	-32.53	4.382	-116.9
	(22.32)	(305.6)	(31.82)	(38.29)	(38.73)	(151.2)
21 to 30 years old firm	-168.6*		-162.4	-7.902		-239.6*
	(91.80)		(102.4)	(31.91)		(137.7)
31 to 40 years old firm	-194.6**	143.7	-204.5	-308.9***		-275.0*
	(77.52)	(414.6)	(140.2)	(50.82)		(150.9)
41 to 50 years old firm	-171.6***	-90.02	-210.7			38.89
	(55.70)	(501.3)	(170.0)			(177.0)
Above 50 years old firm			-536.4***			
			(184.2)			
Constant	-354.7	-3,701	-1,444	-1,636*	3,929	-814.5
	(522.3)	(4,586)	(1,213)	(888.0)	(3,011)	(1,207)
Observations	329	112	294	68	42	280
Number of firms	47	16	42	10	6	40
Note: Hausman test suggest Fixed Effect Model						

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

Dependent Variable: Log Investment	**Food**	**Cement**	**Chemical**	**Petroleum**	**Electronic**	**Other Manufacturing**
	(1)	(2)	(3)	(4)	(5)	(6)
Log sale	-0.0227	-0.374**	-0.271**	-0.213	-0.0564	-0.149**
	(0.0450)	(0.158)	(0.122)	(0.196)	(0.102)	(0.0716)
Log energy cost	-0.0556***	-0.235	-0.215***	-0.413*	-0.761	-0.093***
	(0.0125)	(1.009)	(0.040)	(0.237)	(1.351)	(0.012)
Log raw material cost	-1.470***	-0.186	-0.220*	-0.445	-0.384	-0.870***
	(0.459)	(0.442)	(0.120)	(0.331)	(0.620)	(0.203)
Log wag cost	0.445	-1.126	-0.715*	-0.260	-1.589	-0.0986
	(0.423)	(0.923)	(0.390)	(0.505)	(1.221)	(0.171)
21 to 30 years old firm	0.449**		0.557*	-0.0637		0.256***
	(0.211)		(0.304)	(0.0542)		(0.0598)
31 to 40 years old firm	0.245	-0.105	0.585*	-0.00499		0.394***
	(0.184)	(0.0903)	(0.330)	(0.0394)		(0.105)
41 to 50 years old firm	0.0806	-0.166	0.671*			0.0234
	(0.0718)	(0.134)	(0.349)			(0.0377)
Above 50 years old firm			0.621*			
			(0.351)			
Constant	5.969***	7.618***	8.716***	8.816**	5.930***	8.172***
	(0.756)	(0.907)	(1.114)	(3.628)	(0.709)	(0.795)
Observations	329	112	294	68	42	280
Number of firms	47	16	42	10	6	40
Note: Hausman test suggest Fixed Effect Model						

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

Dependent Variable: Log Investment	**Food**	**Cement**	**Chemical**	**Petroleum**	**Electronic**	**Other Manufacturing**
	(1)	(2)	(3)	(4)	(5)	(6)
Log sale	-0.00442	-0.210**	-0.322**	-0.308	-0.0374	-0.148**
	(0.0550)	(0.0721)	(0.150)	(0.185)	(0.100)	(0.0722)
Log raw material	-1.406***	-0.491	-0.219*	-0.538	-0.549	-0.882***
	(0.459)	(0.658)	(0.121)	(0.334)	(0.623)	(0.203)
Log wag cost	0.268	-1.014	-0.745*	-0.140	-1.480	-0.117
	(0.426)	(0.932)	(0.419)	(0.510)	(1.238)	(0.171)
Non-exporting: log energy cost	-0.108**	-0.586	-0.153	-0.412*	-0.794	-0.105***
	(0.014)	(1.078)	(0.429)	(0.224)	(1.371)	(0.012)
Exporting log energy cost	-0.227*	-0.269	-0.302	-0.632**	-1.098	-0.0162***
	(0.128)	(1.157)	(0.490)	(0.323)	(1.406)	(0.009)
21 to 30 years old firm	0.389*		0.465	-0.0399		0.292***
	(0.220)		(0.282)	(0.0322)		(0.101)
31 to 40 years old firm	0.200	-0.0402	0.479	-0.0261		0.440***
	(0.186)	(0.0236)	(0.327)	(0.0267)		(0.136)
41 to 50 years old firm	0.0214	-0.0547	0.565			0.0205
	(0.0674)	(0.0441)	(0.350)			(0.0362)
Above 50 years old firm			0.501			
			(0.359)			
Constant	6.585***	7.057***	8.986***	9.410**	7.510***	8.358***
	(0.775)	(1.153)	(1.133)	(3.385)	(0.444)	(0.820)
Observations	329	112	294	68	42	280
Number of firms	47	16	42	10	6	40
Note: Hausman test suggest Fixed Effect Model						

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

Dependent Variable: Log of Revenue	**Food**	**Cement**	**Chemical**	**Petroleum**	**Electronic**	**Other Manufacturing**
	(1)	(2)	(3)	(4)	(5)	(6)
Log energy cost	-0.0167**	-1.231**	-0.476**	-0.678**	-3.944**	-0.760**
	(0.005)	(0.612)	(0.179)	(0.242)	(1.044)	(0.370)
Log raw material cost	-0.563*	-0.256	-0.142	-0.0153	2.856**	-0.391
	(0.306)	(0.798)	(0.150)	(0.273)	(0.946)	(0.522)
Log total capital employed	-0.0942	-0.760***	-0.179*	-0.262	-0.581	-0.563*
	(0.129)	(0.154)	(0.0985)	(0.251)	(1.416)	(0.292)
Log the number of employees	0.141	0.198	0.158	0.972***	-0.435	0.268***
	(0.359)	(0.134)	(0.134)	(0.292)	(0.331)	(0.0907)
21 to 30 years old firm	-0.447		0.300	-0.0794		0.152*
	(0.430)		(0.227)	(0.0457)		(0.0884)
31 to 40 years old firm	-0.0615	-0.0601	0.420	-0.104		0.374*
	(0.362)	(0.0878)	(0.281)	(0.0606)		(0.197)
41 to 50 years old firm	0.00466	0.0343	0.620*			-0.160***
	(0.210)	(0.211)	(0.315)			(0.0590)
Above 50 years old firm			0.734**			
			(0.359)			
Constant	11.54***	13.16***	11.34***	9.382**	15.19	12.14***
	(3.353)	(1.223)	(0.992)	(2.924)	(12.87)	(2.234)
Observations	329	112	294	68	42	280
Number of firms	47	16	42	10	6	40
Note: Hausman test suggest Fixed Effect Model						

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

Dependent Variable: Log of Revenue	**Food**	**Cement**	**Chemical**	**Petroleum**	**Electronic**	**Other Manufacturing**
	(1)	(2)	(3)	(4)	(5)	(6)
Log raw material cost	-0.384	0.0512	-0.144	-0.0971	3.211**	-0.385
	(0.283)	(0.881)	(0.160)	(0.159)	(0.917)	(0.518)
Non-exporting: log energy cost	0.145	-0.798*	-0.379**	-0.380***	-4.034***	-0.756*
	(0.403)	(0.403)	(0.170)	(0.115)	(0.917)	(0.374)
Exporting log energy cost	-0.320*	-1.390**	-0.777***	-1.090***	-4.936**	-0.773**
	(0.186)	(0.644)	(0.186)	(0.138)	(1.253)	(0.375)
Log total capital employed	-0.0278	-0.534***	-0.205**	-0.263	-0.436	-0.562*
	(0.145)	(0.170)	(0.0974)	(0.152)	(1.366)	(0.292)
Log the number of employees	0.142	0.196	0.0260	0.773**	-0.393	0.268***
	(0.336)	(0.120)	(0.102)	(0.295)	(0.358)	(0.0907)
21 to 30 years old firm	-0.390		0.0265	0.000174		0.144
	(0.400)		(0.162)	(0.0403)		(0.106)
31 to 40 years old firm	-0.0166	-0.0835	0.0813	-0.161**		0.365*
	(0.331)	(0.120)	(0.184)	(0.0642)		(0.205)
41 to 50 years old firm	0.0810	-0.0146	0.252			-0.160**
	(0.192)	(0.228)	(0.205)			(0.0596)
Above 50 years old firm			0.282			
			(0.208)			
Constant	9.949***	11.47***	11.29***	8.203***	8.923	12.09***
	(2.761)	(1.448)	(0.914)	(2.361)	(14.00)	(2.244)
Observations	329	112	294	68	42	280
Number of new	47	16	42	10	6	40
Note: Hausman test suggest Fixed Effect Model						

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

Appendix C3. Detailed Estimation Results_ All Firms, Regional Classification

Dependent Variable: Log of Investment	**Punjab**	**Punjab**	**Sindh**	**Sindh**
	(1)	(2)	(3)	(4)
Log raw material cost	-1.714***	-1.698***	-0.816***	-0.812***
	(0.294)	(0.289)	(0.155)	(0.153)
Log sale	-0.0752	-0.0811	-0.00225	-0.00609
	(0.0569)	(0.0562)	(0.0337)	(0.0332)
Log energy cost	-0.426*		-0.268	
	(0.248)		(0.195)	
Non-Exporting: log energy cost		-0.407*		-0.260
		(0.237)		(0.188)
Exporting: log energy cost		-0.486*		-0.295
		(0.279)		(0.228)
Log wag	1.024**	1.027**	0.151	0.150
	(0.407)	(0.404)	(0.211)	(0.208)
21-30 years old firm	0.157	0.145	0.0822	0.0674
	(0.165)	(0.159)	(0.129)	(0.123)
31-40 years old firm	0.194	0.176	0.106	0.0870
	(0.176)	(0.172)	(0.142)	(0.135)
41-50 years old firm	0.193	0.170	0.0795	0.0569
	(0.179)	(0.174)	(0.140)	(0.141)
Above 50 years old firm age	0.293	0.260	0.0455	0.0224
21-30 years old firm	(0.214)	(0.209)	(0.149)	(0.156)
Constant	6.464***	6.418***	6.948***	6.917***
	(0.621)	(0.620)	(0.397)	(0.394)
Observations	1,159	1,159	1,136	1,136
Number of firms	167	167	163	163
Note: Hausman test suggest Fixed Effect Model				

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

Dependent Variable: Log Employment	**Punjab**	**Punjab**	**Sindh**	**Sindh**
	(1)	(2)	(3)	(4)
Log sale	0.175**	0.166**	0.222***	0.206***
	(0.0791)	(0.0792)	(0.0521)	(0.0532)
Log Raw Material Cost	0.0684**	0.0498	0.0947***	0.0810**
	(0.0284)	(0.0306)	(0.0333)	(0.0371)
Log energy cost share	-0.104**		-0.0863	
	(0.53)		(0.0968)	
Non-exporting: log energy share		-0.0871		-0.0896
		(0.104)		(0.0946)
Exporting: log energy share		-0.166**		-0.150*
		(0.78)		(0.800)
Log total capital employed	-0.00952	-0.0270	-0.0157	-0.0360
	(0.0638)	(0.0630)	(0.0756)	(0.0734)
21-30 years firm age	-0.257***	-0.273***	-0.0788	-0.147
	(0.0880)	(0.0894)	(0.0914)	(0.117)
31-40 years firm age	-0.451***	-0.469***	-0.142	-0.212*
	(0.112)	(0.113)	(0.0974)	(0.119)
41-50 years firm age	-0.352***	-0.379***	-0.265**	-0.333**
	(0.131)	(0.132)	(0.127)	(0.145)
Above 50 years firm age	-0.433***	-0.469***	-0.294**	-0.359**
	(0.163)	(0.164)	(0.135)	(0.154)
Constant	2.150***	2.483***	0.757	1.183
	(0.716)	(0.740)	(0.709)	(0.802)
Observations	1,154	1,154	1,136	1,136
Number of firms	167	167	163	163
Note: Hausman test suggest Fixed Effect Model				

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

Dependent Variable: Log of Total Revenue	**Punjab**	**Punjab**	**Sindh**	**Sindh**
	(1)	(2)	(3)	(4)
Log energy share	-0.649**		-0.477*	
	(0.295)		(0.281)	
Non-Exporting: log energy share		-0.613**		-0.393
		(0.292)		(0.267)
Exporting: log energy share		-0.687**		-0.567**
		(0.286)		(0.266)
Log raw material	-0.230	-0.201	0.0292	0.0287
	(0.340)	(0.329)	(0.279)	(0.269)
Log Total capital employed	-0.108	-0.108	0.103	0.0828
	(0.0801)	(0.0785)	(0.104)	(0.100)
Log No of employees	0.321***	0.297***	0.384***	0.321***
	(0.111)	(0.112)	(0.0872)	(0.0848)
21-30 years old firm	-0.0689	-0.0944	-1.219*	-1.363*
	(0.0786)	(0.0802)	(0.730)	(0.765)
31-40 years old firm	0.0965	0.0672	-1.059	-1.214*
	(0.102)	(0.102)	(0.695)	(0.735)
41-50 years old firm	0.0520	0.0188	-0.961	-1.117
	(0.159)	(0.159)	(0.677)	(0.717)
51 and above years old firm	-0.0367	-0.0815	-0.584	-0.732
	(0.210)	(0.213)	(0.657)	(0.697)
Constant	7.220***	7.490***	8.257***	8.811***
	(0.846)	(0.867)	(0.998)	(1.021)
Observations	1,154	1,154	1,136	1,136
Number of firms	167	167	163	163
Note: Hausman test suggest Fixed Effect Model				

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

Appendix C4. Detailed Estimation Results_ Textile Firms, Regional Classification

Dependent Variable: Number of Employed Worker			
Exogenous Variables	**Coeff.**	**S.E.**	**P-value**
Log Output	487.87***	136.33	0.000
Log R	78.742*	46.25	0.090
Log Wage	-210.59***	73.65	0.005
Log RM	103.55	94.08	0.272
Log Energy Cost			
Punjab	-312.075***	31.42	0.000
Sindh	-70.49**	32.28	0.041
_cons	-8394.53	2040.95	0.000
Note: Hausman test suggests Fixed Effect Model			

*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable: Log of Investment			
Exogenous Variables	**Coeff.**	**S.E.**	**P-value**
Log Output	0.928215	0.258804	0.000
Log Labor Prod.	-0.41307	0.200639	0.040
Log Wage	0.157014	0.122478	0.200
Log R	-0.42679	0.144751	0.003
Log RM	0.190509	0.201141	0.344
Log Energy Cost			
Punjab	-0.18297	0.11090	0.090
Sindh	-0.037974	0.058903	0.014
_cons	-4.62713	3.510898	0.188
Note: Hausman test suggest Random Effect Model			

Dependent Variable: Log of Export (Punjab Firms)			
Exogenous Variables	**Coeff.**	**S. E.**	**P-value**
Log Labor Prod.	0.005	0.13	0.96
Log Capital Prod.	-0.16	0.05	0.00
Log Investment	1.03	006	0.00
Log RM	-0.30	0.24	0.21
Log of Energy Cost _Punjab	-0.23	0.06	0.00
_cons	0.033	1.52	0.98
Note: Hausman test suggest Random Effect Model			

Dependent Variable: Log of Export (Sindh Firms)			
Exogenous Variables	**Coeff.**	**S. E.**	**P-value**
Log Labor Prod.	0.76	0.24	0.00
Log Capital Prod.	0.65	0.24	0.00
Log Investment	0.99	0.05	0.00
Log RM	-0.53	0.22	0.02
Log of Energy Cost _Sindh	-0.16	0.06	0.01
_cons	-3.77	1.25	0.00
Note: Hausman test suggest Random Effect Model			

Dependent Variable: Log of Domestic Sales Revenue (Punjab Firms)			
Exogenous Variables	**Coeff.**	**S. E.**	**P-value**
Log Labor Prod.	0.03	0.09	0.73
Log Investment	1.09	0.07	0.00
Log RM	-0.09	0.04	0.02
Log of Energy Cost _Punjab	-0.09	0.03	0.00
_cons	-2.26	1.11	0.04
Note: Hausman test suggest Fixed Effect Model			

Dependent Variable: Log of Domestic Sales Revenue (Sindh Firms)			
Exogenous Variables	**Coeff.**	**S. E.**	**P-value**
Log Labor Prod.	-0.12	0.22	0.59
Log Investment	0.11	0.09	0.23
Log RM	0.64	0.24	0.01
Log of Energy Cost_ Sindh	-0.04	0.08	0.61
_cons	16.74	2.81	0.00
Note: Hausman test suggest Fixed Effect Model			

Dependent Variable : Profits/ Loss (PKR Million) Punjab			
Exogenous Variables	**Coeff.**	**S. E.**	**P-Value**
Log Labor Prod.	-279532.9	177111.1	0.11
Log Labor Employ.	-550061.6	213688.2	0.01
Log Investment	597446.5	219058.7	0.01
Log of Energy Cost_ Punjab	-27113.4	14509.7	0.06
_cons	-7182941	218895.0	0.00
Note: Hausman test suggest Fixed Effect Model			

Dependent Variable: Profits/ Loss (PKR Million) Sindh			
Exogenous Variables	**Coeff.**	**S. E.**	**P-Value**
Log Labor Prod.	4575.18	2597.21	0.08
Log Labor Employ.	1271.16	1277.28	0.32
Log Investment	-779.44	1218.46	0.52
Log of Energy Cost_ Sindh	709.43	379.13	0.07
_cons	-26444.02	28472.7	0.36
Note: Hausman test suggest Fixed Effect Model			

Appendix C5. Estimation Results_ Macro-level Data

Fully Modified OLS			
	Textile Exports	Other Manufacturing Exports	Total Exports
Log Energy Tariff	-0.503***	-0.371**	-0.244*
	(0.122)	(0.185)	(0.129)
Interaction of Time Dummy and Energy Tariff	0.767***	0.533**	0.355**
	(0.150)	(0.227)	(0.158)
Log Trade Restrictions (Import Duties)	-0.0212	-0.117	-0.398***
	(0.0644)	(0.0972)	(0.0676)
Log World Real GDP	2.963***	2.267***	2.262***
	(0.260)	(0.392)	(0.273)
Log REER	-0.404**	-0.0386	-0.115
	(0.179)	(0.270)	(0.188)
Log Relative Export Price	-0.412***	-0.0677	-0.0339
	(0.101)	(0.153)	(0.107)
Time Dummy (2018 to 2022=1, otherwise 0)	-2.268***	-1.723***	-1.157***
	(0.413)	(0.624)	(0.434)
Constant	-77.97***	-55.37***	-54.18***
	(8.367)	(12.63)	(8.792)
Observations	19	19	19

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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