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Cotton as the Cornerstone: Analyzing Its Impact on Home Textile Production in Pakistan

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Abstract
The textile industry of Pakistan is among the most significant economic sectors with respect to employment and exporting earnings. It primarily depends on home textiles, with cotton as a core raw material. This research uses the time series data from 2003 through 2023 to apply an Ordinary Least Squares regression framework for estimating the impact of domestic cotton production, cotton imports, and electricity consumption together to shape export performance. As a result, a 1% increment in the production of cotton within the country is reflected by 26.4% growth in home textile exports; it is indeed the very foundation on which industrial output is sustained. Cotton imports complement the domestic supply to fill in shortfall during the time of production shortfall. Above all, electricity consumption tops the heels as the most important factor that reliable and affordable electricity translates into productivity increases and decreases in production costs. Diagnostic tests (multicollinearity, autocorrelation, heteroskedasticity) affirm the model's statistical validity, reinforcing the robustness of these findings. This study strongly highlights the need for policies promoting agricultural innovation, including new high-yielding varieties of cotton and precision farming aimed at increasing domestic production. Concurrently, strategic import policies and investments in energy infrastructure would be critical to alleviating supply chain vulnerabilities and mitigating power shortages. By establishing the empirical links between cotton viability and energy reliability on export competitiveness, this study offers operational lessons to policymakers on how to strengthen a sector critical for Pakistan's economic future. This line of inquiry can be pursued further in future research through firm-level investigations, explorations of synthetic substitutes to cotton, or assessments into trade policy effectiveness, all of which would enhance pathways to strengthening the international competitiveness of the sector.

Keywords: Cotton Production, Home Textile Exports, Pakistan Textile Industry, Export-Led Growth.

JEL: L67, Q13, F14, O13, C22

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Introduction

Home textiles make a significant contribution in terms of employment generation, export earnings, and industrial development in Pakistan. The main categories of home textiles bath linen, bed linen, and upholstery have a dual function in the domestic and foreign markets. Since Pakistan is one of the biggest exporters in the world, it reaps the benefits of having abundant domestic cotton and cheap labor. While there are opportunities and challenges for home textiles in the post-COVID era and with the growth of e-commerce, it will have to adapt to stringent international standards and trade dynamics at a rapid pace. In Pakistan, the home textile industry grown with the availability of domestic cotton and the rise of e-commerce serves major global markets like the USA and Europe. It offers immense potential for growth but also faces challenges regarding quality compliance, technology acceptance, and ever-changing consumer behaviour. This study thus intends to look into the chief dynamics affecting home textile exports by using available information.

Table 1: HOME TEXTILE HS CODE:

6301	**Blankets and travelling rugs of all types of textile materials (excluding table covers, bedspreads and articles of bedding and similar furnishing of heading 9404)**
630 2	**Bed linen, table linen, toilet linen and kitchen linen of all types of textile materials (excluding floor cloths, polishing cloths, dishcloths and dusters)**
630 3	**Curtains, incl. drapes, and interior blinds; curtain or bed valances of all types of textile materials (excluding awnings and sun blinds)**
630 4	**Articles for interior furnishing, of all types of textile materials (excluding blankets and travelling rugs, bed linen, table linen, toilet linen, kitchen linen, curtains, incl. drapes, interior blinds, curtain or bed valances, lampshades and articles of heading 9404)**

Home textiles play a significant role in the life of mankind and include different products such as bedspreads and covers, towels, upholstery, curtains, and so on. All these products have a potential market such as North America, Europe, and Asia-Pacific. Pakistan, along with China and India, plays an important role in the export of these goods, which is facilitated by cheap labor and raw cotton. The large production centres for home textiles include Karachi, Lahore, Faisalabad, and Multan, which add a significant amount to national exports as well.

Table 2: **Pakistan Home Textile Exports**

Year	**Unit (000)$**
2003	2,013,906
2004	1,988,969
2005	2,721,236
2006	2,892,085
2007	2,764,380
2008	2,719,100

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2009	2,560,099
2010	2,836,031
2011	3,039,536
2012	2,712,055
2013	3,071,853
2014	3,251,618
2015	3,136,096
2016	3,178,674
2017	3,331,578
2018	3,434,191
2019	3,425,504
2020	3,439,573
2021	4,505,733
2022	4,589,006
2023	4,051,805
Source: Authors own estimation	

The home textile industry relies on an enormous global supply chain for products, information, and finances, where logistics are of utmost importance. In Pakistan, the vertically integrated value chain from raw cotton to finished goods is confronted with issues like outmoded technology, energy costs, low cotton yields, limited innovation, and inefficient supply systems, hindering its competitiveness and export performance.

Problem Statement

Considering cotton's acknowledged importance in the domestic textile industry, there are few thorough studies that particularly examine its direct influence on manufacturing efficiency and quality. Previous research has mostly concentrated on export demand and economic growth connections, ignoring the granular impact of cotton as a raw material. This study seeks to close this gap by conducting a thorough examination of how cotton influences manufacturing methods and product quality in the home textile industry.

Research Objectives

1. Examine the current cotton industry status and how it affects the quality of home textiles.
2. To assess the barriers that impede the home textile industry in the acquisition and use of cotton products.
3. Formulate measures to enhance home textile production through a more efficient utilization of cotton.

Research Questions

1. How has cotton production affected home textile quality over the ages?
2. What problems confront the home textile industry in terms of cotton acquisition and its application?
3. What measures can be given concerning the enhancement of cotton use in home textiles?

Hypothesis

Null Hypothesis

The use of cotton has no significant impact on the production of home textiles.

Alternative Hypothesis

The use of cotton significantly impacts the production of home textiles.

Significance of the study

This research aims at shedding light on the inter-linkage between cotton growing and home textiles. It would expand the existing literature on textile production by adding the insights obtained from the previous studies on export demand and growth of economy. "It is very important to understand the factors that determine export demand so as to formulate the right policies of enhancing the performance of the sector." (Malik, 2020). The findings will offer practical recommendation for industry stakeholders and inform policy decisions on sustainable cotton sourcing and utilization.

Scope and Limitation

The research particularly examines the influence cotton has on the supply of home textiles emphasizing the past and the present form of production processes. The research will be focused only on selected case studies of the home textile industry, and therefore its results cannot be applied to other branches of textiles. Also, the data constraints as well as the size of the study may define how numerous the results are.

Literature Review

The cotton industry has been studied and analyzed from different angles for its particular role in home textile production. zhan-Smith (2000) challenges the very universality of those approved export-led growth models, thus emphasizing that more stable internal foundations with dependable supply chains of cotton are preferred. Herrerías and Orts (2010) complement his findings by showing that China's economic growth conjugates export performance in domestic investments and institutional reforms. Chaudhary and Shahid (2012) document cotton's predominance in home textiles in India because of its high breathability and durability, whereas Siddiqi et al. (2012) and Bashir et al. (2015) highlight its key position in the Pakistani export-oriented home textile industry.

The paradox of Pakistan being a major cotton producer that largely exports low-value commodities is noted by Hussain (2013), who recommends that the country pursue high-value development. Samuel and Basavaraj (2013) provide an analysis of quality consistency issues in cotton exports from India and call for a stable trade policy in this regard. Ondogan et al. (2005) show that cotton textiles' functionality can be increased and the harmful effects on the environment decreased through the use of laser technology, while Silva et al. (2015) show that the waste produced in the processing of cotton could be minimized through the implementation of optimized production planning. While Mayinger et al. (2018) look into sustainable local value chains in Sweden's textile industry, Cheraghalikhani et al. (2019) develop advanced tools for managing uncertainties in supply chains.

In their consideration of China's apparel export success, Zhang and Hathcote (2008) focus on competitive pricing and trade conditions, whereas Khan and

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Kalirajan (2011) identify trade costs as critical barriers for developing nations. Ridley and Devadoss (2023) consider Brazil's increasing impact on the global cotton markets, while Masood et al. (2025) quantify the value offered by the Free Trade Agreements, especially the Pakistan-China FTA. Choudhry and Elhorst (2010) describe demographic parameters affecting textile production capacity, while Mehar (2022) highlights the profitability gains from value-addition strategies, and Chen et al. (2023) apply gravity models to analyze macroeconomic impacts on cotton trade.
Zaheer et al. (2015) suggest possible policy enhancement for cotton productivity, while Ali and Li (2017) recommend sustainable supply chain development. According to Tahir (2020), the post-pandemic possibility is quality standards and product diversification. Tsen (2010) investigates the dynamics between the export and domestic demand in China's growth, with Malik (2010) detailing cotton's preeminence in Pakistan's textile sector. Latif and Javid (2016) analyzed the demand-supply determinants of Pakistan's textile exports, while Palanisingh et al. (2017) dealt with export quality issues of Indian cotton. Iqbal et al. (2012) find support for the export-led growth hypothesis for Pakistan and conclude a broad frame of cotton's manifold impact on home textile production in the quality, technology, trade, and sustainability dimensions.

Research Methodology
The current study utilizes secondary data from the year 1971 till 2023. Furthermore, data is retrieved from Economic Surveys of Pakistan, World Development Indicator and Federal Bureau of Statistics. The data will be analysed through utilizing simple linear regression model to estimate the impact of cotton on home textile. Data variables will be analysed in percentages, except where noted otherwise. E-Views statistical software will be utilized in order to derive empirical results. Variables that are being taken into account in this analysis includes, home textile exports, cotton imports, cotton production and electric power consumption.

Data Source
Secondary data from the past five years starting from 1971 until 2023. Additional data is collected from: Economic Surveys of Pakistan, World Development Indicators and Federal Bureau of Statistics of Pakistan

Analytical Framework
To estimate the effect of cotton on home textile production, a basic linear regression model will be used. The main model is defined as follows:

$$HTE_t = \beta_0 + \beta_1 CTNP_t + \beta_2 MCT_t + \beta_3 ELE_t \in_t$$

Where:

1. HTE_t is the production output of home textiles for year t
2. $CTNP_t$ represents the cotton used for year t
3. MCT is Cotton Imports
4. ELE represents Electric power consumption (kWh per capita)
5. β_0 is the intercept term
6. β_1 is the coefficient that measures the impact of independent variables
7. ϵ_t is the error term.

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Estimation of Models: Simple linear regression and extended models will be estimated using OLS. The estimates for the coefficients β0, β1, and the extra βs will be provided with the statistical significance by E-Views.

Diagnostic Testing: Post-estimation diagnostics, including tests for autocorrelation, heteroscedasticity, and multicollinearity, will be conducted to validate the model assumptions and ensure the reliability of the results.

Expected Output The principal output of the regression will be the estimated coefficient β1, which represents how the cotton influences home textile production. Positive and statistically significant β1 would mean that an increase in the usage of cotton leads to higher production levels of home textiles. More coefficients will help interpret how other economic and demographic factors influence the production output.

Results and Discussions

By employing OLS regression and various statistical tests, including those on Variance Inflation Factor, Durbin-Watson, Breusch-Godfrey, and Breusch-Pagan-Godfrey, authors study the impact of real cotton production, imports of cotton, and consumption of power on exports of ready-made apparel from Pakistan. Granger causality techniques were also used to explore the relationships existing between the variables, with model validation focusing on the significance and interpretations of the associated coefficients for formulating policy and industry strategies.

Descriptive Statistics

Descriptive Statistics				
	HTE	ELE	CTNP	MCT
Mean	3126811	494.9333	8165.857	927417
Median	3071853	472.9	8540	833234
Maximum	4589006	690	11138	2076591
Minimum	1988969	392.3	3900	318517
Std. Dev.	666169.9	78.43307	1920.984	449064.2
Skewness	0.57384	1.018393	-0.57922	1.151099
Kurtosis	3.298127	3.321193	2.772287	3.916546
Jarque-Bera	1.230293	3.720205	1.219618	5.372649
Probability	0.540562	0.155657	0.543455	0.068131
Sum	65663028	10393.6	171483	19475756
Sum Sq. Dev.	8.88E+12	123034.9	73803589	4.03E+12

Source: Authors own estimation

Mean values: HTE (3,126,811), ELE (494.93), CTNP (8,165.86), MCT (927,417). Skewness values indicate right-tailed distributions for HTE (0.57) and ELE (1.02), left-tailed for CTNP (-0.58). Kurtosis near 3 suggests normal distribution. Jarque-Bera p-values > 0.05 confirm normality.

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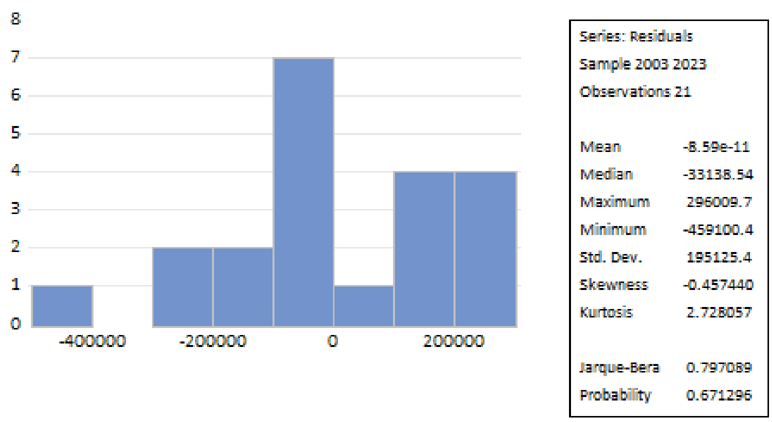
Unit Root Test

Table 3

Unit Root		
	t-Statistic	Prob.*
HTE	-5.33057	0.0005
ELE	-3.22636	0.0342
CTNP	-7.51854	0
MCT	-4.66823	0.0019
Source: Authors own estimation		

All variables stationary ($p < 0.05$): HTE (-5.33, p=0.0005), ELE (-3.23, p=0.034), CTNP (-7.52, p=0.000), MCT (-4.67, p=0.002).

Residual Normality Test



Source: Authors own estimations

Residuals centered around zero (mean=0). Skewness (-0.03) and kurtosis (2.72) near normal. Jarque-Bera p=0.671 confirms normality.

Regression Analysis

Regression Analysis			
Dependent Variable: HTE			
Method: Least Squares			
Variable	Coefficient	Prob.	
CTNP	26.4603	0.0003	
MCT	0.537296	0.0033	
ELE	6162.02	0.000	
C	-637347	0.026	
R-squared	0.914206	**F-statistic**	60.3829
Adjusted R-squared	0.899066	**Prob (F-statistic)**	0.0000

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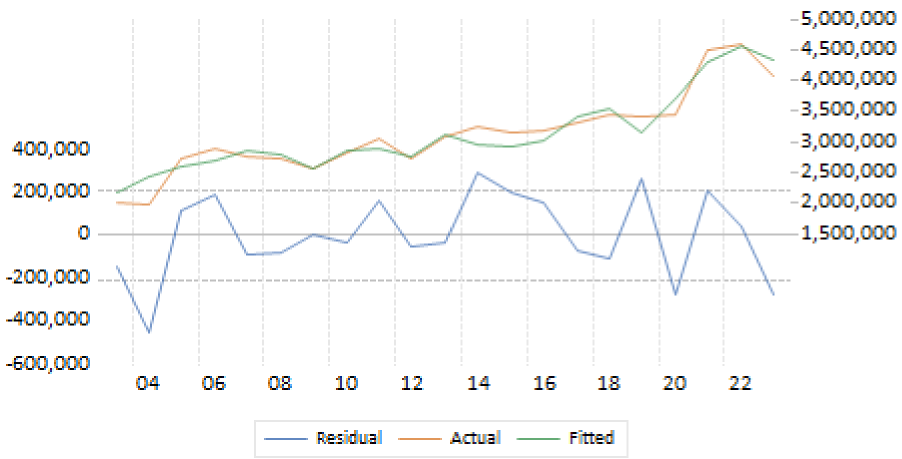
Durbin-Watson stat	2.050929

Source: Authors own estimation

OLS results:

- CTNP: Coeff=26.46 (p=0.0003)
- MCT: Coeff=0.54 (p=0.003)
- ELE: Coeff=6,162.02 (p=0.000)
- C: Coeff=-637,347 (p=0.026)
- R^2=0.914, Adj. R^2=0.899, F-stat=60.38 (p=0.000), Durbin-Watson=2.05

Actual, Fitted, and Residuals Graph



Source: Authors own estimations
Close alignment between actual (orange) and fitted (green) values. Residuals (blue) randomly scattered.

Autocorrelation Test

Table 4

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.089	-0.089	0.1914	0.662
		2	-0.186	-0.195	1.0683	0.586
		3	0.135	0.102	1.5556	0.670
		4	-0.081	-0.100	1.7404	0.783
		5	0.203	0.249	2.9874	0.702
		6	-0.042	-0.070	3.0429	0.803
		7	-0.151	-0.047	3.8309	0.799
		8	0.041	-0.069	3.8945	0.867
		9	-0.076	-0.076	4.1252	0.903
		10	-0.018	-0.066	4.1391	0.941
		11	-0.172	-0.229	5.5718	0.900
		12	-0.229	-0.248	8.3835	0.754

Source: Authors own estimations
All p-values > 0.05. Q-statistic confirms no autocorrelation.

Table-7: Breusch-Godfrey Serial Correlation LM Test:

Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0.435358	Prob. F(2,15)	0.655
Obs*R-squared	1.152124	Prob. Chi-Square(2)	0.5621

Source: Authors own estimations

F-stat=0.44 (p=0.655), Obs*R²=1.15 (p=0.562). No serial correlation

Multicollinearity Check (VIF Test)

Table-8: Variance Inflation Factors			
	Coefficient	Uncentered	Centered
Variable	Variance	VIF	VIF
ELE	925032.8	108.7742	2.540836
CTNP	1447.583	47.63919	2.385131
MCT	0.024778	12.22242	2.231022
C	4.61E+11	215.9802	NA

Source: Authors own estimations

Centered VIFs: ELE (2.54), CTNP (2.39), MCT (2.23). No multicollinearity.

Table-9: Heteroskedasticity Test: Breusch-Pagan-Godfrey			
Null hypothesis: Homoskedasticity			
F-statistic	0.436811	Prob. F(3,17)	0.7295
Obs*R-squared	1.502917	Prob. Chi-Square(3)	0.6816

Source: Authors own estimation

F-stat=0.44 (p=0.730), Obs*R²=1.50 (p=0.682). Homoskedasticity confirmed.

Granger Causality Tests

Table-10: Granger Causality Tests			
Null Hypothesis:	Obs	F-Statistic	Prob.
ELE does not Granger Cause HTE	19	9.58928	0.0024
CTNP does not Granger Cause HTE	19	5.89095	0.0139
CTNP does not Granger Cause MCT		5.25635	0.0198
Source: Authors own estimations			

- ELE→HTE: F=9.59 (p=0.002)
- CTNP→HTE: F=5.89 (p=0.014)

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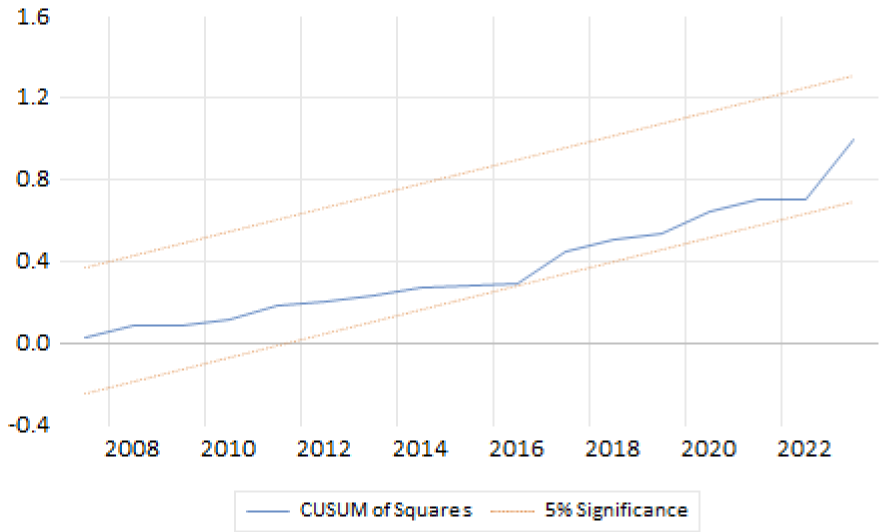
- CTNP→MCT: F=5.26 (p=0.020)

CUSUM of Square Test



Source: Authors own estimation

Test statistic remains within 5% bounds (2006-2022). Sharp increase in 2022 suggests potential structural break.

Conclusion

This section presents the empirical findings of the study, examining the impact of cotton production, cotton imports, and electricity consumption on home textile exports in Pakistan. Using Ordinary Least Squares (OLS) regression analysis, key statistical tests such as multicollinearity (Variance Inflation Factors), autocorrelation (Durbin-Watson and Breusch-Godfrey tests), heteroskedasticity (Breusch-Pagan-Godfrey test), and unit root tests have been conducted to ensure the validity and robustness of the model. Additionally, Granger causality tests were performed to analyze the directional relationships between variables. The results provide valuable insights into how domestic cotton production, import dependency, and energy consumption influence the textile sector's export performance. By evaluating model significance, coefficient interpretations, and statistical diagnostics, this section establishes a data-driven foundation for policy recommendations and industry strategies

Conclusion and Recommendations

This study empirically demonstrates that home-grown cotton is an important driving factor in Pakistan's home textile exports (β=26.46; p<0.001). In addition, cotton imports (β=0.54; p<0.01) and electricity supply (β=6,162; p<0.001) are significant complementary factors. Very rigorous diagnostic tests have validated the validity of the model and confirmed these relationships' statistical reliability.

Key Implications

Agricultural Policy: Cotton yield improvements through advanced farming techniques, use of high-yielding varieties of cotton seeds, and research on and investment in expanding the export capacity of cotton will receive the highest priority.

Trade Policy: Cotton imports must be simplified; however, the trade policies ought to provide a strategic focus on domestic production to fill the gaps on quality/supply.

Energy Infrastructure: The textile sector must be ensured a stable and cost-effective electricity supply through infrastructure enhancements and renewable energy integration.

Industrial Modernization: Improve the global competitiveness of the industry by means of the adoption of sustainable methods of production and quality certification.

Future Research Directions

- Firm-level analysis of production adaptations
- Synthetic fiber substitution potential
- Policy/geopolitical impact assessments

The findings underscore cotton's pivotal role in sustaining Pakistan's textile export advantage, with coordinated action needed across agricultural, industrial and energy sectors to maintain long-term growth. This research provides an empirical foundation for data-driven policymaking in Pakistan's critical textile industry.

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