



## **ITC Mission:**

Established in April 2015, the Innovation and Technology Centre (ITC) at the Lahore School of Economics aims to drive innovation and economic growth in Pakistan through impactful research and policy engagement. Led by Dr. Azam Amjad Chaudhry and Dr. Theresa Thompson Chaudhry, the ITC collaborates with academia, the public sector, businesses, and stakeholders to address key economic and social challenges. Our focus areas include innovation, productivity, manufacturing, exports, and environmental sustainability. Through annual surveys and research projects, we provide valuable insights for evidence-based policymaking. Despite Pakistan's evolving political and economic landscape, the ITC maintains strong connections with policymakers, Chambers of Commerce, and manufacturers, contributing to informed decision-making and sustainable development.

## **2. Projects:**

Following are some of the ongoing projects of the centre:

### **1. ITC, Lahore School of Economics in WTO Chairs Programme**

ITC, Lahore School of Economics was the only institution from Pakistan, among seventeen other universities from least-developed and developing country members, selected as a member of the prestigious WTO's Chairs Programme. The role of the centre, being part of the WTO Chair Programme, would be to enhance knowledge and understanding of the international trading system among academics and policy makers in the country.

The objectives of the WTO Chair at the Lahore School of the Economics are threefold: First, to further the understanding of trade related issues (including trade theory, implications of restrictions on trade, the role of international bodies like the WTO, etc.) amongst students, the business community, policy makers and other stakeholders. Second, to conduct timely, relevant, and broadly inclusive research on trade related issues which is not only of the highest academic quality but is also relevant to stakeholders. Third, to disseminate the findings of its activities (both research and stakeholder consultations) to a broader audience through an effective dissemination campaign.

### **2. Innovation in the Pakistani Textile Sector**

#### **Abstract**

The project has been developed under the *International Growth Centre (IGC)*. Innovation and competitiveness are considered to be the backbone of private sector led economic growth and its sustainability. However, in Pakistan, very little is known about the nature and the extent of innovation as well as its determinants and obstacles. In the absence of such evidence, policies can be misdirected and ineffective. In this project, the researchers surveyed a sample of 500 textile firms in Punjab and Sindh. The survey measured both the technological (product and process) and the non-technological (organizational and marketing) aspects of innovation where an innovation is the introduction of a new or significantly improved product, process, organizational method, or marketing method by an enterprise. Through this survey, the researchers measure 'innovation' in at least four different ways: (1) Innovation rate (based on the response of enterprise if they had innovated during 2011-13, which is further be divided into four types of innovation; i.e. product, process, organizational and marketing), (2) Innovation input (given by the ratio of R&D expenditure to sales), (3) Innovation output (given by the ratio of new

products sales to total sales), and (4) Innovation efficiency (given by the ratio of new product sales to R&D expenditure).

Through this study, the researchers answer the following research questions:

- ☐ How innovative is the textiles sector of Pakistan (measured in four different ways as described above)?
- ☐ What are the correlates (both in terms of promoting and hampering) of innovation? (such as firm type and size, market structure, product market i.e. local or international, government regulations and facilitations, sources and type of cooperation, management patterns, skill profile, ICT, access to finance and source of finances, information on technology and markets, and demand for innovations etc.).

**Researchers:** Waqar Wadho and Azam Chaudhry (Lahore School)

### **3. Nudging SMEs in Pakistan to invest in renewable energy: the role of information provision.**

#### **Abstract**

In this exploratory study, we intend to design and administer a survey across a sample of small-medium manufacturing enterprises in central Punjab to better understand the main structural, informational and behavioral barriers that prevent business owners from switching to greener energy sources. In particular, we will elicit respondents' personal preferences, beliefs and attitudes around greener energy sources, as well as their intended behavior or expected likelihood of adopting greener energy.

**Researchers:** Theresa Chaudhry, Azam Chaudhry, Phillip Garner, Nikita Grabher-Meyer and Nida Jamil

### **4. Fixed costs of innovation as barriers to upgrading in the surgical-goods sector in Sialkot**

#### **Abstract**

We propose to offer grants for innovations that increase exports and for innovations to produce new products (i.e. that have not previously been produced in Sialkot). The main goal is to evaluate the effectiveness of the grant program in promoting innovation among treated firms. We will also look for spillovers of innovations to other (untreated) firms through network links.

**Researchers:** Azam Chaudhry, Shamyla Chaudry, Amit Khandelwal (Yale University), Eric Verhoogen (Columbia University) and David Atkin (MIT)

### **5. High costs of high-quality inputs as a barrier to upgrading in the football sector in Sialkot**

#### **Abstract**

We develop an experiment to offer subsidies for high-quality rexine to a random subset of firms and examine if this subsidy spurs upgrading. We look at two related but distinct dimensions of behavioural responses by firms. First, since high-quality inputs are likely to be complements in production, the subsidy may induce firms to purchase complementary high-quality inputs and produce higher-quality footballs, using their existing technologies and production processes. Second, the subsidy may potentially stimulate learning and spur technological improvements in the production process, if for instance innovation has a higher return in high-

quality segments of the industry or if producing higher-quality balls leads firms to transact with more knowledgeable buyers. Accordingly, we intend to track complementary changes in other inputs, shifts in the composition of output toward higher-quality footballs, and other process innovations.

**Researchers:** Azam Chaudhry (Lahore School), Shamyla Chaudry (Lahore School), Amit Khandelwal (Yale University), Eric Verhoogen (Columbia University) and David Atkin (MIT)

## **6. Heterogeneous Adoption of Knowledge Capital and its impact on the firm's Performance**

### **Abstract**

We will use detailed primary data already collected by the Lahore School from firms in the textile, light engineering and automotive sectors to explore two important aspects of innovation:

First, we explore the heterogeneity in the adoption of 'knowledge capital' (defined as the new set of knowledge acquired, produced and used in the value creation process) at firm level in textile, light engineering and automotive sectors in Punjab to estimate its impact on the firm level outcomes such as revenue, cost of production, quality of the final product and market price of the final product.

This heterogeneity in the adoption of knowledge capital is introduced in two distinct ways: First, the uneven distribution of the sources of innovation acquired across firms in different sectors. The heterogeneous sources of innovation at firm level are introduced via five distinct ways i.e., technology (equipment), product, process, marketing and business model innovation. Amongst these five different types of innovation, we estimate how significantly each of these sources of innovation have affected firm level outcomes, in different sectors.

Second level of heterogeneity is introduced in terms of the variation in technology adoption across firms based upon its origin (local versus international technology), recent versus already established technology and how often a firm upgrades their respective technology to explore how it may affect the firm level outcomes in different sectors differently.

Next, we argue that organizational and market rigidities may play an important role to motivate (deter) the firm to innovate (or not to innovate). We determine the probability of the firms to engage in innovation (product, process, marketing and business) based upon these factors as well as explore whether different sources for funding the innovation at firm level may play a trivial role in the firm's probability to innovate across different sectors.

Last, we explore if any of these factors affect the firm level outcomes and the probability of innovation for the exporting and non-exporting firms any differently.

In addition to the analysis above, we explore one more important aspect of exporting firms in global market. We argue that global competition that the local exporting firms face, may affect their tendency to innovate in terms of its both intensity and direction. While intensity is measured on a scale from 0-5 as the aggregate of five heterogeneous sources of innovation at firm level i.e., technology (equipment), product, process, marketing and business model innovation.

**Researcher:** Rabia Arif (Lahore School) and Azam Chaudhry

**7. Why are Cousin Marriages so common in Pakistan? Examining the Effects of Cultural Norms, Dowry, and Economic Development as Potential Drivers**

**Researchers:** Mary Shenk, Saman Naz, and Theresa Chaudhry (Lahore School of Economics)

**8. Measuring Actual TFP Growth: Stripping away Omitted Price Bias and Demand Shocks**

**Researchers:** Nida Jamil (Early Career Researcher, School of Economics, University of Edinburgh), Theresa Chaudhry (Lahore School of Economics) and Azam Chaudhry (Lahore School of Economics)

**9. ITT Estimates of Impact of Ramadan Exposure on Mothers and Children**

**Researchers:** Theresa Thompson Chaudhry (Lahore School of Economics)

**10. The Impact of Prenatal Exposure to Fasting on Child Health Outcomes**

**Researchers:** Theresa Thompson Chaudhry (Lahore School of Economics) and Azka Sarosh Mir (Lahore School of Economics)

The study's results indicate that prenatal exposure to fasting during the first two trimesters has negative implications for children's height-for-age. In addition, children who were prenatally exposed to fasting in the second and third trimesters were, on average, thinner than nonexposed children. We find no evidence of selection bias arising from the decision to selectively time a pregnancy to avoid Ramadan – a major concern of our study.

**11. Innovation and Firm Performance in Developing Countries: The Case of Pakistani Textile and Apparel Manufacturers**

**Researchers:** Waqar Wadho (Lahore School of Economics), Azam Chaudhry (Lahore School of Economics) and Matthew McCartney (University of Oxford)

The researchers are conducting a firm-level survey of Pakistani textile manufacturers that builds on a similar survey that the researchers conducted in 2015 to construct a unique panel dataset to test the hypothesis that innovation is conducive to employment generation and sales growth, and that this is especially the case for smaller and younger companies. The firm level innovation study involves gathering primary data from 377 textiles manufacturers located in 12 different districts of the Punjab and Sindh provinces through an in person survey based questionnaire. The respondents of the survey will be the top managers of firms. This data then will be combined with the earlier survey in 2015 to generate a panel of 6 years and 377 manufacturers.

The institutional level development strategy will focus on engaging with the Punjab and Sindh bureaus of statistics to collect data and conduct training with their staff on survey design and implementation as well as providing them with a multidimensional view of innovation and development. We also plan to develop the capacity of the Lahore School's Innovation and Technology Centre by training a core group of junior researchers (with a focus on female

researchers) with a focus on survey instrument, questionnaire design, data collection and on data reporting.

The research team also plans to organize seminars in Pakistan and Oxford to disseminate and discuss the findings with various stakeholders including manufacturers and their associations/chambers, bureaus of statistics, policy makers and academics

## **12. Barriers to Upgrading in the Sialkot Football Sector**

Researchers: Azam Chaudhry (Lahore School of Economics), Shamyla Chaudry (Lahore School of Economics), David Atkin (MIT), Amit Khandelwal (Columbia University) and Eric Verhoogen (Columbia University)

The project has been developed under the *International Growth Centre (IGC)* and the *Private Enterprise in Developing Countries (PEDL)* initiative. In this project, the researchers investigate the extent to which high costs of high-quality inputs are a barrier to upgrading in the football sector. One of the primary inputs into football production is an artificial leather called rexine. They propose an experiment to offer subsidies for high-quality rexine to a random subset of firms and examine if this subsidy spurs upgrading. They will look at two related but distinct dimensions of behavioural responses by firms. First, since high-quality inputs are likely to be complements in production, the subsidy may induce firms to purchase complementary high-quality inputs and produce higher-quality footballs, using their existing technologies and production processes. Second, the subsidy may potentially stimulate learning and spur technological improvements in the production process, if for instance innovation has a higher return in high-quality segments of the industry or if producing higher-quality balls leads firms to transact with more knowledgeable buyers.

## **13. Barriers to Product Upgradation in the Sialkot Surgical Goods Sector**

The project has been developed under the *International Growth Centre (IGC)* and the *Private Enterprise in Developing Countries (PEDL)* initiative. In this project, they investigate the extent to which fixed costs of innovation are a barrier to upgrading in the surgical-goods sector in Sialkot. If there are externalities in the process of innovation, there may be an important role for governments in subsidizing the costs of innovation. A leading policy idea is to provide matching grants, in which governments provide supplemental funding for projects chosen by individual firms. However, there has never been a rigorous randomized evaluation of such a program (Campos et al, 2012). The research team is conducting such an evaluation in the surgical-goods industry in Sialkot and plan to offer matching grants for innovations that increase exports.

Researchers: Azam Chaudhry (Lahore School of Economics), Shamyla Chaudry (Lahore School of Economics), David Atkin (MIT), Amit Khandelwal (Columbia University) and Eric Verhoogen (Columbia University)

## **14. Trade Liberalization and Carbon Emissions: Firm-Level Evidence from Pakistan**

Researchers: Azam Chaudhry (Lahore School of Economics), Theresa Thompson Chaudhry (Lahore School of Economics) and Nida Jamil (Early Career Researcher, School of Economics, University of Edinburgh)

### **15. Assessing the Impact of the Carbon Border Adjustment Mechanism on Pakistan's Exports to European Union**

This paper explores the Carbon Border Adjustment Mechanism (CBAM), its definition, operational framework, and potential implications for a developing country like Pakistan. The study begins by calculating Pakistan's sectoral emission intensity across agriculture, manufacturing, and industry from 2012 to 2021, using greenhouse gas (GHG) emissions data from Climate Watch and output data from the Asian Development Bank's input-output tables. It then analyzes Pakistan's exports to the EU over the same period, disaggregating the data at the HS 6-digit level before aggregating it into three broad categories aligned with the emission intensity estimates. Based on this analysis, the paper evaluates the potential CBAM tax burden on Pakistan's exports, including the number of CBAM tax certificates required. Furthermore, scenario analyses estimate the extent to which CBAM might increase the effective cost of Pakistan's exports and project potential declines in export volume to the EU under CBAM's application. The study provides a crucial perspective on how carbon pricing policies could reshape trade dynamics for Pakistan.

**Researchers:** Azam Chaudhry (Lahore School of Economics), Gul Anadaman (Lahore School of Economics)

### **16. Assessing the impact of growth and trade on green house emissions across sectors in Pakistan**

This research paper examines the impact of greenhouse gas emissions in Pakistan and their effects on various sectors of the economy, highlighting the intricate relationship between environmental issues and economic growth. It begins by identifying the sectors that contribute most significantly to emissions and analyzing their environmental impacts. The paper then delves into how industrial emissions affect Pakistan's export capabilities, revealing the challenges faced in maintaining competitive international market positions due to pollution concerns. Furthermore, it investigates the repercussions of emissions on the manufacturing sector's growth, evaluating how environmental degradation could potentially hinder industrial expansion. Additionally, the study explores the effects of emissions on electricity generation, assessing how they impact the efficiency and capacity of power production systems. Finally, the analysis covers the agricultural sector, examining how emissions from farming activities influence agricultural productivity and growth. Overall, the paper underscores the critical need for Pakistan to effectively manage pollution to safeguard the environment while continuing to pursue economic development.

**Researchers:** Azam Chaudhry (Lahore School of Economics), Aymen Junaid (Lahore School of Economics)

### **3. Surveys and Reports:**

Following are the projects conducted by ITC in 2023:

#### **a) Promoting Investment in Solar Energy Across SMES in Pakistan (Interim Report):**

The ITC conducted a survey of 500+ firms in the central Punjab region of Pakistan. Information was collected regarding various firm attributes, including their location, sector, size, exports, and more. Additionally, companies were questioned about their existing utilization of solar energy, if any, and their perspectives on adopting solar technologies.

Among the surveyed firms, 44% were situated in the commercial/industrial zone. Moreover, the majority (82%) of the surveyed companies were property owners, while only 33% identified as exporters. In terms of the industry sector, the textile sector comprised 68% of the surveyed firms, with 41% of them being exporters. The second-largest sector was food and beverage, comprising 23% of the surveyed firms, out of which 21% were involved in exporting. Approximately 16% of the surveyed firms reported the use of solar energy for either some or all of their power requirements. Among these firms, 93% expressed satisfaction with their solar power usage experience. These companies reported an average cost reduction of 40% in their electrical bills as a direct result of adopting solar energy. Almost 13% of the firms were financed through SBP program or commercial bank

Researchers: Azam Chaudhry (Lahore School of Economics), Theresa Thomson (Lahore School of Economics) and Aymen Junaid (Lahore School of Economics)

#### **f) Innovation in the Exporting and Importing & Non-Exporting in the Automobiles sector firms- 2022**

The Innovation and Technology Centre (ITC) of the Lahore School of Economics conducted a survey in 2018/2019 to observe the growing trends in innovation and technology upgradation in the exporting and non-exporting firms from the textile and readymade garment sectors in Lahore. The purpose of this survey was to observe the extent, quality and impact of innovation activities on the performance and profitability of the innovating exporting and non-exporting firms. The survey also looked at the barriers faced by the innovating exporting and non-exporting firms in this sector. The data consisted of 125 firms involved in manufacturing readymade garments and other textiles, including 87 exporting and 38 non-exporting firms, collected during the period of September 2018 to December 2018. In the surveyed exporting firms, 40% of those firms were selling 100% of their output abroad, with majority of them exporting to Europe followed by worldwide.

Looking at the results of innovation, most of automobile firms revealed that their quality of output improved, they didn't have to retrain their employees to adopt new technology, their revenues increased, their cost of production decreased, they didn't have face resistance from their employees while introducing innovations and lastly the prices of their product remained mostly unchanged as the result of innovation.

The two greatest barriers faced while trying to perform innovation were lack of financing and lack of innovation opportunities. It can be concluded that more incentives for innovations could be given by providing more sources of funding for the innovating firms in the form of aid from the government and with the assistance of financial institutions.

**Authors:** Dr. Azam Chaudhry & Saman Khan



**Link** **to** **the** **Report:**  
[https://itc.lahoreschool.edu.pk/downloads/07\\_Innovation%20Report%202022%20V1.pdf](https://itc.lahoreschool.edu.pk/downloads/07_Innovation%20Report%202022%20V1.pdf)

#### **4. The Modelling Lab at the Innovation and Technology Centre (General Equilibrium Macroeconomic Model for the Pakistan Economy)**

##### **Intro to the Modelling Lab**

The Modelling Lab Team at the Lahore School's Innovation and Technology Centre has developed a General Equilibrium Macro (GEM) model for the Pakistan economy over the past two years, for policy simulations and teaching. The Lahore School now does quarterly updates for Pakistan and is also headed towards global macroeconomic modeling estimations, starting with the European Union.

##### **1. State of Pakistan Economy Report No. 02-2024:**

##### **GDP Growth**

The report from the Lahore School of Economics details a GDP growth of 1.68% for FY 2023-24, influenced by weak performances in manufacturing and agriculture sectors. The analysis links these sectors' underperformance directly to adverse policy decisions affecting commodities like wheat. It forecasts an uptick in GDP growth to 3.3% for FY 2024-25, suggesting a slight recovery but remains cautious about the structural weaknesses that persist in the economy.

##### **Inflation for the Fiscal Year 2024**

Inflation is projected at 18.9% for the fiscal year 2023-24, primarily driven by significant depreciation of the currency and the fiscal deficit. The report gives particular attention to the role of energy prices, exacerbated by government tax policies. A detailed examination of how these factors contribute to inflation provides insight into the underlying causes of economic instability and highlights the impact of fiscal mismanagement on price levels.

##### **GOP Emergency Economic Policy over FY 2024**

The report critiques the Government of Pakistan's (GOP) emergency economic policies, emphasizing their reactionary nature and lack of foresight. It discusses the heavy reliance on borrowing, both domestic and external, to fund the budget, which has swollen to Rs. 18.9 trillion for FY 2024-25. The necessity of substantial borrowing is tied to ambitious revenue targets that the report views as optimistic given the current economic climate. It also notes the considerable burden of debt repayment, which constrains fiscal flexibility and economic growth.

##### **Economic Challenges and Recommendations**

The analysis concludes with a discussion on the structural economic challenges, such as the high import dependency which stymies sustainable GDP growth. It suggests that the cyclicity of economic stability is influenced by external imbalances and reserve levels, proposing that policy measures focus on managing import dependencies and stabilizing the currency. The report calls for strategic adjustments in fiscal policy to better support economic stability and

promote growth, urging the government to devise long-term strategies that address the root causes of economic fragility rather than merely reacting to crises.

## **2. State of Pakistan Economy Report No. 02-2023:**

### **GDP Growth**

The Lahore School of Economics macro model for the Pakistan economy projects that GDP growth over the fiscal year July 2022 – June 23, (FY2023), will be 0.82 percent. This projection for the annual growth rate of GDP for FY2023, has been weakened by two quarters of falling GDP growth.

Our projection of GDP growth is comparable to the IMF and World Bank's estimate of GDP growth of 2 percent for FY2023.

Our model's estimates show that the flood damage to lives, livelihoods and incomes, over just the first quarter (Q1) of the fiscal year, from July to September 2022, have taken a devastating toll.

### **Inflation for the Fiscal year 2023**

Inflation for FY 2023 is estimated by our model at 26.1%, as shown in Table 2. This is year on year, for FY 2023, compared to FY 2022.

Our estimate of inflation at 26.1% for FY 2023, is quite comparable to GOP's estimate of 27%. Our model estimates inflation as being driven by four factors. An output gap. The budget deficit. Depreciation of the exchange rate. And global commodity prices.

For FY 2023, the overwhelming driver of inflation has been the huge depreciation of the exchange rate. By some 32% as observed over Q1 and Q2 of FY 2023. Contributing to near two thirds of the inflation rate. Note that after Q2, the exchange rate is assumed to have reached its equilibrium value, and therefore is not estimated to depreciate any further over Q3 and Q4.

### **GOP Emergency Economic Policy over FY 2023**

GOP faces a near flattened growth rate of 0.8% over FY 2023. Its forex reserves have dwindled to approximate \$3 billion, giving half a month's worth of imports.

With the extension of the IMF's EFF to calendar year 2023, covering virtually all of FY 2023, its fiscal stance is extremely limited by the terms of the agreement with the IMF.

That does leave it monetary policy to generate growth and support welfare. Monetary policy is primarily occupied with controlling inflation raging at 26% per annum. Largely using the interest rate peaking at 17% per annum.

However, we have shown here that two thirds of this inflation rate is being contributed to by the massive depreciation of the exchange rate.

Further, research at the Lahore School shows that depreciation of the exchange rate sets in place depreciationary expectations, leading to increase capital outflows, (Mahmood and Chaudry, Lahore Journal of Economics, 2020). Which of course Pakistan's weak Current and Capital Accounts can ill afford. Nor can a weak investment rate of 16% of GDP.

Therefore, on all these counts, GOP needs to arrest the depreciation of the exchange rate urgently.

## **State of the Pakistan Economy**

### **Quarter Two Based Estimates of Annual Growth in Pakistan**

#### **Fiscal Year 2023**

##### **GDP Growth for Fiscal Year 2023**

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**Authors:** Dr. Moazam Mahmood, Dr. Azam Chaudhry, Aimal Tanvir Malik & Seemab Sajid

### **3. . State of Pakistan Economy Report No. 01-2022:**

#### **GDP Growth**

The Lahore School of Economics macro model for the Pakistan economy estimates that GDP growth over the fiscal year July 2021 – June 22, (FY2022), has been 5.05 percent. The Covid 19 pandemic, intermittent lockdowns and openings, and hysteresis, have given way to growth. Our estimate is comparable to GOP's estimate for FY2022, of 5.79 percent. While noting the IMF's estimate of 4 percent.

Our model also uniquely estimates a supply shock, positive or negative. Which then feeds into a demand shock. To give a final change in GDP for FY2022.

Both the unique estimation of the supply cum demand shock, accounts for the difference between GOP's estimate of GDP growth for FY2022 of 5.79 percent, and our estimate of 5.05%.

#### **GOP's Economic Policy Stance over FY 2022**

With the Covid-19 pandemic and shutdowns of FY2021, GOP had two policy objectives. To generate growth. And to curb inflation raging at 12%-14%.

As inflation has continued to trend upwards over FY2022, from 8% to 14%, GOP has had to raise the interest rate. From 7% to 7.25% in a small rise of 25 basis points. Then a much higher 150 basis points rise to 8.75%. Tapering to a 100 basis points rise to 9.75%. With a final massive 250 basis points rise to 13.75%. Which has brought the real interest rate effectively to zero. Equaling the inflation rate. But raising the cost of investment.

The second tradeoff is for the policy instrument of the exchange rate. The exchange rate has to be appreciated or kept constant to curb importing inflation. But the exchange rate needs to be depreciated to improve the current account balance. Raising exports, and lowering imports.

GOP's policy choice here has been more fraught. It has continued to free the exchange rate, allowing it to depreciate from Rs 157 to the USD in June 2021, to Rs 201 by June 2022.

This has had the punitive outcome of leaving inflation stubbornly high, and trending higher. Nor has inflation been countered sufficiently by the raising of the interest rate.

**Authors:** Dr. Moazam Mahmood, Dr. Azam Chaudhry, Aimal Tanvir Malik & Seemab Sajid

**Link to the Article:** <https://www.brecorder.com/news/amp/40183983>

## 5. Details of Publications

Some of ITC's publications from the years 2020 to 2024 include:

### 1. Intensive Kinship, Development, and Demography: Why Pakistan has the Highest Rates of Cousin Marriage in the World

Abstract

Pakistan has the highest rates of consanguinity in the world, with nearly two-thirds marrying cousins. To understand this pattern, we adopt the theoretical framework of intensive and extensive kinship that allows us to predict correlates of consanguineous marriages and logically connect patterns in Pakistan with those in other regions. Using data from the Punjab Consanguinity Survey, we examine indicators of economic development, fertility, cultural norms, and marriage payments as potential correlates of cousin marriage. Consistent with the intensive kinship framework, we find that number of cousins, parental consanguinity, spousal proximity, and caste or clan endogamy are associated with higher likelihood of consanguinity. In contrast, the likelihood of cousin marriage decreases with extensive kinship indicators including husband's education, co-education, and large wedding expenditures. For women, cousin marriages are often "marrying down" financially, keeping women's wealth in the family. Comparison of Pakistan to other countries highlights the importance of low levels of literacy and female education, high fertility, and rapid population growth. We conclude that high rates of cousin marriage persist in Pakistan due to slow economic development which maintains motivations for cooperation with kin, and high fertility rates which sustain the large numbers of cousins that enable high levels of consanguinity

**Researchers:** Theresa Thompson Chaudhry (Lahore School of Economics) , Saman Naz and Mary K. Shenk

Shenk, M., Naz, S. and T. Chaudhry (2024) "Intensive Kinship, Development, and Demography: Why Pakistan Has the Highest Rates of Cousin Marriage in the World," *Population and Development Review*.

### 2. Measuring process innovation outputs and understanding their implications for firms and workers: Evidence from Pakistan.

Abstract:

New processes significantly affect firms and workers; however, due to a lack of quantitative indicators, our understanding of the measures, determinants, and impacts of new processes remains limited. Drawing on unique data from Pakistan, we analyzed five different measures of process innovation output: cost reductions, defect rate reductions, reductions in production cycle time, increases in production capacity, and improvement in product quality. We find that the breadth and depth of innovative capabilities, level of competition, and availability of market

sources of knowledge are important inducers of process innovation and that smaller firms are more likely to introduce new processes and are better able to transform them into higher output. All five process innovation outputs are associated with higher labor productivity and higher sales. We do not find that adopting new processes led to labor displacement; however, there is suggestive evidence that new processes led to the increased employment of skilled workers.

**Researchers:** Waqar Wadho (Lahore School of Economics) and Azam Amjad Chaudhry (Lahore School of Economics)

Wadho, W., & Chaudhry, A. (2024). [Measuring process innovation outputs and understanding their implications for firms and workers: Evidence from Pakistan](#). *Technovation*, 136, 103085.

### **3. The closed-form solutions for a model with technology diffusion via Lie symmetries**

Abstract:

A critical component of economic growth is growth in productivity which is dependent on technology adoption. While most technologies are created in developed economies, they diffuse to developing economies through various channels such as trade, migration and knowledge spillovers. In this paper, we develop the first model that integrates compartmental models with diffusion to analyze technology adoption within a framework of a system of second-order non-linear partial differential equations. We employ Lie point symmetries to derive reductions and closed-form solutions for a model of technology diffusion. A three-dimensional Lie algebra is established for the model. We utilize the combinations of Lie symmetries to obtain reductions and establish closed-form solution for the technology diffusion model. Additionally, we utilise the closed-form solution to provide graphical representations of the technology diffusion process over effective distance and over time and find the commonly observed S-curve path of technology diffusion. Furthermore, we conduct a sensitivity analysis to develop policy insights into the factors influencing the diffusion of technology

**Researchers:** Azam Amjad Chaudhry (Lahore School of Economics) and Rehana Naz (Lahore School of Economics)

Chaudhry, A., & Naz, R. (2024). [The closed-form solutions for a model with technology diffusion via Lie symmetries](#). *Discrete and Continuous Dynamical Systems-S*, 0-0.

### **4. Gender Norms vs. Altruism: The Impact of Consanguineous Marriage on Children's Education**

Abstract

Cousin marriage is an important social institution in many parts of Asia and Africa, yet few studies have looked beyond the health consequences to its role in shaping intra-household dynamics. In this study, we use a unique survey of households in Pakistan to examine the role of parental consanguinity on the educational investments and attainment of their children, and how those effects differ by gender. We find that, for the children of parents who are first cousins, the number of years of education completed and rates of school progression are lower and the number of days of school missed are higher, while enrollment rates and educational expenditures are roughly the same as children of parents who not related or are related more distantly. The results are stronger for daughters than for sons.

**Researchers:** Rabia Arif (Lahore School of Economics), Theresa Thompson Chaudhry (Lahore School of Economics) and Azam Amjad Chaudhry (Lahore School of Economics)

Chaudhry, T., & Arif, R. (2023). [The Impact of Consanguineous Marriage on Children's Human Capital in Pakistan](#). *Journal of South Asian Development*, 09731741231200380.

## **5. Emigration's Heterogeneous Impact on Children's Wellbeing in Punjab, Pakistan**

Abstract:

We investigate the impact of the migration of a household member who is potentially a caregiver on child health and schooling outcomes in Pakistan. We use micro-level cross-sectional data on more than 600,000 children from multiple rounds of the UN's Multiple Indicator Cluster Survey (MICS) dataset from 2008–2018 for Punjab province. We implement a new instrumental variable to address the endogeneity of the migration decision, comprising a triple interaction of nighttime light intensity of the major destination countries, historic migration rates at the district level, and the number of adult males in a household. The absence of the migrating member of the household negatively (positively) affects younger (older) children: the short-term nutritional status of children under age five is harmed, while children aged 5–17 are more likely to be enrolled in school. These results are robust to the inclusion of controls for mother, child, and household characteristics, in addition to location and survey year fixed effects. The negative impact on nutritional status for children under five years is smaller for boys in urban areas, in wealthier households, and in households with more educated mothers. However, the positive impact of migration on schooling outcomes is driven by girls, families in rural areas, and wealthier households.

Arif, R., Chaudhry, T.T & Chaudhry, A. (2023).” [Emigration's Heterogenous Impact on Children's Wellbeing in Punjab, Pakistan](#)”, *Child Indicators Research*.

## **6. Adjustments in markups after a Free Trade Agreement: An analysis of Pakistani firms gaining increased access to China**

Abstract:

Increased market access through trade liberalization can affect the markups, prices, and marginal costs of exporters. Understanding these dynamics is critical for firms and policymakers, particularly as they formulate export strategies. We examine the impact of China lowering tariffs on Pakistani products under the Pakistan–China Free Trade Agreement (FTA), which gave Pakistani exporters greater market access. Using disaggregated output and price data for textile manufacturers in Punjab, Pakistan, we estimate product-level markups and marginal costs using the methodology of De Loecker, Goldberg, Khandelwal, and Pavcnik ([Citation2016](#)) [“Prices, Markups, and Trade Reform.” *Econometrica* 84 (2): 445–510]. We then extend this to the firm level by using the methodology of De Loecker and Warzynski (2012) [“Markups and Firm-Level Export Status.” *American Economic Review*, 2437–2471]. We find that Pakistani firms exporting to China followed a dynamic pricing strategy by reducing prices to compete with global competitors in the Chinese market. We also find evidence of a decrease in marginal costs as a result of reductions in X-inefficiencies. But because Pakistan's exports to China are relatively homogeneous, the extent of quality differentiation and markup margins was limited. Finally, we find evidence of pro-competitive effects.



Jamil, N., Chaudhry, T., & Chaudhry, A. (2023). [Adjustments in markups after a Free Trade Agreement: An analysis of Pakistani firms gaining increased access to China](#). *The Journal of International Trade & Economic Development*, 1-27..

## **7. Empowered mothers and co-resident grandmothers: Two fundamental roles of women impacting child health outcomes in Punjab, Pakistan**

Abstract:

We show that i) empowered mothers and ii) coresident grandmothers each benefit children's nutritional health measured by height-for-age z-scores (HAZ) and weight-for-age z-scores (WAZ) for age groups 5 years and less. First, using cross-sectional data from the Pakistan Demographic and Health Survey (PDHS) for the year 2017–18, we estimate the impact of empowered mothers on child health outcomes using an instrumental variable approach to correct for endogeneity. Empowerment is measured by two indices: as a sum of the questions that gauge both attitudinal and behavioral dimensions of female agency and also using multiple correspondence analysis (MCA) for these same questions. Second, we use a fuzzy regression discontinuity design (FRDD) to measure the causal impact of coresident grandmothers on the health outcomes of the children using multiple rounds of the Multiple Indicator Cluster Survey (MICS) from the years 2008, 2011, 2014 and 2018. The difference between the actual ages of the grandmother from the Potential Retirement Eligibility Criteria (PREC) has been used to correct for potential endogeneity. The results show that on average, the weight for age z-scores (WFA) for children under five increases by 0.28 SD with a one-index point increase in mother's empowerment. Similarly, on average, WFA increases by 0.098 SD when grandmothers are present in a household. Finally, we explore heterogeneity in the average effects stated above based upon the gender of the child as well as the wealth and geographic location of the household. The benefits of mothers' empowerment are largely driven by improvements in girls' nutrition as well as children living in rural areas while the presence of grandmothers primarily improves the nutrition of boys, children in rural areas, and children belonging to poor families.

Arif, R., Chaudhry, A., & Chaudhry, T. (2023). [Empowered mothers and co-resident grandmothers: Two fundamental roles of women impacting child health outcomes in Punjab, Pakistan](#). *Plos one*, 18(11), e0285995.

## **8. Experimental Evidence on Group-based Attendance Bonuses in Team Production**

Abstract

We test the effectiveness of a group-based attendance bonus in a field experiment in a factory in Pakistan, where workers manufacture electric fans in stages using batch-production methods. We find that the group-based attendance bonus increased by more than a quarter the average number of days that the team's attendance target was met. This effect was larger for junior and mid-level workers as compared to senior workers. We find that the bonus incentivized better coordination among workers, especially in the latter part of the month, rather than through higher average attendance. Our experiment's results suggest that temporary incentive programmes may help workers in the transition period to new ways of organizing production and may prove to be a valuable tool for change management. Group-based bonuses offer an alternative to individual or tournament-based incentives based on one's own or relative performance, which may have deleterious effects on intrinsic motivation and pro-social behaviour.

Chaudhry, T., Tirmazee, Z., & Ayaz, U. (2022). “Experimental Evidence on Group-based Attendance Bonuses in Team Production”. *Journal of South Asian Development*, 0(0). <https://doi.org/10.1177/09731741221129350>

## 9. Impact of prenatal exposure to Ramadan on disability in Pakistan among adults age 18–64

### Abstract

Temporary disruptions to eating and sleeping patterns due to exposure to Ramadan during pregnancy have been shown to increase the probability of disability and chronic health problems later in life. This study aims to analyze the intent-to-treat effect of prenatal exposure to Ramadan (the Islamic month of fasting) on individual disabilities for individuals age 18 to 64 across three provinces encompassing 94% of Pakistan's population.

Chaudhry, Theresa Thompson. (2022). "Impact of prenatal exposure to Ramadan on disability in Pakistan among adults age 18–64", Journal: Dialogues in Health; Publisher: Elsevier

## 10. Trading textiles along the new silk route: The impact on Pakistani firms of gaining market access to China

### Abstract

In this study, we analyze the impact of the lower Chinese tariffs on Pakistani textile manufacturers that resulted from the Pakistan-China Free Trade Agreement (FTA). As a result of lower Chinese tariffs, Pakistani textile manufacturers increased exports though the number of firms exporting to China changed marginally and only in the spinning sector did exports substantially rise. Using a variety of recently developed methodologies, our results indicate that the productivity of textile manufacturers rose 3-8 percent and product quality rose 1-2 percent. Firms reduced product offerings in response to tariff drops. In contrast to a number of previous studies where exporting was accompanied by investment or R&D, exporters to China increased material and labor inputs but not capital. Non-exporters' productivity and quality also rose, indicating the presence of spillovers. Testing this, we find that these spillovers occurred for non-exporters downstream from higher productivity exporters in close geographic proximity.

Chaudhry, A., Chaudhry, T.T., & Jamil, N. (2022). “Trading Textiles along the New Silk Route: the impact on Pakistani firms of gaining market access to China,” *Journal of Development Economics*, Volume 158.

## 11. Innovation strategies and productivity growth in developing countries: Firm-level evidence from Pakistani manufacturers

### Abstract

We examine the determinants of product, process, and organizational innovations, and their impact on firm labor productivity using data from a unique innovation survey of firms in Pakistan. We find significant heterogeneity in the impact of different innovations on labor productivity: Organizational innovation has the largest effect followed by process innovation. But unlike much of the literature, we found a negative impact of product innovation suggesting a disruption effect of new products. We find a strong impact of engaging in knowledge creation on product and process innovation. We also find that external knowledge networks and



innovation cooperation play no significant role in firms' decision to engage in innovation and its intensity, however, vertical linkages with suppliers (clients) promote product (process) innovations. Foreign competition has a negative effect on product innovation and a positive effect on organizational innovation. Exposure to foreign markets both in term of exporting and quality standard certification leads to better innovation performance.

Chaudhry, A., & Wadho, W. (2022). "[Innovation strategies and productivity growth in developing countries: Firm-level evidence from Pakistani manufacturers.](#)" *Journal of Asian Economics*, Volume 81.

## **12. Home-Based Enterprises: Experimental Evidence on Female Preferences from Pakistan**

### **Abstract**

Enterprises run by women in developing countries are largely home based and belong to small-business networks, which may explain these businesses' small size, low profitability, and short life. Using data from Pakistan, we confirm that the majority of female-owned microenterprises are home based and find that these home businesses are likely to close within 2 years. Our incentivized tasks elicit household preferences for business location and advice-taking from women and male decision makers. Both men and women are willing to sacrifice almost 60% of median profits for running businesses from home. Women avoid taking outside advice, even when it increases task earnings. Women's preferences are correlated with business experience but not with agency within the household, mobility, and household responsibilities.

Chaudhry, A., d'Adda, G., Said, F., & Mahmood, M. (forthcoming), "[Home-based Enterprises: Experimental Evidence on Female Preferences from Pakistan.](#)" *Economic Development and Cultural Change*.

## **13. Impact of Remittances on Child Health Outcomes in Punjab, Pakistan**

### **Abstract:**

Primary motive of temporary migration in developing countries like Pakistan is generally in response to the income constraint faced by the households. Therefore, to relax the resource constraint, migrants tend to remit back to their families in home countries. This study attempts to look at the impact of remittances on child health outcomes as measured by height-for-age Z-scores (HAZ) & weight-for-age Z-scores (WAZ) in Punjab, Pakistan using a cross-sectional data set from the Multiple Indicator Cluster Survey (MICS). We use an instrumental Variable Approach to correct for the endogenous decision to remit. Two Stage Least Square with an instrument that comprise of an interaction of number of banks in each district with the number of adult males in a household to create household level variation in the instrument has been used to estimate the causal relation between remittances and child's health outcomes. Our results suggest significant positive impact of remittances on both indicators of child health outcomes. Further this study confirms that gains for girls are greater relative to boys.

R Arif, M Aslam (2022), "[Impact of Remittances on Child Health Outcomes in Punjab, Pakistan](#)", *Journal of Development and Social Sciences*".

#### **14. Determining the Extent of Gender Discrimination in Educational Attainment: A Case of Pakistan**

##### **Abstract**

Gender bias in developing countries may restrict educational opportunities for girls in comparison to boys. This paper attempts to measure the gender disparity in education amongst children from 5 years to 18 years of age across Pakistan. Using the Cross-sectional data from PSLM and applying Oaxaca decomposition with probit estimation we measure the gender gap through explained and unexplained variation on three aspects of education; first, the overall school enrollments across Pakistan, second the differences in the school enrollments based upon the type of school i.e. public vs. private schools for the three levels of education: primary, middle/secondary and higher secondary. Third, we determine whether gender discrimination exists in the accumulated schooling decision for the age group of 18 to 30 years. The results interestingly show that although a strong bias exists against females in overall enrollment rates, but as we explore further we see that males drop out of private schools more as compared to females and the accumulated level of schooling of the male adults is also lower than that of females. We find that much of these differences are not due to the endowment effects. Large negative deviation for males may be attributed to the unobservable pressure and society's norms regarding the role of males that affect them in an adverse manner.

R Arif, M Khalid, (2022). "[Determining the Extent of Gender Discrimination in Educational Attainment: A Case of Pakistan](#)" *Pakistan Social Sciences Review*.

#### **15. Measuring Mother's Empowerment Through Culture of Son Preference in Pakistan**

##### **Abstract**

This paper highlights whether giving birth to a son plays a role in determining mother's empowerment in Pakistan and in particular, if the birth-order of the son has any additional impact in uplifting the mother's status within a household, using the Pakistan Demographic and Health Survey (PDHS) 2012-13. In Pakistan, the household's economic conditions make parents treat their sons and daughters differently and ultimately, giving preference to sons over daughters, in terms of education, health and nutrition, as the social and economic utility of a son, overpowers that of a daughter. In the presence of this culture of son preference, if women then give birth to a son or a number of sons, then it should help empower them. The results of the study show having a son significantly helps in empowering mothers in Pakistan. In contrast, the son's birth-order (both higher or lower) is not an important factor for improving mother's empowerment. Mother's empowerment is mainly driven by the number of sons, and age of the son, and these results are more pronounced in rural areas of Pakistan, and for mothers belonging to poor households

Arif & Tanvir. (2022). "[MEASURING MOTHER'S EMPOWERMENT THROUGH THE CULTURE OF SON'S PREFERENCE IN PAKISTAN](#)" *Journal of Research and Reviews in Social Sciences Pakistan*, Vol 5 (2), 2022 pp 1884-1917.

#### **16. The Macro Determinants of the Drop in Pakistan's Long Run GDP Growth**

##### **Abstract**

This paper attempts to address the long-run determinants of trend GDP growth in Pakistan for years 1973 till 2017. The theoretical framework chosen has been the Keynesian general equilibrium framework of aggregate demand, decomposed into the macro aggregates of consumption, investment, government expenditures, exports and imports (Keynes, 1937). The analytical strategy we have used is to establish first whether there has been a discrete drop in GDP growth at any particular break date. Establishing a break date allows us to define two periods of GDP growth, a higher growth period, followed by a lower growth period. The determinants of GDP growth can then be established, by looking for correlated changes in their behavior between the two time periods. Our findings suggest that high GDP growth in the first phase, pre-1992, is explained by high investment growth. Paired with a Marginal Propensity to Consume in this phase which is low. Making this high GDP growth phase investment led. Low GDP growth in the second phase, post-1992, is now explained by low investment growth. Paired with a Marginal Propensity to Consume, in this phase which is higher. Making this phase consumption-led.

Moazam, Rabia & Mahmood, M. (2022), “[The Macro Determinants of the Drop in Pakistan’s Long Run GDP Growth](#)”, Pakistan Business Review, Volume 24, Issue 2.

## 6. Research Grants Awarded

- International Growth Centre (FCDO, UK) for Research on Promoting Investment in Solar Energy across SMEs in Pakistan, 2023.
- World Trade Organization (WTO) Chairs Programme, 2022.

## 7. Publications 2024:

- Papers:
  - Shenk, M., Naz, S. and **T. Chaudhry** (2024) “[Intensive Kinship, Development, and Demography: Why Pakistan Has the Highest Rates of Cousin Marriage in the World,](#)” *Population and Development Review*. <https://onlinelibrary.wiley.com/doi/10.1111/padr.12678>.
  - Chaudhry, A., & Naz, R. (2024). [The closed-form solutions for a model with technology diffusion via Lie symmetries.](#) *Discrete and Continuous Dynamical Systems-S*, 0-0.
  - Wadho, W., & Chaudhry, A. (2024). [Measuring process innovation outputs and understanding their implications for firms and workers: Evidence from Pakistan.](#) *Technovation*, 136, 103085.
- Book and Book chapters
  - Chaudhry, A., **Chaudhry, T.**, and M. Mehmood (2024) *Policy Challenges for Macroeconomic Management and Growth in Pakistan*, Lahore: Lahore School of Economics.
  - **Chaudhry, T.**, and H. Ahmad (2024) “The Global Gig Economy: Pakistan’s Opportunity to Become a Leader in Service Exports?” in *Policy Challenges for Macroeconomic Management and Growth in Pakistan*, Lahore: Lahore School of Economics.
  - Jamil, N., **Chaudhry, T.** and A. Chaudhry (2024), “Access to Foreign Markets: An Analysis of the Pak-China FTA,” in *Policy Challenges for Macroeconomic Management and Growth in Pakistan*, Lahore: Lahore School of Economics.
  - Policy Challenges for Macroeconomic Management and Growth in Pakistan,

8. Working Papers:.

1. ITC Working Paper No. 13-2024: “Product Space: Exploring potential for higher exports in Pakistan.” Gul Andaman, Aymen Junaid, and Azam Chaudhry.
2. ITC Working Paper No. 14-2024: “Understanding the Nature of Pakistan’s Trade Policies and Testing their Impact on Pakistan’s Trade Performance.” Gul Andaman, Aymen Junaid and Azam Chaudhry.
3. ITC Working Paper No. 19-2024. : “Trade Liberalization and Carbon Emissions: Firm-Level Evidence from Pakistan. Nida Jamil, Theresa Chaudhry and Azam Chaudhry.
4. ITC Working Paper No. 18-2024: “Can Foreign Aid Trigger Unofficial Capital Outflows? A Panel Data Analysis.” Gul Andaman, Aymen Junaid and Azam Chaudhry.
5. ITC Working Paper No. 17-2024: “Does Innovation Benefit Exporters in Pakistan more than Non-Exporters? An Analysis of Firms from the Textile, Light Engineering and Automotive Sectors.” Rabia Arif and Azam Chaudhry.
6. ITC Working Paper No. 16-2024: “Pricing dynamics in an informal economy-A Bayesian DSGE analysis.” Syeda Rabab Jafri and Azam Chaudhry.

Artistic productions (catalogued)

1. Enhancing Pakistan - China Trade: A Data Driven Approach, ITC Report.
2. State of the Pakistan Economy: Estimates of Annual Growth in Pakistan (Quarter One, Financial Year 2024), ITC Report.
3. State of the Pakistan Economy Growth, Inflation Welfare and the Budget (Financial Year 2023-2024), ITC Report.
4. Is there a future for export-led growth in Pakistan? Op-ed piece in Express Tribune Newspaper, May 3rd, 2024, <https://tribune.com.pk/story/2464931/is-there-a-future-for-export-led-growth-in-pakistan>.

## ITC Stakeholder Activities

1. The ITC, in collaboration with the Pakistani Ministry of Commerce, organized a two-day workshop on "Extracting, Understanding and Analyzing Trade Data" from December 8-9, 2022. The workshop aimed to equip policymakers with tools to make informed decisions amid Pakistan's macroeconomic crisis. Dr. Azam Chaudhry emphasized the importance of developing industrial policies before commercial ones, drawing lessons from Brexit.
2. The Lahore School of Economics and the ITC hosted an interactive roundtable on the Pakistani economy on February 4, 2023. Mr. Ahsan Iqbal, the Minister for Planning, discussed the need for infrastructural stabilization and export expansion. Dr. Azam Chaudhry highlighted findings from his study on Pakistan's economic crisis, emphasizing the balance of payments issue.
3. Dr. Azam Chaudhry, as WTO Chair from Pakistan, held a webinar on February 22, 2023, discussing the current economic situation and potential strategies for Pakistan's Ministry of Commerce.
4. The 16th Annual Conference on The Management of Pakistan's Economy was held by the Lahore School of Economics on May 2-3, 2023. The conference addressed macroeconomic management, structural reform, and the impact of supply shocks on Pakistan's GDP growth and export diversification.
5. Dr. Azam Chaudhry presented at the WTO Chairs Programme Annual Conference 2023 in Geneva, Switzerland, from June 21-23, 2023. He emphasized the importance of addressing inequality and climate-induced disasters in economic policy discussions.
6. On July 10, 2023, the ITC welcomed Mr. Matthew Stephenson from the World Economic Forum to discuss research outputs and involvement in the WTO Chairs Programme. Discussions focused on Digital Foreign Direct Investments and Pakistani firms' investment preferences.
7. An online session on 'Economic Challenges Faced by Pakistan and Way Forward' was conducted on August 1, 2023, by Dr. Azam Amjad Chaudhry, highlighting sectoral contributions to Pakistan's GDP and employment.
8. On August 8, 2023, the ITC held a GIS workshop focusing on economic and social analyses using QGIS and ArcGIS software.
9. The 5th International Annual Development Economics Conference was co-hosted by the ITC and CREBS from August 23-25, 2023. The conference aimed to highlight research for sustainable growth and provided a platform for discussions on potential collaborations.
10. Dr. Azam Chaudhry remotely presented at the "Role of Academic Institutions in Fostering WTO-Related Capacity" conference on September 11, 2023, discussing efforts to enhance free trade policy awareness in Pakistan.